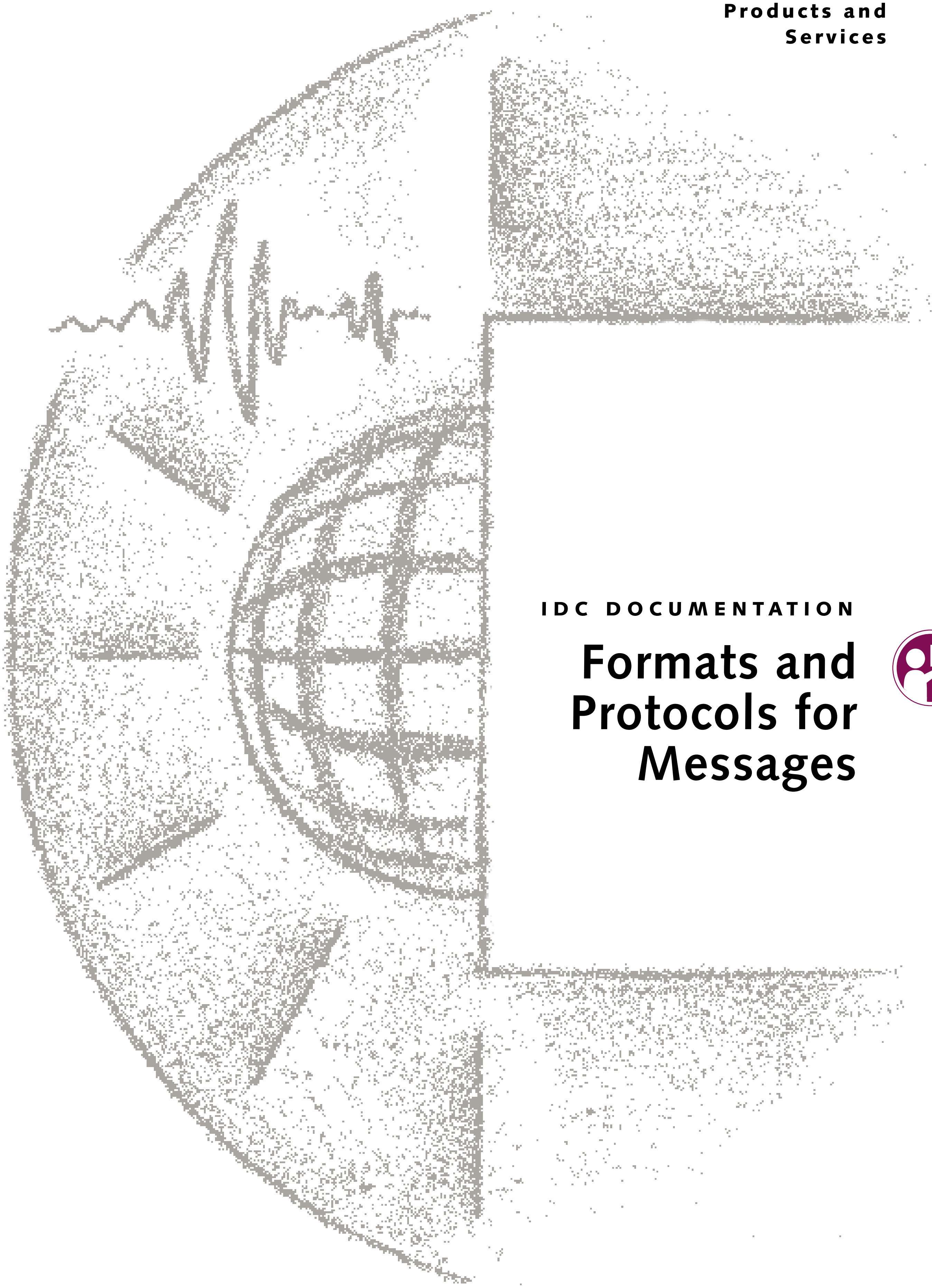
Products and Services



IDC DOCUMENTATION

Formats and Protocols for Messages

Revision 2

Notice

This document was published by the Monitoring Systems Operation of Science Applications International Corporation (SAIC) as part of the International Data Centre (IDC) Documentation. It was first published in May 1998 and was republished as Revision 1 in March 1999 to include major changes. This revision of the document was published electronically as Revision 2 in November 2000. IDC documents that have been changed substantially are indicated by a whole revision number (for example, Revision 1). A summary of changes from the previous version is given in the following Change Pages and in "About this Document" on page ii.

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Ordering Information

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Change Page

This document is Revision 2 of the *Formats and Protocols for Messages*. The following changes have been made for this publication:

REVISION 2 DOCUMENT CHANGES

Page	Change
All	The document number has been updated to IDC-3.4.1Rev2.
All	Chapter numbers are included in the document and appear at the top of each page.
throughout	IMS2.0 refers to the message format version used for radionuclide messages. IMS1.0 refers to the message format version used for S/H/I messages.
throughout	Dates in the document text have been changed to the document standard (*dd monthname*, *yyyy*).
throughout	Dates used in examples have been changed.
throughout	`msg_id` values used in examples have been changed.
ii	Descriptions of document changes have been updated.
v	The "scope" of the document has been changed to include formats that will never be implemented at the IDC.
vi	The "audience" of the document has been expanded to include all *AutoDRM* developers and users.
vi	Reference to the documentation "Roadmap" has been dropped.
vii	Descriptions of new chapters and appendices have been added.
viii	The Typographical Conventions table was updated using examples from this document.
4	A version format number was added as a difference between S/H/I and radionuclide messages.
4	The maximum message size has been reduced from "unlimited" to 100 megabytes.
6	The phrase "that must be parsed" has been changed to "that are parsed."
5	The line break character is not implemented at the IDC.
6	"–999" has been changed to "–9999."
8	The UTC definition has been changed.
8	Radionuclide site code descriptions have been changed.
9	Radionuclide detector code examples have been changed.
15	Message splitting is not implemented at the IDC.

REVISION 2 DOCUMENT CHANGES (CONTINUED)

Page	Change
25	Range limits have been redefined to be left-inclusive, right-exclusive.
27, 56, 57, 74, 75	The AUX_LIST environment is not supported at the IDC.
28	The BEAM_LIST environment, missing from [IDC3.4.1Rev1], has been added. BEAM_LIST is not supported at the IDC.
31, 34, 35, 36, 37, 41, 55, 75	Text has been changed to conform with left-inclusive, right-exclusive range limits.
30	The COMM_LIST environment is not supported at the IDC.
41	The TIME environment description has been changed.
45	Executive Summary has been added to the S/H/I Data Request Environment Variables. Environments for NEB and NSEB have been deleted from this table.
46, 103	New products have been added to the Radionuclide Data Request Environment Variables table and RMS Subscription Request Environments table.
47, 103	ALERT_FLOW has been added as a new request line.
47, 104	ALERT_SYSTEM has been added as a new request line.
48, 105	ALERT_TEMP has been added as a new request line.
49, 105	ALERT_UPS has been added as a new request line.
51, 107, 156, 159, 163, B10	The REVIEWED, GROUPED, and UNASSOCIATED ARRIVAL/SLSD subtypes are not supported at the IDC.
53	New environments have been added to the BULLETIN request line.
53, 72, 122	The FPEB request line was renamed SSREB.
56	LAT and LON are not supported for the CHANNEL request at the IDC.
57	The minimum TIME precision is days for the CHAN_STATUS request.
58, B19	The COMMENT request is not supported at the IDC.
59, 113, B19	The COM_STATUS request is not supported at the IDC.
61	EXECSUM has been added as a new request line.
62, 115	GASBKPHD has been added as a new request line.
63, 116	MET has been added as a new request line.

Revision 2 Document Changes (continued)

Page	Change
64, B26	The description of the NETWORK request line has been added. NETWORK is not supported at the IDC.
68, 118	RLR has been added as a new request line.
69, 119	RMSSOH has been added as a new request line.
69, 120	RNPS has been added as a new request line.
70, 120	The ARMR request line was renamed RRR.
73	LAT and LON are not supported for the STATION request at the IDC.
74	The minimum TIME precision is days for the STA_STATUS request.
78	Several new radionuclide products have been made available through subscriptions.
81	FREQ has been moved into the Control Line section for subscriptions and removed from the environments.
81	FREQ = `custom` is not supported at the IDC.
83	NEBs and NSEBs may be established through subscriptions.
87	A modified BULL_TYPE environment has been added and includes a description of naming NEBs and NSEBs.
89	DEPTH_KVALUE has been added as a new request environment.
90	HYDRO_CP_THRESH has been added as a new request environment.
91	HYDRO_TE_THRESH has been added as a new request environment.
93	MB_ERR has been added as a new request environment.
95	MIN_DP_SNR has been added as a new request environment.
96	MIN_MB has been added as a new request environment.
96	MIN_MOVEOUT has been added as a new request environment.
97	MIN_NDEF has been added as a new request environment.
97	MIN_NDP has been added as a new request environment.
99	MIN_WDEPTH_THRESH has been added as a new request environment.
99	MS_ERR has been added as a new request environment.
100	REG_CONF has been added as a new request environment.

REVISION 2 DOCUMENT CHANGES (CONTINUED)

Page	Change
101	New products and environments were added to the S/H/I Subscription Request Environments table.
110	An example of establishing an NEB has been added.
112	The CHAN_LIST and STA_LIST environments are not supported for CHAN_STATUS subscriptions at the IDC.
143, 145, 154	The “AU” subformats have been replaced with a new “CSF” subfomat.
171	The Event Screening block format for bulletins has been replaced.
174	The Event Characterization Arrival block format for bulletins has been updated.
179	The AUTH_STATUS data type is not supported at the IDC.
182	The Channel Statistics block format has been updated to include decimal seconds.
184	The Data Timeliness block format has been updated to include decimal seconds.
185	The COMM_STATUS data type is not supported at the IDC.
192	The Sta_status format has been updated to include decimal seconds.
197	The Radionuclide Data Messages chapter has been extensively modified.
200	A paragraph referencing message structure has been added.
200	Descriptions of the data types included in the chapter have been expanded.
200	Reference to RMS data format version has been removed. The data format is now IMS2.0.
201	A table containing radionuclide data types has been added.
201	New pulse height data types have been added, and old definitions have been changed.
203	The table listing blocks to be included in PHD has been altered.
204	A table listing blocks to be included in PHD for 3-D coincidence data has been added.
205	The #Header block format has been altered.
206	A description of designator has been added.
206	A description of site code has been added.
206	A description of detector code has been added.
206	A description of system type has been added.

REVISION 2 DOCUMENT CHANGES (CONTINUED)

Page	Change
207	The description of sample geometry has been altered.
207	The description of spectral qualifier has been altered.
207	The description of sample reference identification has been altered.
210	The description of sample reference identification has been altered.
210	The description of measurement identification has been altered.
211	The description of background measurement identification has been altered.
211	A description of gas background measurement identification has been added.
211	A description of transmit date and time has been added.
212	A description of total air volume sampled has been added.
213	The format for a #processing block has been added.
214	The format for the #sample block has been altered.
214	The format for the #g_energy block has been altered from the #energy block.
215	The format for a #b_energy block has been added.
215	The format for the #g_resolution block has been altered from the #resolution block.
216	The format for a #b_resolution block has been added.
216	The format for the #g_efficiency block has been altered from the #efficiency block.
217	The format for a #ROI_limits block has been added.
217	A figure showing 2-D ROI in energy space has been added.
218	A section describing ROI number has been added.
220	A section describing nuclide name has been added.
221	The format for the #totaleff block has been altered.
223	A section describing ratio identifier has been added.
224	The section describing energy span has been altered and expanded.
227	The format for the #certificate block has been altered.
228	A section describing half life has been added.
228	A section describing state of health data has been added.

REVISION 2 DOCUMENT CHANGES (CONTINUED)

Page	Change
244	The format for meteorological data has been altered.
245	The format for general alert messages has been altered.
246	A section describing radionuclide laboratory reports (RLR) has been included.
249	Several new "reports" have been added in a section renamed "Data Products."
250	Several changes were made to the descriptions of the contents of an ARR.
252	A %b-gEff section has been added to the ARR description.
254	New detector types have been added to the ARR description.
258	New station types have been added to the ARR description.
260	Formats for RRR (formerly ARMR) have been altered.
260	Formats for SSREB (formerly FPEB) have been altered.
261	A section describing the contents of a RNPS New has been added.
263	Chapter 6: Summary Messages was added. This chapter includes the format for the Executive Summary.
A1	A new appendix was added that includes country, station, and seismic instrument codes that were in other chapters in Revision 1.
A2	The country codes that were in Table 1 of the first chapter have been moved to an appendix.
B1	Data message examples were moved from Appendix A to Appendix B.
B2	"ALERT" message examples have been replaced.
B3	An example of an ARR for noble gas has been added.
B4	The original example of an ARR has been changed to an ARR for particulates.
B11	The BLANKPHD example has been altered.
B16	The CALIBPHD example has been altered.
B18	The CHAN_STATUS example has been altered.
B19	The DETBKPHD example has been altered.
B22	An example of an EXECSUM has been added.
B23	An example of a GASBKPHD has been added.

REVISION 2 DOCUMENT CHANGES (CONTINUED)

Page	Change
B26	The MET example has been altered.
B28	The QCPHD example has been altered.
B30	An example of a RLR has been added.
B32	An example of a RMSSOH has been added.
B33	An example of a RNPS has been added.
B33	An example of a RRR for noble gas has been added.
B35	The original example of an ARMR has been changed to an RRR for particulates.
B42	An example of a SAMPLEPHD for nobel gas has been added.
B44	An example of a SAMPLEPHD for particulates has been added.
B46	The original example of an FPEB has been changed to an SSREB.
B48	The STA_STATUS example has been altered.
C1	The authentication example was moved from Appendix B to Appendix C.

Formats and Protocols for Messages

CONTENTS

Formats and Protocols for Messages

FIGURES

Formats and Protocols for Messages

TABLES

About this Document

This chapter describes the organization and content of the document and includes the following topics:

- Purpose
- Scope
- Audience
- Related Information
- Using this Document

About this Document

PURPOSE

This document describes the International Monitoring System 1.0 (IMS1.0) version of the formats and protocols used for discrete message exchange, including requests for subscriptions and data messages. (For radionuclide messages, the version number is IMS2.0).

This document is Revision 2 of *Formats and Protocols for Messages*. The following changes have been made for this publication:

- General

  Chapter numbers are now included in the document and appear at the top of each page.

  The version number for radionuclide messages has been increased from 1.0 to 2.0.

  References to the *Continuous Data Subsystem* have been updated from [3.4.2Rev1] to [3.4.3].

  This document describes message formats that may not be supported at the IDC. Footnotes are used to indicate which formats are not implemented at the IDC.

  Dates in the document text have been changed to the documentation standard *dd monthname*, *yyyy* where *dd* is the day of the month, *monthname* is the name of the month, and *yyyy* is the four-digit year.

  `msg_id` values used in examples have been changed.

- About this Document

  Reference to the "Roadmap" of documentation has been dropped.

  The "Scope" and "Audience" sections have been expanded to include general *AutoDRM* users and developers and to explain that not all of the formats are supported at the IDC, but are included for international use.

  Descriptions of the contents of Chapter 6 and Appendix A were added in the "Using this Document" section.

  Typographical conventions in Table I have been altered to include only the conventions used in this document and to use examples from this document.

- Chapter 1: Message Protocol

  The country codes that were in Table 1 of this chapter have been moved to Table A-1 on page A2.

  The f5.2 example definition for "no data" has been changed from "–999" to "–9999."

  The definition for UTC has been changed.

  Radionuclide site code descriptions have been changed.

  Radionuclide detector code examples have been changed.

- Chapter 2: Request Messages

  Environment lines specific to establishing NEBs and NSEBs have been moved to the Subscription Messages chapter. The BEAM_LIST environment has been described.

  Twelve new request lines have been added: one for the executive summary product (EXECSUM) and 11 others for new radionuclide products.

- Chapter 3: Subscription Messages

  A capability to create NEBs and NSEBs for retrieval via subscriptions and *AutoDRM* request messages has been added.

  Twenty-one request environments have been either moved from the Request Message chapter or added as new environments to support custom event screening for NEBs and NSEBs.

  The BULL_TYPE environment for subscriptions was redefined to be either the bulletin product being subscribed to or the name of a new NEB or NSEB bulletin product.

  The bulletin request line definition has been changed to describe how BULLETIN is used when requesting a subscription or establishing a NEB or NSEB.

  New request lines have been added for 11 new radionuclide products.

- Chapter 4: S/H/I Data Messages

  The event screening block has been revised, and the event characterization block in the SEB and SSEB bulletins has been modified.

  The CHAN_STATUS, DATA_TIMELINESS, and STA_STATUS data formats have been updated to include decimal seconds in time fields.

- Chapter 5: Radionuclide Data Messages

  This chapter has been changed significantly; most notably the formats for reporting beta-gamma (β-γ) coincidence data, state of health (SOH) data, and radionuclide laboratory results have been included. Also, formats for station and detector codes have changed, Pulse Height Data message formats have been modified, and a new data product (the Radionuclide Network Product Summary [RNPS]) is available. For a complete list of changes to the formats of radionuclide data messages, see "Preface" on page 198 at the beginning of Chapter 5: Radionuclide Data Messages.

- Chapter 6: Summary Messages

  This new chapter contains the formats for the Executive Summary data product (EXECSUM). A separate chapter was added because the Executive Summary contains information from all technologies.

- Appendix A: Codes

  This new appendix contains lists of country, station, and instrument codes that were in other chapters.

- Appendix B: Data Message Examples

  This appendix was Appendix A in Revision 1 of the document. Examples of new radionuclide data types have been added, and formats for the other examples have been updated as needed.

- Appendix C: Authentication Example

  This appendix was Appendix B in Revision 1 of the document.

- The Glossary includes additional terms.
- The Index has been updated with entries for new material.

SCOPE

This document describes message exchange formats, some of which have not been and will not be implemented in International Data Centre (IDC) software. Formats that are not used at the IDC are included in recognition of the fact that convergence of data formats between the various geophysical communities (treaty verification, earthquake reporting, and so on) is of obvious common benefit. The International Seismic Centre (ISC) has extended the IMS formats in such a way as to not affect use of the formats as described in this volume [ISC99]. The format enhancements utilize formatted comment lines and the addition of subblocks for certain data types. Nothing in the formats described by this document restricts the use of comments or the addition of new subblocks.

Software for receiving or generating messages or the formats and protocols for continuous data exchange are not described. These topics are described in sources cited in "Related Information" on page vi.

AUDIENCE

This document is intended for *AutoDRM* users in general, and software developers and engineers of the IDC *Message* and *Subscription Subsystem*s in particular.

RELATED INFORMATION

The following documents complement this document:

- *Formats and Protocols for Continuous Data CD-1.1* [IDC3.4.3]
- *Message Subsystem Software Users Manual* [IDC6.5.19]
- *Message Subsystem* [IDC7.4.2]
- *Subscription Subsystem* [IDC7.4.4]

See "References" on page 277 for a listing of all the sources of information consulted in preparing this document.

USING THIS DOCUMENT

This document is part of the overall documentation architecture for the IDC. As part of the Products and Services document category, this document provides descriptions of IDC products and their formats.

This document is organized as follows:

- Chapter 1: Message Protocol

  This chapter provides a high-level description of the protocol used to exchange messages.

- Chapter 2: Request Messages

  This chapter describes the formats for messages that are used to make requests for data and data products.

- Chapter 3: Subscription Messages

  This chapter describes the formats for messages that are used to establish and manipulate subscriptions.

- Chapter 4: S/H/I Data Messages

  This chapter describes the formats for messages that contain seismic, hydroacoustic, and infrasonic (S/H/I) data and data products.

- Chapter 5: Radionuclide Data Messages

  This chapter describes the formats for messages that contain radionuclide data and data products, including messages used for reporting problems encountered within the Radionuclide Monitoring System (RMS).

- Chapter 6: Summary Messages

  This chapter describes the formats for messages that contain summary data and data products.

- Chapter 7: Station AutoDRM Basics

  This chapter describes the formats that must be supported by auxiliary seismic stations of the International Monitoring System (IMS).

- References

  This section lists the sources cited in this document.

- Appendix A: Codes

  This appendix contains codes such as country codes and station codes used in IDC *AutoDRM* messages.

- Appendix B: Data Message Examples

  This appendix contains examples of formatted data messages.

- Appendix C: Authentication Example

  This appendix contains an example of an authenticated request message.

- Glossary

  This section defines the terms, abbreviations, and acronyms used in this document.

- Index

  This section lists topics and features provided in the document along with page numbers for reference.

Conventions

This document uses a variety of conventions, which are described in the following tables. Table I shows the typographical conventions. Table II explains certain technical terms that are not part of the standard Glossary, which is located at the end of this document.

TABLE I: TYPOGRAPHICAL CONVENTIONS

Element	Font	Example
required environments	**bold**	**time**
processes and software units user-defined arguments	*italics*	*AutoDRM* `msg_id id_string` [*source*]
computer code and output text that should be typed in exactly as shown	`courier`	`msg_type data` `begin ims1.0`
key words of control lines, environment lines, request lines, data lines, and specific data message types when used in text	CAPITALS	E-MAIL, TIME, ARR, BULLETIN, LOG, UNASSOCIATED, SHORT

TABLE II: TERMINOLOGY

Term	Description
*	(asterisk) symbol indicating that any ASCII character(s) may be substituted
[ ]	(square brackets) symbols delineating optional parameters in a syntax description
…	(ellipsis) symbol indicating that lines of an example have been intentionally omitted
|	(vertical bar) symbol indicating "or" in a syntax or environment description
block	group of lines in a data message that constitutes a cohesive unit of information

TABLE II: TERMINOLOGY (CONTINUED)

Term	Description
compressed data	data that have been reduced significantly in size to make transmission more efficient
control lines	request or subscription message lines that specify how/when the response to the request or subscription will be sent
data message	*AutoDRM* message that contains data, usually sent in response to a request message or a subscription
data products	reports, bulletins, and other products that contain the results of processing
environment lines	request or subscription message lines that establish an environment within which requests or subscriptions are made
identification lines	*AutoDRM* message lines that identify the *AutoDRM* version, message type, and reference numbers
logical line	*AutoDRM* instruction or data line that is a complete unit as defined in this document. A logical line may consist of one or more physical lines.
physical line	line terminated by a Line Feed or by a Line Feed followed by a Carriage Return
request lines	request or subscription message lines that specify the data or data product being requested
request message	*AutoDRM* message that requests data or data products
subscription message	*AutoDRM* message that establishes or alters regular delivery of data or data products

Formats in this document represent either American Standard Code for Information Interchange (ASCII) characters or binary fields, depending on the type of data being described. The conventions for ASCII formats include the following format types:

- "a" alphanumeric character strings
- "i" integers
- "f" floating point numbers

- "e" exponential numbers

Depending on the format type indicator (a, i, f, e), each is followed by either an integer or a decimal number. For alphanumeric character strings and integer numbers, the number following the format type is an integer that describes the maximum number of characters or digits allowed in a field. For example, the format "a5" indicates that the field is represented by five alphanumeric characters (for example, `SE001`), and the format "i4" indicates an integer number with four positions (for example, `4321`). For floating point and exponential numbers, the type indicator is followed by two numbers separated by a period as in "n.m". In both formats, "n" describes the maximum number of characters that may be used to represent the number, including decimal points, exponential indicators, plus or minus signs, and so on. For floating point numbers, "m" is the recommended number of digits that follow the decimal point. The number of digits after the decimal point is allowed to "float" to accommodate anomalous data. For example, "f5.2" accommodates numbers from `.0001` to `9999.`, but the preferred representation is two digits after the decimal point. For exponential number formats, "m" is the exact number of digits to the right of the decimal. For example, "e11.4" accommodates numbers like `–1.2345+E03`.

Some fixed formats allow combinations of the format types. Time and date formats combine the a, f, and i format types. A typical format for a date (such as `1998/04/15`) is i4,a1,i2,a1,i2.

Where binary data are part of a format description, the numbers and characters are expressed as the number of bytes that are used to store them along with the convention that is used for ordering the bytes. The Institute for Electrical and Electronic Engineers (IEEE) byte order convention is used throughout this document.

Chapter 1: Message Protocol

This chapter describes the message protocol and includes the following topics:

- Introduction
- Protocols
- Message Conventions
- Message Structure
- Message Authentication

Chapter 1: Message Protocol

INTRODUCTION

The protocol for exchanging noncontinuous IMS data, IDC products, and other messages is based upon *AutoDRM*, an automatic data request management system used for obtaining data automatically through a system of email messages [Kra93]. When request messages are sent via electronic mail (email) to the *AutoDRM*, the system responds with a return email message containing the requested data.

The basic *AutoDRM* formats and protocols established by [Kra93] were extended for the Group of Scientific Experts Third Technical Test (GSETT-3) [GSE95b]. The GSETT-3 formats were adopted for use at the IDC and were expanded from the original seismic application to include hydroacoustic, infrasonic, and radionuclide messages. This version of the formats was designated IMS1.0. Although S/H/I messages still use the IMS1.0 version of the formats, substantial additions and changes to radionuclide messages have advanced the version number for radionuclide messages from IMS1.0 to IMS2.0.

The three types of messages are described as follows:

- Request

  This message type contains a request for IMS/IDC data or data products.

- Subscription

  This message type establishes (or alters) standing requests for IMS/IDC data/data products.

- Data

  This message type contains IMS/IDC data or data products as well as RMS Alert data messages.

These message types are described in subsequent chapters.

PROTOCOLS

Two standard low-level protocols are used for the exchange of messages: electronic mail (email) and file transfer protocol (FTP). Differences exist, however, in the circumstances under which these protocols are used for transmitting radionuclide and S/H/I data messages.

For S/H/I-related messages, the use of the available message protocols depends on the message length and content. For example, email is used for exchanging shorter S/H/I-related messages containing alphanumeric data. FTP is used for exchanging longer S/H/I-related messages as well as those containing binary data.

In contrast, all radionuclide-related messages are exchanged via email. FTP is used only in extremely limited cases where large radionuclide data files are sent from the IMS/IDC to a National Data Center (NDC).

At the application level, the message protocol requires that request and subscription messages be answered with data messages. Information controlling the format, low-level protocol, and destination for the data message are included in request and subscription messages.

MESSAGE CONVENTIONS

Basic message conventions are used for both radionuclide- and S/H/I-related messages. However, some differences in conventions exist between the radionuclide- and S/H/I-related messages, including:

- fixed-format field justification
- case sensitivity

- blank lines
- missing data
- station naming
- comment conventions
- version format number

Version Format Number

For all S/H/I messages, the version format number is IMS1.0. For all radionuclides messages, the version format number is IMS2.0. This is a result of extensive changes made to the formats for radionuclide messages.

Message Size

The maximum size of a message is 100 MB. The maximum message size depends on the bandwidth of the connection between the message source and recipient, as well as the space available on computers for storing messages.

Although certain sites may be constrained by system limitations to sending email messages smaller than 400 KB, Transmission Control Protocol/Internet Protocol-based (TCP/IP) email systems are generally reliable up to at least 1 MB. To accommodate data messages larger than these limits, a mechanism is provided for a single data message to be split into several parts that can be reconstructed by the recipient (see "REF_ID" on page 15).

Radionuclide-related messages larger than 1 MB should be broken into several smaller emails using the methods described in "REF_ID" on page 15. For S/H/I-related messages, the message size determines the protocol that is most appropriate for message transmission. Messages larger than 1 KB should be transferred via FTP.

Line Length

Line length conventions apply only to ASCII message lines (as opposed to binary message lines that may be used in some waveform data messages). A line may be up to 1,024 characters long, excluding the special characters Line Feed (`LF`) and Carriage Return (`CR`). An ASCII message line may be terminated by a `LF` or by a `LF` followed by a `CR`.

The format for a message line determines its logical line length. A logical line may be broken into several physical lines. To break a logical line into several physical lines, a backslash (\)[1] is inserted at the desired break point. The logical line is then continued on the next physical line. The backslash may occur in any character position of the line and is counted as one of the physical line characters. The backslash does not hold the place of a blank or any other character. The character preceding the backslash is concatenated with the character in position one of the next physical line. If the logical line length for an ASCII line is longer than 1,024 (such as with ASCII waveform data), then the line break character (\) is not used. Data are simply continued on the next line.

Free-format Lines

Message lines that are not in fixed format are known as free-format lines. A free-format line may consist of a keyword followed by an argument list or it may contain unformatted free text. Free-format lines are left justified and case insensitive. Free-format lines must have one or more blank spaces between fields. All lines in request and subscription messages are free-format lines.

Fixed-format Lines

Fixed-format lines differ from free-format lines in that they have explicitly defined character fields. Most data message lines are in fixed format (header and data lines are examples).

1. The line break character (/) is not implemented at the IDC.

Although many fixed-format lines are case insensitive, some are not. Fixed-format lines that are case sensitive include message lines in waveform data messages after compression by the CM6 compression scheme (see "Subformat CM6" on page 152). No fixed-format lines in radionuclide data messages are case sensitive.

Field contents in radionuclide data messages that are parsed into the IMS/IDC database are left justified regardless of field or line formatting. Otherwise, field contents are right or left justified according to the field and line formatting. Alphanumeric character fields in fixed-format lines (such as a field with format a12) must be left justified. Numeric fields and numeric/alphanumeric character combination fields (such as f10.4; or i4,a1,i2) must be right justified.

Blank Lines

Blank lines are not permitted in radionuclide data messages that must be parsed into the IMS/IDC database. The exception to this rule occurs within free-format line text. Blank lines are allowed in free text fields such as those found in a `#Comment` block and an ALERT data message (see Table 56 on page 211 and "Alerts" on page 244).

In all other message types, blank lines may be added to improve legibility where they do not cause ambiguity.

Missing Data

Some fields in a message are required, while others are not. Blank characters can be used for missing data in S/H/I data message but not in Radionuclide data messages. For proper data parsing during automatic input processing, Radionuclide fields that are not required and are missing data must be filled. Missing Radionuclide numerical data (that is, floating point, integer, and exponential numbers) are indicated by a negative sign followed by as many "9s" as the field formatting will allow. For example, if the quantity for a field with format f5.2 is unknown, then the field should contain the number –9999. Missing Radionuclide character data with formats such as a50 are designated with a a single zero (0).

Comments

Comments for S/H/I-related messages are used primarily in LOG, ERROR_LOG, and FTP_LOG data messages. In these messages the comments are free-format lines in which the first character is blank.

Some ISC extensions of the IMS1.0 formats use comment lines to include additional information for some data types. These comment lines are formatted, always including a left parenthesis in the second column, and either a hash (#) or plus (+) in the third column, depending on the usage (see [ISC99]).

Comments in radionuclide-related messages use a free-format line structure that begins with a `#Comment` line. The lines following the `#Comment` line contain the comment text. The end of the comment is designated by a `STOP` line or another line beginning with a `#`. Comments may appear in all radionuclide data messages, however, only one `#Comment` block is allowed per message. `#Comment` blocks cannot occur within other data blocks, but instead must precede or follow a data block.

Date and Time Formats

The standard format for specifying the date and time contains two fields: one for the date and one for the time, with a blank separating the two fields. The date must always be present, but the time field may be omitted. When no time is specified, the field defaults to 00:00:00.000.

The time field may have varying degrees of precision (that is, decimal places in the *seconds* attribute). The time format with the highest precision follows:

Syntax

yyyy/mm/dd hh:*mm*:*ss*.*sss*

yyyy	year
mm	month number
dd	day of the month
hh	hour in universal coordinated time (UTC)
mm	minute
ss.sss	seconds

The range of time over a day is from 00:00:00.000 up to (but not including) 00:00:00.000 of the next day. Leading zeros in any of the number fields may be dropped in free-format lines, but they must be present in fixed-format lines. In addition, some of the values may be dropped from the time field in free-format lines. If the seconds, or the minutes and seconds, are dropped, then they are assumed to be "0" (for example, `21:03` is interpreted as 21:03:00.000 and `9` is interpreted as 09:00:00.000).

The following date-time formats are acceptable for free-format lines:

```
1994/01/01 13:04:12.003
1994/12/23
1995/07/14   01:05
1995/09/10 2:15:3
```

Radionuclide Site Codes

Radionuclide site codes must contain five characters. The first two characters are the country code for the country in which the site resides (see Table A-1 on page A2). The next character identifies the sample type collected at the station. Sample types include P for particulate radionuclide station, G for noble gas radionuclide station, and L for certified lab. The last two characters are the two-digit numbers assigned to the station or laboratory in the text of the CTBT. Radionuclide site codes for particulate stations, tentative noble gas stations, and certified labs are listed in the tables in "Radionuclide Site Codes" on page A10.

Radionuclide Detector Codes

The detector code enables easy identification of a unique detector and its location. RMS detector codes contain nine characters. The first five characters are the site code (see Radionuclide Site Codes). This code is followed by a unique four-character alphanumeric identifier assigned to the detector by its owner(s) or operating staff in accordance with the IMS.

The following example shows a possible detector code for an HPGe detector located at station DEP33:

```
DEP33HPGE
```

The following example shows a possible detector code for an HPGe detector at Health Canada in Ottawa used regularly for counting particulate samples from a remote, manual station:

```
CAL05-0G2
```

The following example shows a possible detector code for a β-γ coincidence detector located at station SEG63:

```
SEG63-XE1
```

S/H/I Network Codes

With the large number of S/H/I stations distributed globally, unique station names cannot be guaranteed. The S/H/I network naming format supports the concept of duplicate station names and thus requires that stations be affiliated with a network.

The network identifier can be up to nine characters in length and consists of two parts separated by an underscore. The first part is three or four characters in length and is the "domain" of the network. This code is either an internationally recognized affiliation (such as IDC) or a three-letter ISO standard country code, as shown in Table A-1 on page A2. The second part of the network identifier is the network code (1–4 characters) within that domain. An NDC sending data to the

IDC may use the network code `NDC`. For example, the three-letter ISO code for the Czech Republic is `CZE`, so the default network code for the NDC of the Czech Republic is `CZE_NDC`.

S/H/I Station Codes

To guarantee that station names are unique and follow international naming conventions, S/H/I station codes should be registered with the International Seismic Centre (ISC) in the United Kingdom/the National Earthquake Information Center (NEIC) in the United States.

All station codes must be five or fewer characters. Array stations have unique station codes for each element of the array as well as a unique array code that refers to the entire array. The code referencing the array should not be the same as the station code of any of the array elements.

S/H/I Channel Codes

The format for channel designators of S/H/I stations expands upon the format used by the Federation of Digital Seismic Networks (FDSN). Three characters are used to designate a channel. The first specifies the general sampling rate and the response band of the instrument, as shown in Table 1. The second character specifies the instrument code, as shown in Table 2. The third character specifies the physical configuration of the members of a multiple axis instrument package or other parameters as specified for each instrument, as shown in Table 3.

TABLE 1: S/H/I CHANNEL BAND CODES

Band Code	Band Type	Sample rate (Hz)	Corner period (seconds)
E	extremely short period	≥ 80	< 10
S	short period	≥ 10 to < 80	< 10
H	high broadband	≥ 80	≥ 10
B	broadband	≥ 10 to < 80	≥ 10

TABLE 1: S/H/I CHANNEL BAND CODES (CONTINUED)

Band Code	Band Type	Sample rate (Hz)	Corner period (seconds)
M	mid period	> 1 to < 10	
L	long period	= 1	
V	very long period	= 0.1	
U	ultra long period	= 0.01	
R	extremely long period	= 0.001	
W	weather/environmental		
X	experimental		

TABLE 2: S/H/I CHANNEL INSTRUMENT CODES

Instrument Code	Description
H	high-gain seismometer
L	low-gain seismometer
G	gravimeter/accelerometer seismometer
M	mass position seismometer
D	pressure sensor
C	composite trace

TABLE 3: S/H/I CHANNEL ORIENTATION CODES

Orientation Code	Description
Z, N, or E	traditional (vertical, north-south, east-west)
A, B, or C	tri-axial (along the edges of a cube turned up on a corner)
T or R	for transverse and radial rotations
1, 2, or 3	orthogonal components but nontraditional orientations

TABLE 3: S/H/I CHANNEL ORIENTATION CODES (CONTINUED)

Orientation Code	Description
U, V, or W	optional components
H	hydrophone
F	infrasonic pressure
C	coherent beam
I	incoherent beam
O	origin beam

S/H/I Auxiliary Codes

The auxiliary designator is used to distinguish between different instruments or data streams that have the same station and channel codes. This four-letter designator is used only when a conflict exists. When not needed, this field is left blank.

Latitude/Longitude Conventions

All latitudes and longitudes are written as floating point numbers. Latitudes in the Southern Hemisphere have negative values. Longitudes in the Western Hemisphere have negative values.

Energy Units

All energy units are reported in kiloelectron volts (keV).

Distance Units

Distance units used for S/H/I-related messages are nanometers for ground displacement, degrees for source-receiver distances, and kilometers for all other distance measures (this includes, for example, event depth, emplacement depth, and station elevation). Distance units in radionuclide-related messages are specific to each field as described in "Radionuclide Data Messages" on page 197.

MESSAGE STRUCTURE

The first three lines of a message are the BEGIN, MSG_TYPE, and MSG_ID lines. These provide information on

- the message format version number,
- the message type, and
- the message identification code.

If the message refers to a previous message (for example, a data message in response to a request message), then the fourth line is the REF_ID line. This line contains the message identification code of the referenced message.

If the message is a data message for a subscription, then the fourth line is a PROD_ID line. This line contains the product identification number and the sequence number for that product.

The BEGIN, MSG_TYPE, MSG_ID, and REF_ID/PROD_ID lines are followed by data specific to the message type. The final line of the message is the STOP line. The basic structure of a message is as follows:

Syntax

```
begin ims1.0
msg_type data | request | subscription
msg_id id_string [source]
[ref_id ref_str [ref_src] [part seq_num [of tot_num]]] |
[prod_id product_id delivery_id]
...
stop
```

BEGIN

Except in the case of a HELP message, the BEGIN line is the first line of an *AutoDRM* message. The BEGIN line contains the version identifier of the *AutoDRM* command syntax.

Syntax

```
begin [ims1.0]
```

The argument in the BEGIN line of a data message indicates the form of the data to follow. In some cases, earlier format versions will be accepted by the IDC.

The argument in the BEGIN line of a request message is the default format of the data that are requested. If a specific format string is given on a request line, that format specification will override the default.

MSG_TYPE

The MSG_TYPE line is the second line of a message. A message type is required for *AutoDRM* to distinguish between the different types of messages. Only one MSG_TYPE is allowed per message. Combining different message types in the same message is prohibited.

Syntax

```
msg_type request | data | subscription
```

MSG_ID

The MSG_ID line is the third line of a message. A message identification code is required for tracking and identifying messages. The MSG_ID line is comprised of the MSG_ID keyword followed by an *id_string* code and a *source* code separated by a blank.

The sender is responsible for providing a unique *id_string*, as well as a descriptive *source* code. The *id_string* may contain up to 20 alphanumeric characters. The *source* code is optional and may contain up to 16 alphanumeric characters. Blanks or backslash (\) characters are not allowed in either the *id_string* or the *source* codes.

Syntax

`msg_id` *id_string* [*source*]

id_string	unique identification code (up to 20 characters)
source	message source code (up to 16 characters)

The *source* of a message can be a station, a laboratory, an NDC, or the IDC. For radionuclide facilities, the radionuclide site code is used as the *source* (see "Radionuclide Site Codes" on page 8). For S/H/I stations and data centers (NDC and the IDC) the source is the network code (see "S/H/I Network Codes" on page 9).

REF_ID

The REF_ID line is included in a message in two cases:

- when a message is generated and transmitted to a party in response to a message received from (sent by) the same party, and/or
- when a very large message is split into several separate, smaller messages.

Like the MSG_ID, the REF_ID also serves to track and identify messages. If the REF_ID line function is not required in a message, it is omitted. Otherwise, it occurs as the fourth message line.

The REF_ID line is comprised of the REF_ID command followed by a *ref_str* code and a *ref_src* code, separated by a blank. The *ref_str* and *ref_src* are, respectively, the *id_string* and *source* in the MSG_ID line of the original message received. Like the *source*, the *ref_src* is not a required field.

For multiple messages that must be recombined to form a complete message, the REF_ID line contains additional commands and attributes.[2] Following the *ref_src*, the commands `part` and `of` are added with their respective attributes *seq_num*

2. Splitting messages is not implemented at the IDC.

and *tot_num*. The *tot_num* is the total number of separate messages that comprise the complete message unit. The order in which the messages should be recombined is indicated in the *seq_num*.

Syntax

`ref_id` *ref_str* [*ref_src*] [`part` *seq_num* [`of` *tot_num*]]

ref_str	the *id_string* from the MSG_ID line of the request message
ref_src	the message source code from the MSG_ID line of the request message
seq_num	sequence number beginning with 1
tot_num	total number of parts for this response

If a message must be split into smaller messages, the split(s) must occur only at DATA_TYPE boundaries. This method has the following advantages:

- data sections are never broken in the middle; and
- each message split is headed by BEGIN, MSG_TYPE, MSG_ID, and REF_ID lines, and terminated by a STOP line.

Each *id_string* in the MSG_ID lines of the individual split messages must be unique. The REF_ID lines, however, will have identical *ref_str* and *ref_src* codes. The `part` *seq_num* command is needed only when a message is split into parts. The `of` *tot_num* coding is optional for all but the last section of the split message.

Examples

To illustrate the use of REF_ID, suppose the following request for waveform data is sent from the NDC in country ABC to the IDC:

```
begin ims1.0
msg_type request
msg_id 1999/05/21_0001 ABC_NDC
...
stop
```

The IDC's response to the request will have a REF_ID from the IDC and will use the request message MSG_ID string in the REF_ID line:

```
begin ims1.0
msg_type data
msg_id 00000023 IMS_IDC
ref_id 1999/05/21_0001 ABC_NDC
...
stop
```

The following example shows a data message with four distinct DATA_TYPES:

```
begin ims1.0
msg_type data
msg_id 54965 IMS_IDC
ref_id 0002324 ANY_NDC
data_type type1 ims1.0
...
data_type type2 ims1.0
...
data_type type3 ims1.0
...
data_type type4 ims1.0
...
stop
```

The following example shows how a message can be split. The single message in the previous example is split into two distinct messages using the `part` *seq_num* [`of` *tot_num*] referencing mechanism.

```
begin ims1.0
msg_type data
msg_id 54965 IMS_IDC
ref_id 0002324 ANY_NDC part 1 of 2
data_type type1 ims1.0
...
data_type type2 ims1.0
...
stop

begin ims1.0
msg_type data
msg_id 54966 IMS_IDC
ref_id 0002324 ANY_NDC part 2 of 2
data_type type3 ims1.0
...
data_type type4 ims1.0
...
stop
```

PROD_ID

The PROD_ID line is the fourth line of a data message that is generated for a subscription. The PROD_ID line is comprised of the PROD_ID keyword followed by a *product_id* code and a *delivery_id* code, separated by a blank. These numbers help users receiving the subscription know if a delivery has been omitted.

Syntax

`prod_id` *product_id delivery_id*

product_id	product identification code
delivery_id	delivery identification

STOP

Except in the case of a HELP message, the STOP line is the last line of an *AutoDRM* message. In the case where two or more messages with different MSG_ID *id_string*s are included in one email or file, all lines between the STOP and BEGIN lines are ignored. A message without a STOP line is considered incomplete and is ignored.

MESSAGE AUTHENTICATION

IMS1.0 and IMS2.0 messages are sent via email using Multi-purpose Internet Mail Extension (MIME) (see Request for Comments [Fre96a], [Fre96b], [Moo96], [Fre96c], and [Fre96d]). Data and request messages in IMS1.0 or IMS2.0 format may be authenticated using MIME email-signed message formats without altering the formats. The authentication mechanism encapsulates the message within MIME boundaries consisting of the message body and the signature.

The MIME format is defined in [Gal95] and [Cro95]. Further drafts for these formats have standardized more aspects of the encapsulating procedures. The current industry practices, based on the standard described in [PKCS-7], provide the basis for the internet drafts. Messages delivered using a retrieval mechanism based on FTP would also use the MIME format for authentication.

Email signatures for messages would usually carry the entire senders X.509-signed certificate in the signature block [ISO95]. "Appendix C: Authentication Example" on page C1 provides an example of a signed email request and a breakdown of the signature block.

Standard email readers and senders have the capability to interpret and create these authentication signatures. With an appropriate certificate installed in a mail application, a user could manually create a valid request message. The particular message format does not have to be changed to be authenticated; it will just be encapsulated in a MIME standard signed format.

The originating parties signature may be retained when data or products are forwarded from one site to another. In this case, any subsequent signatures would encapsulate the entire previously signed message into a message body with an additional signature.

Chapter 2: Request Messages

This chapter describes the request message formats and includes the following topics:

- Introduction
- Help Line
- Request Format
- Request Control Lines
- Request Environment Lines
- Request Lines

Chapter 2: Request Messages

INTRODUCTION

The request message format provides a framework in which almost all data or data products can be requested from the IMS/IDC. The data and data products available include radionuclide pulse height data and analysis reports, S/H/I waveforms and bulletin products, and more.

Within a single request message, several types of data may be requested. For example, requests may be made for a bulletin and associated waveforms or for specific event information from several different regions. The order of the requests in the request message is preserved in the response (data) message.

Implementation of the *AutoDRM* formats will vary from site to site and will depend on the type of data and information that is available from the site. The minimum required configuration for a station or NDC *AutoDRM* is outlined in "Station AutoDRM Basics" on page 269.

HELP LINE

The HELP line is considered a request message because it is used to request an *AutoDRM* User's Guide by email. Only the *AutoDRM* email address is required for this protocol to work properly. No other message lines are required in a HELP line message. The same result may be achieved by sending the *AutoDRM* an empty message with the word "`help`" as the email subject (see "HELP" on page B25).

REQUEST FORMAT

With the exception of the HELP request, all request messages require the basic message structure described in "Message Structure" on page 13. To inform the *AutoDRM* that the message is a request message, the MSG_TYPE is set to `request`.

The body of a request message contains a series of free-format command lines that provide information about the return message (request control lines), set the environment for subsequent request lines (request environment lines), and specify the type of data that are to be returned within the limits of the environment (request lines). Some request lines must be preceded by environment lines that, by constraining the request, limit the size of the response.

The response to a request is contained in a data message. In the response data message, the identification (ID) fields from the MSG_ID line of the request message are placed in the REF_ID line.

REQUEST CONTROL LINES

Request control lines are commands that specify the protocol of the response data message. The existing options for the response message protocol are email and FTP. These options should be used in accordance with the guidelines described in "Protocols" on page 3 and "Message Size" on page 4.

Only one response message protocol can be specified in each request message. If different protocols are desired for the response data, separate request messages must be submitted to the *AutoDRM*. A request message that does not specify a response message protocol will be answered by email using the return address of the sender.

The syntax for the E-MAIL and FTP request control lines are described in the following sections.

E-MAIL

The E-MAIL line indicates to the *AutoDRM* that the response message protocol is email. The argument for the E-MAIL command is the email address to which the response message should be sent.

Syntax

`e-mail` *address*

address email address to send reply

If no E-MAIL line is included in the request message, the reply is sent to the address obtained from the mail header. Because the return address from an email header may not be reliable, it is highly recommended to specify the return email address using an E-MAIL line.

FTP

The FTP line specifies that the message should be put in a file for transmission using FTP. The argument for the FTP line is the email address to which notification should be sent, indicating that the FTP file is ready for transfer.

Syntax

`ftp` *address*

address email address to send notification

The notification message (an FTP_LOG data message) sent to the requestor contains the name and location of the FTP file(s) with the requested data or data product. (See “FTP_LOG” on page 194 for more about this data type and “Ftp_log” on page B23 for an example of an FTP_LOG data message.)

REQUEST ENVIRONMENT LINES

Environment lines identify the variables to which the response to the request line is constrained (for example, TIME or STATION). An environment variable is set by arguments that follow a predetermined keyword and is reset with another environment line including the same keyword. An environment keyword with no arguments resets the constraint on that environmental parameter to the default value. Environment variables may be specified using either ranges or lists.

An environment range constrains the variable to limits specified by two values. The two range limits are separated by the word "` to `" (including blank spaces).

Syntax

environment_keyword [[*low_limit*] `to` [*high_limit*]]

Open-ended ranges are specified by omitting the *low_limit* or the *high_limit*. A blank may also be used in the *low_limit* or the *high_limit* when a TIME environment is being specified.

Examples

All times from 23 February, 1999 at 00:00:00 up to (and including) 10 March, 1999 at 14:37:02 are specified with the following environment line:

```
time 1999/02/23 to 1999/03/10 14:37:02
```

The following example specifies all magnitudes of 5.0 and above:

```
mag 5.0 to
```

List environment lines contain lists of comma-delimited parameters that specify discrete constraints, such as station names and channels. Some list environments are allowed only one parameter (for example, BULL_TYPE); others may have an unlimited number. Spaces after the commas are optional. The general syntax for a list environment is as follows:

Syntax

environment_keyword [*arg1*[, *arg2*[, *arg3*[, …]]]]

Lists can be long, so a wild card character (*) may be used as a substitute for any string of characters in some list environments.

Examples

The following environment line specifies all IMS stations, including seismic, hydroacoustic, and infrasonic stations:

```
sta_list *
```

The following environment line specifies all IMS stations beginning with "A":

```
sta_list a*
```

The following environment line specifies all radionuclide stations operated by the U.S.:

```
sta_list us*
```

The following environment line specifies all IMS channels ending with "Z":

```
chan_list *Z
```

The following sections describe specific environment variables. Default settings and examples are given for each variable. Although many environment variables are listed, only certain ones may be applicable to a particular *AutoDRM* installation. Those variables that have been implemented are described in the *AutoDRM* User's Guide available through the HELP request line (see "Help Line" on page 22).

The STA_LIST, TIME, and TIME_STAMP environments can be used in requesting either radionuclide or S/H/I data. All other environment variables are used exclusively for requesting S/H/I data.

ARRIVAL_LIST

A unique arrival identification code is assigned to each waveform arrival. This arrival identification number appears in the data types for arrivals and bulletins and may be used to obtain arrival information.

Syntax

arrival_list [*arid* [, *arid* [, ...]]]

arid arrival identification code

Default

```
arrival_list *
```

Example

The following environment line limits the arrivals to those with arids `8971234` or `90814`:

```
arrival_list 8971234,90814
```

AUX_LIST

Station and channel are not always adequate to completely describe a specific data stream for some seismic stations.[1] An auxiliary identification is supplied for completeness in handling these special cases. The instances in which the auxiliary identifications are necessary should be rare. The wildcard character (*) is allowed in specifying auxiliary codes.

1. The AUX_LIST environment is not supported at the IDC.

Syntax

```
aux_list [aux[, aux[, ...]]]
```

aux auxiliary code

Default

```
aux_list *
```

Example

The following environment line limits the auxiliary code to `chi` and `med`:

```
aux_list chi,med
```

BEAM_LIST

Array station data may be delayed and summed (with weights) to form beams.[2] The BEAM_LIST environment specifies which beams are being requested.

Syntax

```
beam_list [beam[, beam[, ...]]]
```

beam beam code

Default

none

Example

The following line limits the beams to the frequency-wavenumber (fk) beam:

```
beam_list fkb
```

2. The BEAM_LIST environment is not supported at the IDC.

BULL_TYPE

The BULL_TYPE environment provides a means to specify which type of S/H/I bulletin to retrieve. Only one bulletin type may be specified in any BULL_TYPE line. The bulletin types include SEL1 (Standard Event List 1), SEL2 (Standard Event List 2), SEL3 (Standard Event List 3), REB (Reviewed Event Bulletin), SEB (Standard Event Bulletin), and SSEB (Standard Screened Event Bulletin). In addition, BULL_TYPE can be used to specify NEB (National Event Bulletin) and NSEB (National Screened Event Bulletin) bulletins defined using subscription messages.

Syntax

`bull_type` [*bulletin*]

bulletin	bulletin code (`sel1`, `sel2`, `sel3`, `reb`, `seb`, `sseb`, or `neb`/`nseb` bulletin types)

Default

none

Example

The following environment line limits the bulletin type to `sel1`:

```
bull_type sel1
```

CHAN_LIST

The S/H/I channel search list is given in the CHAN_LIST environment. The wildcard character (*) is allowed for specifying channel codes.

Syntax

`chan_list` [*chan* [, *chan* [, …]]]

chan	channel code

Default

```
chan_list *z
```

Example

The following environment line limits the channels to three short-period channels:

```
chan_list shz, shn, she
```

The following environment line limits the channels to all short-period channels:

```
chan_list s*
```

COMM_LIST

The communications list is a list of communication links to include in status reports.[3] Links are defined by the end of the link closest to the station. Thus, for the link between station ABC and the data center collecting data from that station, the communications link would be designated as ABC.

Syntax

comm_list [*comm* [, *comm* [, …]]]

comm	communications link code

Default

```
comm_list *
```

Example

The following environment line limits the communications links to those links from stations ABC and DEF to the data center:

3. The COMM_LIST environment is not supported at the IDC.

```
comm_list ABC, DEF
```

DEPTH

S/H/I events may be constrained by their depth using the DEPTH environment. Depth is given in kilometers from the surface.

Syntax

depth [[*shallow*] to [*deep*]]

shallow	low depth range
deep	high depth range

Default

no constraint

Example

The following environment line limits depths to a range from 0 to 10 km depth:

```
depth 0.0 to 10.0
```

DEPTH_MINUS_ERROR

The DEPTH_MINUS_ERROR environment is used to obtain all S/H/I events that have a 90 percent probability of being within a certain depth range. The ranges must be given in kilometers of depth from the surface.

Syntax

depth_minus_error [[*shallow*] to [*deep*]]

shallow	low depth range
deep	high depth range

Default

no constraint

Example

The following environment line limits the depth of events to a 90 percent probability of being within 10 km of the surface:

```
depth_minus_error 0.0 to 10.0
```

EVENT_LIST

A unique event identification code is assigned to each S/H/I event. This number appears in S/H/I bulletins and may be used subsequently to request waveforms or comments associated with a specific event.

Syntax

event_list [*evid* [, *evid* [, …]]]

evid — event identification code

Default

```
event_list *
```

Example

The following environment line limits the event number to `87623495` and `87`:

```
event_list 87623495, 87
```

EVENT_STA_DIST

The EVENT_STA_DIST environment is the distance in degrees between the S/H/I event and the S/H/I station. The environment is applied in context to the request. When requesting waveform data associated with specific S/H/I events, EVENT_STA_DIST helps determine the stations from which the data will be retrieved. When requesting bulletin-type information (bulletins, events, origins, or arrivals), EVENT_STA_DIST helps determine the S/H/I events for which the data will be retrieved.

Syntax

`event_sta_dist [[` *low_dist* `] to [` *high_dist* `]]`

low_dist	low-distance range
high_dist	high-distance range

Default

no constraint

Examples

The following EVENT_STA_DIST environment line limits the request for S/H/I bulletin information to events within 20 degrees of stations `ABC` or `DEF`:

```
sta_list ABC, DEF
event_sta_dist 0 to 20
bull_type REB
bulletin ims1.0
```

The following EVENT_STA_DIST environment line limits the request for waveform data to stations within 20 degrees of an event:

```
event_sta_dist 0 to 20
bull_type REB
relative_to bulletin
waveform ims1.0
```

GROUP_BULL_LIST

S/H/I events are often common between bulletins. Sometimes it is desirable to list the various solutions (origins) together. GROUP_BULL_LIST is a list of the bulletins that should be combined with the S/H/I bulletin specified in the BULL_TYPE environment. Origin information from these other bulletins will be included in the combined bulletin that is returned. The arrival information will be for the BULL_TYPE bulletin.

Events in the GROUP_BULL_LIST will be grouped with at most one S/H/I event in the BULL_TYPE bulletin. To be grouped, events must have locations within three degrees and origin times within 60 seconds. If the initial criteria are met for more than one S/H/I event, all events within the range are reported.

Syntax

`group_bull_list [` *bulletin* `[ ,` *bulletin* `[ , ... ] ] ]`

bulletin bulletin code

Default

none (no grouping)

Example

The following environment lines group `SEL3` origins with the `SEL1`:

```
bull_type SEL1
group_bull_list SEL3
```

LAT

The LAT environment specifies the range of latitude in degrees. Southern latitudes are negative. The low-range value must be smaller than the high-range value.

In cases where LAT can apply to origins or stations (for example, when requesting a S/H/I bulletin), the constraint will be applied to origins.

Syntax

```
lat [[low_lat] to [high_lat]]
```

low_lat	low-range latitude
high_lat	high-range latitude

Default

no constraint

Example

The following environment line limits latitudes to a range from 12 south up to (and including) 17 north:

```
lat –12 to 17
```

LON

The LON environment specifies the range of longitude in degrees. Western longitudes are negative, and the range is interpreted from west to east. Either both or neither (to return to the default values) of the longitudes must be provided in the LON environment.

In cases where LON can apply to S/H/I origins or stations (for example, when requesting a S/H/I bulletin), the constraint will be applied to origins.

Syntax

```
lon [west_lon to east_lon]
```

west_lon	western longitude
east_lon	eastern longitude

Default

no constraint

Examples

The following environment line limits the longitude range to the 350 degree swath from 175 degrees west up to (and including) 175 degrees east:

```
lon –175 to 175
```

The following environment line limits the longitude range to a 10-degree range spanning the international date line:

```
lon 175 to –175
```

MAG

The MAG environment specifies the range of magnitudes to include in the search for seismic events. The type of magnitude (m_b, M_s, and so on) is specified in the MAG_TYPE environment.

Syntax

`mag [[` *low_mag* `] to [` *high_mag* `]]`

low_mag	low-magnitude range
high_mag	high-magnitude range

Default

no constraint

Example

The following environment line limits magnitudes to those with magnitudes 4.5 and above:

```
mag 4.5 to
```

MAG_TYPE

The MAG_TYPE list environment specifies the type of magnitude to search when the MAG environment is provided. Standard accepted magnitude codes are `mb` (body wave magnitude), `Ms` (surface wave magnitude), and `ML` (local magnitude). Data centers may report other types of magnitudes, provided an explanation is given in the HELP message.

Syntax

`mag_type` [*mag_type* [`,` *mag_type* [`,` …]]]

mag_type `mb` | `Ms` | `ML`

Default

no constraint

Example

The following environment line limits the magnitude types to m_b and M_s:

```
mag_type mb, Ms
```

MB_MINUS_MS

This difference between m_b and M_s magnitude values specifies the range of magnitude differences to include in the search.

Syntax

`mb_minus_ms` [[*low_mag_diff*] `to` [*high_mag_diff*]]

low_mag_diff low-magnitude difference

high_mag_diff high-magnitude difference

Default

no constraint

Example

The following environment line limits the difference of magnitudes to the range from 1 up to (and including) 2:

```
mb_minus_ms 1.0 to 2.0
```

ORIGIN_LIST

A unique origin identification code is assigned to each origin. This origin identification code appears in S/H/I bulletins and may be used subsequently to request waveforms or comments associated with a specific origin.

Syntax

`origin_list` [*orid* [, *orid* [, ...]]]

orid origin identification code

Default

```
origin_list *
```

Example

The following environment line limits the origins to those with orids `132456` or `190672`:

```
origin_list 132456,190672
```

RELATIVE_TO

The concept of association provides the ability to tie or associate one S/H/I data type with another. The most common association is between waveforms and events and allows a user to request waveforms associated with a particular set of origins.

RELATIVE_TO has all of the characteristics of a list environment, except that it is active only for the subsequent request line, and the arguments are request keywords.

Syntax

```
relative_to origin | event | bulletin
```

The data type given in the RELATIVE_TO environment line is not returned in the response. That data type must be explicitly requested on another line, which typically precedes the RELATIVE_TO environment line.

Example

The following message requests the associated waveforms in `CM6` subformat for events found in the bulletin between 1:00 and 1:15 on 9 January, 1999:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1999/1/9 1:00 to 1999/1/9 1:15
bull_type reb
relative_to bulletin
waveform ims1.0:cm6
stop
```

To also request the REB bulletin for the time period in the example given above, the line `bulletin ims1.0` must be added:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1999/1/9 1:00 to 1999/1/9 1:15
bull_type reb
bulletin ims1.0
relative_to bulletin
waveform ims1.0:cm6
stop
```

STA_LIST

The STA_LIST environment provides the station search list. This variable may be used for specifying radionuclide and/or S/H/I stations. Radionuclide stations are identified by site codes (see "Radionuclide Site Codes" on page 8). If a S/H/I array station is specified, then all elements of the array are implied. Specific array elements may be referenced individually. The wildcard character (*) is allowed in specifying station codes.

When S/H/I bulletins are requested, STA_LIST can be used to specify the events to be included. If an event in the S/H/I bulletin contains at least one of the stations in the STA_LIST, that event, and all arrivals available for that event, will be included in the bulletin.

Syntax

sta_list [*sta* [, *sta* [, …]]]

sta	station or array code

Default

```
sta_list *
```

Example

The following environment line limits the station list to four specific S/H/I stations:

```
sta_list WHY,WOOL,STKA,FCC
```

The following environment line limits the returned data to that from radionuclide station CAP17:

```
sta_list CAP17
```

The following environment line limits the stations to those beginning with the character "A":

```
sta_list A*
```

TIME

The TIME environment is expressed as a range with date and decimal time entries. The time entries are optional. Unlike most range environments, a space is allowed between the date and time entries of the limits. In addition, this environment variable is translated according to the context of the requested data product. For example, TIME applies to the collection date and time for Standard Screened Radionuclide Event Bulletins (SSREBs), Sample Pulse Height Data (SAMPLEPHD), Automatic Radionuclide Reports (ARRs), and Reviewed Radionuclide Reports (RRRs), but applies to acquisition date and time for Gas Background Pulse Height Data (GASBKPHD), Blank Pulse Height Data (BLANKPHD), Meteorological Data (MET), Calibration Pulse Height Data (CALIBPHD), Detector Background Pulse Height Data (DETBKPHD), and Quality Control Pulse Height Data (QCPHD). TIME also applies to the creation date for the Radionuclide Network Product Summary (RNPS), the Radionuclide Laboratory Report (RLR), and ALERT messages, and the period date for Radionuclide Monitoring System State of Health (RMSSOH) messages. This convention is used only for request messages.

In requests for S/H/I data, only the date and time fields that are necessary to obtain the resolution must be specified; all other fields are assumed to be 0 or 1 as appropriate (1 for month and day, 0 for hour, minute, and second).

Syntax

time [[*date1* [*time1*]] to [*date2* [*time2*]]]

date1 time1 low-range date and time

date2 time2 high-range date and time

Default

time *(current date and time)* to *(current date and time)*

Examples

The following environment line limits the time to a range from 1999/02/01 00:00:00.0 up to (and including) 1999/03/01 00:00:00.0:

```
time 1999/02/01 to 1999/03/01
```

Either of the following environment lines limits the time to a range from 1999/02/01 23:14:19.7 up to (and including) 1999/03/01 12:00:00.0:

```
time 1999/02/01 23:14:19.7 to 1999/03/01 12
time 1999/2/1 23:14:19.7 to 1999/3/1 12
```

TIME_STAMP

The TIME_STAMP environment is used to request that data messages be time stamped. If requested, time stamps will appear at the beginning and end of each data type. Time stamps record the start time and end time that the message entered and exited the processing system.

Syntax

```
time_stamp
```

Default

none (do not time stamp the returned message)

Example

The following environment line turns on the time stamp utility:

```
time_stamp
```

REQUEST LINES

Request lines specify the type of information to be retrieved from the *AutoDRM* installation. All arguments in a request line are optional and include the format for the return message. The format is specified as a generic term, such as `ims1.0`. The arguments *subtype* and *sub_format* are used only in requests for S/H/I data. Radionuclide data are returned in the format specified on the BEGIN line.

Syntax

request_keyword [**:***subtype*] [*format* [**:***sub_format*]]

request_keyword
: The *request_keyword* specifies the requested data type.

subtype
: The S/H/I *subtype* specifies which subtype to use with this data type. The *subtype* allows a more precise data selection. The *subtype* is used primarily for arrival requests.

format
: The *format* specifies the data format to use in the return message (for example, `ims1.0`).

sub_format
: The S/H/I *sub_format* further specifies the precise format to use with this data type.

If the format of the S/H/I return data is not specified, the default format in the BEGIN line will be used.

The *subtype* argument is concatenated to the *request_keyword* with a colon (:) (for example, `arrival:automatic`). In addition, *sub_format* is concatenated to the *format* with a colon (for example, `ims1.0:cm6`).

For each request, a subset of the environments described in "Request Environment Lines" on page 25 must be specified (see Table 4 and Table 5). All required environments are enforced for each request. If an environment is not specified explicitly, then the default is used. Because the default values for some environments specify a zero length range (for example, `time`), a request made without explicitly defining these environments will result in no data being returned. Descriptions of the request lines include the applicable environment variables.

The order of the request lines is significant because the environment established prior to the request line is used to constrain the request. The environment can be changed between request lines to allow multiple requests for the same type of information within the same request message.

Example

The following message requests S/H/I bulletin information for all events in January 1999 within the areas defined by 10 to 20 degrees north and 120 to 160 degrees east and 55 to 45 degrees south and 25 to 15 degrees west:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1999/01/01 to 1999/02/01
lat 10.0 to 20.0
lon 120.0 to 160.0
bull_type reb
bulletin ims1.0
lat -55.0 to -45.0
lon -25.0 to -15.0
bulletin ims1.0
stop
```

TABLE 4: S/H/I DATA REQUEST ENVIRONMENT VARIABLES

Environments[1]	Request Lines: arrival/SLSD	bulletin	channel	chan_status	comment[2]	comm_status[2]	event	execsum	network[2]	origin	outage	response	station	sta_status	waveform
arrival_list	o	o			o										
aux_list[2]			o	o							o	o		o	o
beam_list[2]	o														o
bull_type	r	r					r			r					
chan_list	o		o	o[2]							o	o			o
comm_list[2]						o									
depth		o					o	o		o					
depth_minus_error		o					o	o		o					
event_list		o			o		o	o							
event_sta_dist		o					o	o		o					
group_bull_list		o					o								
lat		o	o[2]				o	o		o			o[2]		
lon		o	o[2]				o	o		o			o[2]		
mag		o					o	o		o					
mag_type		o					o	o		o					
mb_minus_ms		o					o			o					
origin_list		o			o			o		o					
relative_to															o

TABLE 4: S/H/I DATA REQUEST ENVIRONMENT VARIABLES (CONTINUED)

Environments[1]	Request Lines														
	arrival/SLSD	bulletin	channel	chan_status	comment[2]	comm_status[2]	event	execsum	network[2]	origin	outage	response	station	sta_status	waveform
sta_list	o	o	o	o[2]	o		o	o	o	o	o	o	o	o	o
time	r	r		r[3]	o	r	r	r		r	r	o		r[3]	r
time_stamp	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o

1. r = required, o = optional
2. Not supported at the IDC.
3. Minimum precision is days at the IDC.

TABLE 5: RADIONUCLIDE DATA REQUEST ENVIRONMENT VARIABLES

Environments[1]	Request Lines														
	alert_*	arr	blankphd	calibphd	detbkphd	gasbkphd	met	qcphd	rlr	rmssoh	rnps	rrr	sphdf	sphdp	ssreb
sta_list	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
time	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r
time_stamp	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o

1. r = required, o = optional

The following sections describe the possible request lines and include the applicable environment variables. The variables that must be explicitly specified to obtain a result are in **bold** type.

ALERT_FLOW

This data type is one of several radionuclide data products available from the IDC. The ALERT_FLOW indicates that a sampler flow rate is above or below a specified threshold. See "Alerts" on page 244 for a complete description and "ALERT_FLOW" on page B2 for an example.

Environment

`time`,
`sta_list`, `time_stamp`

Example

The following example requests time-stamped ALERT_FLOW messages for all radionuclide stations during the year 1999. Because the STA_LIST environment is not specified, the default (all stations) is used.

```
begin ims2.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time_stamp
time 1999/01/01 to 2000/01/01
alert_flow
stop
```

ALERT_SYSTEM

This data type is one of several radionuclide data products available from the IDC. The ALERT_SYSTEM indicates that the computer controlling the sampler/acquisition system is being rebooted or that the system is shutting down. See "Alerts" on page 244 for a complete description and "ALERT_SYSTEM" on page B2 for an example.

Environment

time,
sta_list, time_stamp

Example

The following example requests ALERT_SYSTEM messages for all radionuclide stations in the Russian Federation from January 1996 through August 2000.

```
begin ims2.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1996/01/01 to 2000/09/01
sta_list RU*
alert_system
stop
```

ALERT_TEMP

This data type is one of several radionuclide data products available from the IDC. The ALERT_TEMP indicates that a system temperature is outside the required IMS temperature range for that parameter. See "Alerts" on page 244 for a complete description and "ALERT_TEMP" on page B2 for an example.

Environment

time,
sta_list, time_stamp

Example

The following example requests ALERT_TEMP messages from station ARP01 from 22 November, 2000 through 31 December, 2000.

```
begin ims2.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 2000/11/22 to 2001/01/01
sta_list ARP01
alert_temp
stop
```

ALERT_UPS

This data type is one of several radionuclide data products available from the IDC. The ALERT_UPS indicates a problem with the UPS. See “Alerts” on page 244 for a complete description and “ALERT_UPS” on page B2 for an example.

Environment

time,
sta_list, time_stamp

Example

The following example requests time-stamped ALERT_UPS messages from all radionuclide stations in Australia from 25 April, 1999 to 15 October, 1999.

```
begin ims2.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time_stamp
time 1999/04/25 to 1999/10/16
sta_list AU*
alert_ups
stop
```

ARR

This data type is one of several radionuclide data products available from the IDC. The ARR includes results from the automated analysis of a radionuclide sample. See "ARR" on page 250 for a complete description and "ARR – Noble Gas Version" on page B3 and "ARR – Particulate Version" on page B4 for examples.

Environment

`time`,
`sta_list`, `time_stamp`

Example

The following message requests time-stamped ARR messages from radionuclide stations `FRP27` and `RUP54` for the month of March 2001:

```
begin ims2.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time_stamp
time 2001/03/01 to 2001/04/01
sta_list FRP27,RUP54
arr
stop
```

ARRIVAL/SLSD

The ARRIVAL and SLSD (Standard List of Signal Detections) requests are synonymous. An arrival is defined by excess energy that is identified in S/H/I waveform data. The amount of information about an arrival depends on the amount of processing that has been applied to the data. The different stages of processing are expressed using subtypes to the ARRIVAL or SLSD request lines as follows:

- `arrival:automatic` | `slsd:automatic`

  The AUTOMATIC subtype provides the result of the automatic detection process run on waveforms.

- `arrival:reviewed` | `slsd:reviewed`[4]

  The REVIEWED subtype provides the arrivals that have been automatically or manually reviewed to the extent that phase names have been assigned.

- `arrival:grouped` | `slsd:grouped`[4]

  The GROUPED subtype provides the arrivals that have been assigned phase names and that have also been grouped together with the assumption that they belong to the same event.

- `arrival:associated` | `slsd:associated`

  The ASSOCIATED subtype provides the arrivals that have been run through a location program and are associated to an event. ASSOCIATED is the default subtype for ARRIVAL/SLSD.

- `arrival:unassociated` | `slsd:unassociated`[4]

  The UNASSOCIATED subtype provides the arrivals that have been detected but not associated with any event.

A specific bulletin type must be specified through the BULL_TYPE environment for associated and unassociated arrivals.

Environment

`bull_type`, **`time`**,
`arrival_list`, `beam_list`[5], `chan_list`, `sta_list`,
`time_stamp`

4. The REVIEWED, GROUPED, and UNASSOCIATED ARRIVAL/SLSD subtypes are not supported by the IDC.
5. The BEAM_LIST environment is not supported by the IDC.

Example

The following message requests automatically determined arrivals from stations ABC and DEF for the month of March 1999:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1999/03/01 to 1999/04/01
sta_list ABC,DEF
bull_type SEL1
arrival:automatic ims1.0
stop
```

The following message requests associated arrivals from the REB from stations ABC and DEF for the month of March 1999:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1999/03/01 to 1999/04/01
sta_list ABC, DEF
bull_type reb
arrival:associated ims1.0
stop
```

BLANKPHD

BLANKPHD is one of several pulse height data (PHD) types available for particulate radionuclide samples. It contains the PHD of an unexposed air filter as well as other important information. See "Pulse Height Data" on page 201 for a description of the various PHD types and "BLANKPHD" on page B11 for an example.

Environment

time,
sta_list, time_stamp

Example

The following message requests time-stamped BLANKPHD messages from all radionuclide stations acquired during the year 2000. Note that the STA_LIST environment is not explicitly specified and therefore defaults to all stations.

```
begin ims2.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time_stamp
time 2000/01/01 to 2001/01/01
blankphd
stop
```

BULLETIN

Bulletins are composed of S/H/I origin, event, and associated arrival information. The SSREB cannot be obtained using BULLETIN; it is requested using a SSREB request line.

The IMS1.0 format bulletins, as implemented by the IDC, have two subformats: `ims1.0:short` and `ims1.0:long`. If the subformat is not specified, the SHORT subformat is used.

The environment for BULLETIN is also used to constrain waveforms when the RELATIVE_TO environment is used.

Environment

bull_type, **time**,
arrival_list, depth, depth_minus_error, event_list,
event_sta_dist, group_bull_list, lat, lon, mag, mag_type,
mb_minus_ms, relative_to, sta_list, time_stamp

Example

The following message requests the REB for 25 December, 1998:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1998/12/25 to 1998/12/26
bull_type reb
bulletin ims1.0
stop
```

The following message requests the REB and associated SEL2 origins for 25 December, 1998:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1998/12/25 to 1998/12/26
bull_type reb
group_bull_list sel2
bulletin ims1.0
stop
```

The following message requests the REB and associated SEL2 origins whose DEPTH_MINUS_ERROR is less than 10 km in the LONG subformat for 25 December, 1998:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1998/12/25 to 1998/12/26
depth_minus_error to 10
bull_type reb
group_bull_list sel2
bulletin ims1.0:long
stop
```

The following message requests the REB and associated SEL2 origins for 25 December, 1998 with DEPTH_MINUS_ERROR less than 10 km and MB_MINUS_MS 0.5 or greater:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1998/12/25 to 1998/12/26
depth_minus_error to 10
mb_minus_ms 0.5 to
bull_type reb
group_bull_list sel2
bulletin ims1.0
stop
```

CALIBPHD

This data type is one of several PHD types available for radionuclide samples. It contains the PHD of a standard calibration source, as well as other important information. See "Pulse Height Data" on page 201 for a description of the various PHD types and "CALIBPHD" on page B16 for an example.

Environment

time,
sta_list, time_stamp

Example

The following message requests time-stamped CALIBPHD messages from all radionuclide stations acquired during the year 2000. Because the STA_LIST environment is not specified the default (all stations) is used.

```
begin ims2.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time_stamp
time 2000/01/01 to 2001/01/01
calibphd
stop
```

CHANNEL

Channel is a complete set of information about the location, emplacement, and type of seismometers at a station.

Environment

aux_list[6], chan_list, lat[7], lon[7], sta_list, time_stamp

6. The AUX_LIST environment is not supported by the IDC.
7. LAT and LON are not supported for the CHANNEL request at the IDC.

Example

The following message requests the short-period channel information for stations in South America using the appropriate LAT and LON environment range. Note that the STA_LIST environment is not explicitly specified; the default for this variable is all stations.

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
lat -60 to 10.0
lon -81 to -34
chan_list s*
channel ims1.0
stop
```

CHAN_STATUS

Channel status is given for the channels in the CHAN_LIST[9] environment for the stations in the STA_LIST[9] environment. The TIME environment defines the report period. The minimum report period is one day.

Environment

time[8],
aux_list[9], chan_list[9], sta_list[9], time_stamp

Example

The following message requests the channel status reports over a four-day period:

8. The minimum precision of the TIME environment for CHAN_STATUS requests is days.
9. The AUX_LIST, CHAN_LIST, and STA_LIST environments are not supported by the IDC.

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1998/11/14 to 1998/11/18
chan_status ims1.0
stop
```

COMMENT

Comments may be associated with a S/H/I station, a S/H/I event, an origin, or an arrival.[10] To retrieve comments, the station code or the identifications (IDs) of the arrival, origin, or event can be used. These codes or IDs are listed in the bulletins and are obtained with a request (or subscription to) a bulletin or event list.

Environment

arrival_list | **event_list** | **origin_list** | **sta_list**,
time, time_stamp

Example

The following message requests the comments for events 510 and 512:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
event_list 510, 512
comment ims1.0
stop
```

10.The COMMENT request is not supported by the IDC.

COMM_STATUS

Communications status is given for the communications links listed in the COMM_LIST environment.[11] The TIME environment defines the report period. The minimum report period is one day. The *sub_format* field is used to indicate a verbose communications status report.

Syntax

```
comm_status [ ims1.0 [ :verbose ] ]
```

Environment

`time`,
`comm_list`, `time_stamp`

Example

The following message requests the verbose communications status reports for the link from `any_ndc` over a one-week period:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1998/11/14 to 1998/11/21
comm_list any_ndc
comm_status ims1.0:verbose
stop
```

11. The COMM_STATUS request is not supported by the IDC.

DETBKPHD

This data type is one of several PHD types available for radionuclide samples. It contains the PHD of an empty detector chamber as well as other important information. See "Pulse Height Data" on page 201 for a description of the various PHD types and "DETBKPHD" on page B19 for an example.

Environment

time,
sta_list, time_stamp

Example

The following message requests time-stamped DETBKPHD messages acquired during the year 2000 from radionuclide stations DEP33, SEP63, and GBP66:

```
begin ims2.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time_stamp
time 2000/01/01 to 2001/01/01
sta_list DEP33,SEP63,GBP66
detbkphd
stop
```

EVENT

An S/H/I event is the physical occurrence that was detected through the network of S/H/I sensors. S/H/I events can have many estimates of their time and location; these estimates are known as origins. Only those estimates given in the BULL_TYPE and GROUP_BULL_LIST environments are provided. The origin estimates in BULL_TYPE provide the basis for associating the origins in the GROUP_BULL_LIST.

Environment

bull_type, **time**,
depth, depth_minus_error, event_list, event_sta_dist,
group_bull_list, lat, lon, mag, mag_type, mb_minus_ms,
relative_to, sta_list, time_stamp

Example

The following message requests all of the March 1998 REB events within regional distance (20 degrees) of stations ABC and/or DEF. The list is also requested to include the SEL2 events that can be grouped with the REB events.

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1998/03/01 to 1998/04/01
bull_type reb
group_bull_list sel2
sta_list abc,def
event_sta_dist 0.0 to 20.0
event ims1.0
stop
```

EXECSUM

The executive summary (EXECSUM) contains summary statistics of the number of events in the SEB and those in the various event-screening categories, the number of radionuclide detections and those categorized as Level 4 or Level 5, and the number of events with cross-referenced radionuclide and seismic-acoustic data. It also contains status metrics regarding the IMS network, GCI communications, IDC processing, and Radionuclide Laboratories.

Environment

time,
depth, depth_minus_error, event_list, event_sta_dist, lat, lon, mag, mag_type, origin_list, sta_list, time_stamp

Example

The following message requests the EXECSUM for 25 December, 1998:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1998/12/25 to 1998/12/26
execsum ims1.0
stop
```

GASBKPHD

This data type is one of several radionuclide data products available from the IDC. The GASBKPHD contains the pulse height data of an empty plastic scintillation gas cell. At present, only noble gas monitoring systems that utilize beta-gamma coincidence counting have plastic scintillation gas cells. The GASBKPHD is acquired after a sample has been evacuated from the gas cell and before the next sample acquisition. The purpose of the GASBKPHD is to enable the quantification of radioxenon atoms that are adsorbed onto the walls of the plastic scintillation gas cell. See "Pulse Height Data" on page 201 for a complete description and "GASBKPHD" on page B23 for an example.

Environment

time,
sta_list, time_stamp

Example

The following example requests GASBKPHD messages for station DEG33 for 22 January, 2001.

```
begin ims2.0
msg_type request
msg_id example any_ndc
email name@my.computer
time 2001/01/22 to 2001/01/23
sta_list DEG33
gasbkphd
stop
```

MET

This data type is one of several radionuclide data products available from the IDC. The MET message contains meteorological data recorded at an RMS station. See “Meteorological Data” on page 244 for a complete description and “MET” on page B26 for an example.

Environment

time,
sta_list, time_stamp

Example

The following example requests time-stamped MET messages for station CAP14 for the month of January 2000.

```
begin ims2.0
msg_type request
msg_id example any_ndc
email name@my.computer
time_stamp
time 2000/01/01 to 2000/02/01
```

```
sta_list CAP14
met
stop
```

NETWORK

The NETWORK request line is used to obtain network information for stations in the STA_LIST environment.[12]

Environment

`sta_list`, `time_stamp`

Example

The following example requests time-stamped network information for station ARCES:

```
begin ims1.0
msg_type request
msg_id example any_ndc
email name@my.computer
time_stamp
sta_list ARCES
network
stop
```

ORIGIN

Origins are solutions to the location and time of a S/H/I event. Several origins may be determined for any one S/H/I event.

12.The NETWORK request is not supported at the IDC.

Environment

bull_type, **time**,
depth, depth_minus_error, event_sta_dist, lat, lon, mag,
mag_type, mb_minus_ms, origin_list, relative_to, sta_list,
time_stamp

Example

The following message requests origin information for the REB origins for 8 August, 1998:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1998/08/08 to 1998/08/09
bull_type reb
origin ims1.0
stop
```

The following message limits the previous request to a specific magnitude and depth range by including more environment lines:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1998/08/08 to 1998/08/09
mag 4.5 to 5.5
depth 0 to 10
bull_type reb
origin ims1.0
stop
```

OUTAGE

OUTAGE requests reports on S/H/I data that are not available for the specified time range.

Environment

`time`,
`chan_list`, `sta_list`, `time_stamp`

Example

The following message requests the outage reports for all S/H/I stations and channels for the month of March 1998. If the station and channels of interest are not explicitly specified, then the default station list (*) and channel list (*z) are used.

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1998/03/01 to 1998/04/01
outage ims1.0
stop
```

QCPHD

This data type is one of several PHD types available for radionuclide samples. It contains the PHD of a 15 minute sample acquisition as well as other important information. See "Pulse Height Data" on page 201 for a description of the various PHD types and "QCPHD" on page B28 for an example.

Environment

`time`,
`sta_list`, `time_stamp`

Example

The following message requests QCPHD messages from KWP40 acquired on 14 December, 1999:

```
begin ims2.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1999/12/14 to 1999/12/15
sta_list KWP40
qcphd
stop
```

RESPONSE

The response is the instrument response of the specified S/H/I network/station/channel identification code. Responses are valid at any given time and may change through time.

Environment

`chan_list`, `sta_list`, `time`, `time_stamp`

Example

The following message requests all the instrument responses for the broadband vertical channel of station `ABC` used in January 1999:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1999/01/01 to 1999/02/01
sta_list abc
```

```
chan_list bhz
response ims1.0
stop
```

RLR

This data type is one of several radionuclide data products available from the IDC. The RLR contains sample analysis results from a certified radionuclide laboratory. See "Data Products" on page 249 for a complete description and "RLR" on page B30 for an example.

Environment

time,
sta_list, time_stamp

Example

The following example requests time-stamped RLR messages for the month of September 2001 from radionuclide lab AUL02.

```
begin ims2.0
msg_type request
msg_id example any_ndc
email name@my.computer
time_stamp
time 2001/09/01 to 2001/10/01
sta_list AUL02
rlr
stop
```

RMSSOH

This data type is one of several radionuclide data products available from the IDC. The RMSSOH message describes the state of health of the collection, processing, and acquisition equipment at the IMS radionuclide stations. See "State of Health Data" on page 228 for a complete description and "RMSSOH" on page B32 for an example.

Environment

time,
sta_list, time_stamp

Example

The following example requests RMSSOH messages from all radionuclide stations in the United Kingdom of Great Britain and Northern Ireland for the period 6 February, 2001 to 5 March, 2001.

```
begin ims2.0
msg_type request
msg_id example any_ndc
email name@my.computer
time 2001/02/06 to 2001/03/06
sta_list GB*
rmssoh
stop
```

RNPS

This data type is one of several radionuclide data products available from the IDC. The RNPS is "a compilation of the status of collection, processing, and analysis of particulate and noble gas data from all radionuclide stations," [WGB00]. The RNPS is produced daily and summarizes the results for each station over the past three days. See "RNPS" on page 261 for a complete description and "RNPS" on page B33 for an example.

Environment

`time`,
`sta_list`, `time_stamp`

Example

The following example requests time-stamped RNPSs from all radionuclide stations from January 2001 through June 2001. Because the STA_LIST environment is not specified, the default (all stations) is used.

```
begin ims2.0
msg_type request
msg_id example any_ndc
email name@my.computer
time_stamp
time 2001/01/01 to 2001/07/01
rnps
stop
```

RRR

This data type is one of several radionuclide data products available from the IDC. The RRR, or Reviewed Radionuclide Report, is a revised version of the ARR, or Automated Radionuclide Report, and is generated after manual review of a radionuclide sample is complete. See "RRR" on page 260 for a complete description and "RRR – Noble Gas Version" on page B33 and "RRR – Particulate Version" on page B35 for examples.

Environment

`time`,
`sta_list`, `time_stamp`

Example

The following message requests time-stamped RRR messages from all U.S. radionuclide stations for the month of June 2000:

```
begin ims2.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time_stamp
time 2000/06/01 to 2000/07/01
sta_list US*
rrr
stop
```

SLSD

SLSD is a synonym for arrival. See "ARRIVAL/SLSD" on page 50.

SPHD/P

The Sample Pulse Height Data – Full (SPHDF) and Sample Pulse Height Data – Preliminary (SPHDP) data types are two of several PHD types available for radionuclide samples. The SPHDP contains PHD from a sample acquired for a time shorter than that of the full acquisition time. The SPHDF contains PHD from a sample acquired for the IDC-defined full acquisition time. Like the other PHD types, the SPHDF and SPHDP also include other important information. See "Pulse Height Data" on page 201 for a description of the various PHD types and "SAMPLEPHD – Noble Gas Version" on page B42 and "SAMPLEPHD – Particulate Version" on page B44 for examples.

Environment

time,
sta_list, time_stamp

Example

The following message requests SPHDP messages and SPHDF messages from all Australian radionuclide stations for 22 June, 2000:

```
begin ims2.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 2000/06/22 to 2000/06/23
sta_list AU*
sphdp
sphdf
stop
```

SSREB

This data type is one of several radionuclide data products available from the IDC. The SSREB, or Standard Screened Radionuclide Event Bulletin, is generated by the IDC when fission or activation products are detected at a radionuclide station above normal limits. An SSREB contains RRR messages from the stations that detect the fission product(s), information identifying the fission product(s), an estimate of the source location and time, as well as any sample analysis results from Certified Laboratories. See "SSREB" on page 260 for a description of the SSREB and "SSREB" on page B46 for an example.

Environment

time,
sta_list, time_stamp

Example

The following message requests all SSREB messages generated by the IDC during the first quarter of 2000:

```
begin ims2.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 2000/01/01 to 2000/04/01
ssreb
stop
```

STATION

S/H/I station information includes station codes, locations, elevations, station type (array, 3-C), and dates for which waveform or arrival data are available from an *AutoDRM*. Additional station codes may be reported for which neither waveform nor arrival data are available, but this can present problems for users of the *AutoDRM*.

Environment

lat[13], lon[13], sta_list, time_stamp

Example

The following message requests station information for all S/H/I stations serviced by this *AutoDRM*:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
station ims1.0
stop
```

The following message requests station information for S/H/I stations in the southern hemisphere:

13.LAT and LON are not supported for the STATION request at the IDC.

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
lat -90 to 0.0
station ims1.0
stop
```

STA_STATUS

Station status is given for the S/H/I stations in the STA_LIST environment. The TIME environment defines the report period. The minimum report period is one day.

Environment

time[14],
aux_list[15], sta_list, time_stamp

Example

The following message requests the S/H/I station status reports for all stations over a one-week period:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1998/11/14 to 1998/11/21
sta_status ims1.0
stop
```

14.The minimum precision of the TIME environment for CHAN_STATUS requests is days.
15. The AUX_LIST environment is not supported by the IDC.

WAVEFORM

Waveforms are digital timeseries data (S/H/I). The WAVEFORM request format will typically accept subformats that specify how the digital data are formatted within the general format of the waveform data type. The subformats include `int`, `cm6`, `cm8`, and `csf` for IMS1.0 data.

Environment

`time`,
`aux_list`[16], `beam_list`[17], `chan_list`, `sta_list`, `time_stamp`

Example

The following message requests data in six-bit compressed subformat from all channels of station ABC from 03:25 up to (but not including) 03:40 on 1 March, 1998:

```
begin ims1.0
msg_type request
msg_id example any_ndc
e-mail name@my.computer
time 1998/03/01 03:25 to 1998/03/01 03:40
sta_list abc
chan_list *
waveform ims1.0:CM6
stop
```

16. The AUX_LIST environment is not supported by the IDC.
17. The BEAM_LIST environment is not supported by the IDC.

Chapter 3: Subscription Messages

This chapter describes the formats for subscription messages and includes the following topics:

- Introduction
- Subscription Procedures
- Subscription Format
- Subscription Control Lines
- Subscription Environment Lines
- Subscription Request Lines

Chapter 3: Subscription Messages

INTRODUCTION

Subscription messages can be used as follows:

- to initiate a subscription,
- to change a subscription,
- to request an inventory of personal subscriptions,
- to request that issue(s) of a subscription be resent,
- to terminate a subscription, or
- to establish national bulletin products (NEBs and NSEBs).

The messages containing the subscription data are sent as data messages.

Subscriptions allow authorized users to have IDC data and data products automatically forwarded to them on a regular basis. The S/H/I products available through subscriptions include the continuous data from primary S/H/I stations in near-real time, bulletins, waveform segments, and arrival information. The radionuclide products available through subscriptions include all those available by request: ALERT_FLOW, ALERT_SYSTEM, ALERT_TEMP, ALERT_UPS, ARR, BLANKPHD, CALIBPHD, DETBKPHD, GASBKPHD, MET, QCPHD, RLR, RMSSOH, RNPS, RRR, SPHDF, SPHDP, and SSREB.

Subscriptions may be set up for continuous delivery (in the case of continuous data), immediately upon receipt or generation at the IDC (for example, discrete waveform or radionuclide data and data products), on a daily basis (for example, daily S/H/I bulletins and status reports or radionuclide data and data products), or at a user-specified frequency/time.

SUBSCRIPTION PROCEDURES

A subscription is made by sending a subscription message to the IDC *AutoDRM*. Upon receipt, the source of a subscription message is first validated for its authenticity. Next the volume of data that will be generated by the request is checked. Subscription messages that are not sent by an authorized user are rejected. After validation, the new subscription is added to the existing subscriptions for that user, and notification of the new subscription is sent to the subscriber in the form of a LOG data message. (See "LOG" on page 195 for a description of the LOG message and "Log" on page B26 for an example.) Each subscription is assigned a unique identification number at the IDC.

Examples

A subscription message is sent to the IDC requesting the daily REB:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq daily
bull_type reb
bulletin ims1.0
stop
```

The subscriber receives the following LOG data message as confirmation of the subscription. The subscription ID and product ID numbers are included in the message.

```
begin ims1.0
msg_type data
msg_id response_example ctbo_idc
ref_id example any_ndc
data_type log ims1.0
 subscription id: 52
 product id: 74
   added at 1997/01/12 19:36:00
```

```
 freq daily
 bull_type reb
 bulletin ims1.0
stop
```

After the subscription begins, data messages sent to the subscriber include the PROD_ID line that includes the product identification (ID) and a delivery ID number along with the subscription data.

SUBSCRIPTION FORMAT

A subscription message is formatted much the same way as a request message, but because subscription messages provide data on a scheduled basis rather than as a response to an individual request, they are given a separate message type and have additional capabilities that are not found in request messages.

Like most messages, a subscription request must contain the basic message lines: BEGIN, MSG_TYPE, MSG_ID, and STOP.

Example

The following example shows the general format of a subscription message:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
...
stop
```

A subscription message contains information about where to send the subscribed data, how often the subscribed data should be sent, and what data (or data products) to send. Like request messages, subscriptions are defined through environment variables that constrain the data to be sent and request lines that specify which data to send. Separate subscriptions are delimited by separate subscription request lines. In other words, each time a subscription request line is encountered, a corresponding subscription will be initiated for the user.

SUBSCRIPTION CONTROL LINES

Subscription control lines specify:

- the protocol of the response data message,
- the time duration and frequency of the subscription, and
- whether or not a message should be sent if there are no data to send.

Like request messages, the existing options for the response message protocol are email and FTP. These options should be used in accordance with the guidelines described in "Protocols" on page 3 and "Message Size" on page 4. The formats for E-MAIL and FTP control lines are identical to that in Request messages and can be found in "Request Control Lines" on page 23.

As in request messages, only one response message protocol can be specified in a subscription message. If different protocols are desired for the response data, separate subscription messages must be submitted to the *AutoDRM*. A subscription message that does not specify a response message protocol will be answered by email using the return address of the sender.

Control lines that are unique to subscription messages are described below.

FREQ

The FREQ control line specifies how often the data or products should be sent to the subscriber. The FREQ line may appear only once in a subscription message.

Four frequencies are allowed: `continuous`, `immediate`, `daily`, or `custom`[1]. When requesting continuous waveform data, FREQ is set to `continuous`. If it is desired for data or products to be delivered as soon as they become available, FREQ is set to `immediate`. When FREQ is set to `daily`, data and products are delivered once every day. If none of the previous FREQ options satisfies a user's needs, a FREQ of `custom` may be used. This allows a subscriber to specify the frequency/time at which a subscription is to be delivered.

1. FREQ = `custom` is not supported at the IDC.

Syntax

freq [continuous | immediate | daily | custom *per*/*dow*:*dom*:*hr*]

per	number of hours between messages
dow	day of the week (Sunday is 0)
dom	day of the month
hr	hour of the day

(–1 in any field indicates that the field should be ignored)

Default

```
freq daily
```

Example

The following environment line limits the delivery of data messages to the third day of every month at 00:00:00.000 UTC (*per* and *dow* have no meaning and are set to –1):

```
freq custom -1/-1:3:0
```

SEND_EMPTY

The SEND_EMPTY control line is a switch that controls whether or not a message is sent if no data match the subscription. This option allows a user to be notified of the absence of data or products.

To prevent the sending of numerous empty messages, this control line is not allowed when the FREQ control line is set to `immediate`.

Syntax

```
send_empty
```

Default

none (empty messages are not sent)

TIME

In a subscription message, the TIME control line refers to the active time of a subscription. The active time is given as a range. The format of TIME is similar to that in the request environment line (see "TIME" on page 41). In a subscription control line, however, the start time may have the value `now` (the current date and time), and the end time may have the value `forever` (the subscription will run indefinitely). These time limits are not valid for use in request messages.

Default

```
time now to forever
```

In the event that a subscription includes a start time before `now`, *AutoDRM* will generate a request message for the data from `time` *start time* `to now`, and the actual subscription will run from `now` to the specified end date.

SUBSCRIPTION ENVIRONMENT LINES

Subscription environment lines are used to define and limit the response to subscription request lines (see "Subscription Request Lines" on page 100) and to establish national bulletin products such as an NEB or NSEB. Many of the request environment variables in "Request Environment Lines" on page 25 are also used as subscription environment variables. These environment lines include BULL_TYPE, CHAN_LIST, DEPTH, DEPTH_MINUS_ERROR, EVENT_STA_DIST, LAT, LON, MAG, MAG_TYPE, MB_MINUS_MS, RELATIVE_TO, and STA_LIST. Some environment variables for request messages are not used in subscription messages. These include ARRIVAL_LIST, BEAM_LIST, EVENT_LIST, ORIGIN_LIST, and TIME (for subscriptions, TIME is a control line). Still other environment variables are unique to subscription messages, and the formats for these environment variables are provided in the following sections. Environment variables used in both request and subscription messages are not repeated in this chapter. See "Request Environment Lines" on page 25 for descriptions of these environment variables.

Of the environment variables unique to subscriptions, four are used when manipulating existing subscriptions or establishing subscriptions to standard products (DELIVID_LIST, SUBSCR_LIST, SUBSCR_NAME, and PRODID_LIST). The other environment variables are used to define screening criteria for national bulletins (NEBs and NSEBs) and national executive summaries, which can be obtained either through subscriptions or through the standard request mechanism. These subscription environment variables include:

> BULL_TYPE (which is used to establish the name for the product), DEPTH_CONF, DEPTH_KVALUE, DEPTH_THRESH, HYDRO_CP_THRESH, HYDRO_TE_THRESH, LOC_CONF, MB_ERR, MBMS_CONF, MBMS_SLOPE, MBMS_THRESH, MIN_DP_SNR, MIN_MB, MIN_MOVEOUT, MIN_NDEF, MIN_NDP, MIN_NSTA_MS, MIN_WDEPTH_THRESH, MS_ERR, and REG_CONF.

DELIVID_LIST

The DELIVID_LIST environment is a list of delivery identifiers. The delivery identifier is a number that appears as the third argument in the PROD_ID line for each message sent to a user for a given subscription. The second argument in the PROD_ID line is the product identifier, which denotes a specific product. These numbers are consecutive. This feature allows a user to identify a missing issue to a subscription. This environment is used only with the command SUBSCR_RESEND.

Syntax

`delivid_list` [*deliv_id* [`,` *deliv_id* [`,` …]]]

deliv_id	delivery identification number

Default

none

Example

The following subscription example demonstrates how delivery identification numbers are provided through the PROD_ID line.

Three consecutive messages received by a subscriber over three days contain sequential delivery identification numbers: 30, 31, and 32.

```
begin ims1.0
msg_type data
msg_id example_a ctbo_idc
prod_id 74 30
data_type bulletin ims1.0:short
...
(bulletin information)
...
stop

begin ims1.0
msg_type data
msg_id example_b ctbo_idc
prod_id 74 31
data_type bulletin ims1.0:short
...
(bulletin information)
...
stop

begin ims1.0
msg_type data
msg_id example_c ctbo_idc
prod_id 74 32
```

```
data_type bulletin ims1.0:short
...
(bulletin information)
...
stop
```

PRODID_LIST

The PRODID_LIST environment is a list of product ID numbers. A product ID number is a unique identifier for a certain IDC product and may be shared by multiple subscribers. All of the products identified in the PRODID_LIST will be processed for a subscription when the subscription request line is reached.

Syntax

`prodid_list` [*prod_id* [, *prod_id* [, …]]]

prod_id	identification number of the product

Default

The default values for this subscription environment variable depends on the subscription request line. The subscription request lines are as follows:

- none for `unsubscribe` (see "UNSUBSCRIBE" on page 127)
- all for `subscr_prod` (see "SUBSCR_PROD" on page 125)
- all for `subscr_log` (see "SUBSCR_LOG" on page 124)

SUBSCR_LIST

The SUBSCR_LIST environment lists subscription ID numbers. A subscription ID is a unique identifier for a particular subscription. All of the subscriptions specified in the SUBSCR_LIST will be processed for a subscription when the subscription request line is reached.

Syntax

`subscr_list` [*subscr_id* [, *subscr_id* [, …]]]

subscr_id identification number of the subscription

Default

The default values for this subscription environment variable depends on the subscription request line. The subscription request lines are as follows:

- none for `unsubscribe` (see "UNSUBSCRIBE" on page 127)
- all for `subscr_prod` (see "SUBSCR_PROD" on page 125)
- all for `subscr_log` (see "SUBSCR_LOG" on page 124)

SUBSCR_NAME

The SUBSCR_NAME environment lists the names of certain IDC data products. All IDC data products specified in the SUBSCR_NAME line will be processed for a subscription when the subscription request line is reached. These names may be used instead of subscription identifiers or product identifiers.

Syntax

`subscr_name` [*name* [, *name* [, …]]]

name name of the subscription

Default

none

BULL_TYPE

The BULL_TYPE environment provides a means to specify the name of a bulletin. In the context of subscribing to a bulletin product, BULL_TYPE is the name of the bulletin and can be the name of any standard bulletin (for example, `sel1`, `sel2`, sel3, reb, seb, or sseb) or a previously established NEB or NSEB. In the context of establishing a national bulletin, BULL_TYPE sets the name for the new national bulletin product. NEB and NSEB bulletin types must include either neb_ (for National Event Bulletin) or NSEB_ (for National Screened Event Bulletin) as the first characters of the bulletin code. Only one name may be specified in the BULL_TYPE line.

Syntax

The following syntax is used to subscribe to an existing bulletin product:

bull_type [*bulletin*]

bulletin	bulletin code (sel1, sel2, sel3, reb, seb, sseb, neb_*identifier*, nseb_*identifier*)
identifier	NEB or NSEB identifier

The following syntax is used to establish a NEB or NSEB:

bull_type n[s]eb_*identifier*

identifier	two-letter country code (see “Country Codes” on page A2) and number (for example, FR01 for a national bulletin of France)

Default

none

Example

The following environment line sets the bulletin name to NSEB_FR03:

```
bull_type NSEB_FR03
```

DEPTH_CONF

The DEPTH_CONF environment defines the confidence level for the seismic depth screening criterion, given as a number between 0.0 and 1.0.

Syntax

`depth_conf` [*conf*]

conf confidence level of depth screening criterion

Default

```
depth_conf 0.975
```

Example

The following environment line sets the confidence level for the depth screening criterion at 99 percent:

```
depth_conf 0.990
```

DEPTH_KVALUE

The DEPTH_KVALUE environment defines the depth model uncertainty in kilometers. This value is added to the uncertainty used in the screening criterion for free-depth solutions.

Syntax

`depth_kvalue` [*kvalue*]

kvalue depth model uncertainty

Default

```
depth_kvalue 20.0
```

Example

The following environment line sets the depth model uncertainty to 30 km:

```
depth_kvalue 30.0
```

DEPTH_THRESH

The DEPTH_THRESH environment defines the depth screening threshold in kilometers of depth from the surface. The value of DEPTH_THRESH must be non-negative. S/H/I events with depth confidence intervals deeper than this threshold are screened out.

Syntax

`depth_thresh` [*threshold*]

threshold	depth threshold

Default

```
depth_thresh 10.0
```

Example

The following environment line sets the depth screening threshold at 20.0 km:

```
depth_thresh 20.0
```

HYDRO_CP_THRESH

The HYDRO_CP_THRESH environment defines the hydroacoustic cepstral peak screening threshold. An S/H/I event with a hydroacoustic cepstral peak value greater than this threshold is not screened out, regardless of the other hydroacoustic screening criteria.

Syntax

```
hydro_cp_thresh [ threshold ]
```

threshold hydroacoustic total energy threshold

Default

```
hydro_cp_thresh 6.0
```

Example

The following environment line sets the hydroacoustic cepstral peak threshold to 7:

```
hydro_cp_thresh 7.0
```

HYDRO_TE_THRESH

The HYDRO_TE_THRESH environment defines the hydroacoustic total energy screening threshold, in decibels (dB). An S/H/I event with hydroacoustic total energy less than this threshold is screened out, provided it also satisfies additional criteria that the entire location error ellipse is offshore, with minimum water depth greater than the value of the MIN_WDEPTH_THRESH environment, and has a clear path to at least one IMS hydrophone.

Syntax

```
hydro_te_thresh [ threshold ]
```

threshold hydroacoustic total energy threshold

Default

```
hydro_te_thresh 10.0
```

Example

The following environment line sets the hydroacoustic total energy threshold to 15.0:

```
hydro_te_thresh 15.0
```

LOC_CONF

The LOC_CONF environment sets the confidence level of location error ellipses, as a number between 0.0 and 1.0, used to (1) assess whether the error ellipse for an S/H/I event was onshore, offshore, or mixed (in other words, partially onshore and offshore); (2) estimate the minimum water depth within the error ellipse; and (3) assess whether or not a hydroacoustic signal from any point within the error ellipse has a clear path to at least one IMS hydrophone.

Syntax

`loc_conf` [*conf*]

conf confidence level for location error ellipses

Default

```
loc_conf 0.90
```

Example

The following environment line sets the confidence level for location error ellipses at 99 percent:

```
loc_conf 0.99
```

MB_ERR

The MB_ERR environment defines the uncertainty term (standard deviation) for single-station m_b magnitude estimates, used in the computation of the confidence interval of the network estimate of m_b minus M_s.

Syntax

mb_err [*err*]

err — m_b uncertainty

Default

```
mb_err 0.3
```

Example

The following environment line sets the m_b uncertainty to 0.35:

```
mb_err 0.35
```

MBMS_CONF

The MBMS_CONF environment defines the confidence level for the Am_b–M_s screening criterion, given as a number between 0.0 and 1.0, where *A* is the slope.

Syntax

mbms_conf [*conf*]

conf — confidence level of the Am_b–M_s screening criterion

Default

```
mbms_conf 0.975
```

Example

The following environment line sets the confidence level of the Am_b–M_s screening criterion at 99 percent:

```
mbms_conf 0.99
```

MBMS_SLOPE

The MBMS_SLOPE environment defines the slope (*A*) of the Am_b–M_s relation. The value should be a positive number (typically between 1.0 and 1.5).

Syntax

mbms_slope [*slope*]

slope	the slope (*A*) of the Am_b–M_s relation

Default

```
mbms_slope 1.25
```

Example

The following environment line sets the slope of the Am_b–M_s relation at 1.50:

```
mbms_slope 1.50
```

MBMS_THRESH

The MBMS_THRESH environment defines the Am_b–M_s screening threshold in units of magnitude. S/H/I events with confidence intervals for Am_b–M_ss less than this threshold are screened out. The value of MBMS_THRESH is not restricted.

Syntax

```
mbms_thresh [ threshold ]
```

threshold threshold of the Am_b–M_s screening criterion

Default

```
mbms_thresh 2.20
```

Example

The following environment line sets the Am_b–M_s screening threshold at 3.5:

```
mbms_thresh 3.50
```

MIN_DP_SNR

The MIN_DP_SNR environment sets the minimum snr required for depth phases to be acceptable for use in event screening.

Syntax

```
min_dp_snr [ dp_snr ]
```

dp_snr depth phase snr

Default

```
min_dp_snr 2.0
```

Example

The following environment line sets the minimum depth phase snr to 1.5:

```
min_dp_snr 1.5
```

MIN_MB

The MIN_MB environment sets the minimum mb magnitude cutoff for an event to be considered for application of the S/H/I event-screening criteria.

Syntax

min_mb [*mb*]

mb event screening magnitude cutoff

Default

```
min_mb 3.5
```

Example

The following environment line sets the event screening magnitude cutoff to 4.0:

```
min_mb 4.0
```

MIN_MOVEOUT

The MIN_MOVEOUT environment sets the minimum depth phase moveout of pP–P (in seconds) required for a depth-phase solution to be acceptable for use in event screening.

Syntax

min_moveout [*moveout*]

moveout minimum depth phase moveout

Default

```
min_moveout 1.5
```

Example

The following environment line sets the minimum depth phase moveout to 2.5 seconds:

```
min_moveout 2.5
```

MIN_NDEF

The MIN_NDEF environment sets the minimum number of defining phases required for an event to be considered for event screening.

Syntax

`min_ndef` [*integer*]

integer minimum number of time-defining phases

Default

```
min_ndef 3
```

Example

The following environment line sets the minimum number of time-defining phases to 1:

```
min_ndef 1
```

MIN_NDP

The MIN_NDP environment sets the minimum number of depth phases required for a depth-phase solution to be acceptable for use in event screening.

Syntax

min_ndp [*integer*]

integer minimum number of depth phases

Default

```
min_ndp 3
```

Example

The following environment line sets the minimum number of depth phases to 1:

```
min_ndp 1
```

MIN_NSTA_MS

The MIN_NSTA_MS environment sets the minimum required number of seismic stations with M_s measurements for the Am_b–M_s screening criterion to be applied. The value of MIN_NSTA_MS must be a positive integer.

Syntax

min_nsta_ms [*integer*]

integer minimum number of seismic stations required with M_s measurements

Default

```
min_nsta_ms 1
```

Example

The following environment line sets the minimum number of seismic stations required with M_s measurements at 2:

```
min_nsta_ms 2
```

MIN_WDEPTH_THRESH

The MIN_WDEPTH_THRESH environment sets the minimum water depth threshold, in kilometers. The hydroacoustic screening algorithm will only be executed for S/H/I events with the minimum water depth within the location error ellipse greater than this value.

Syntax

`min_wdepth_thresh` [*threshold*]

threshold	minimum water depth threshold, in kilometers

Default

```
min_wdepth_thresh 0.5
```

Example

The following environment line sets the minimum water depth threshold to 0.7:

```
min_wdepth_thresh 0.7
```

MS_ERR

The MS_ERR environment defines the uncertainty term (standard deviation) for single-station M_s magnitude estimates, used in the computation of the confidence interval of the network estimate of m_b minus M_s.

Syntax

`ms_err` [*err*]

err	M_s uncertainty

Default

```
ms_err 0.3
```

Example

The following environment line sets the M_s uncertainty to 0.35:

```
ms_err 0.35
```

REG_CONF

The REG_CONF environment defines the confidence level for the regional P/S screening criterion, given as a number between 0.0 and 1.0.

Syntax

reg_conf [*conf*]

conf	confidence level of the regional screening criterion

Default

```
reg_conf 0.995
```

Example

The following environment line sets the confidence level of the regional screening criterion at 99.0 percent:

```
reg_conf 0.990
```

SUBSCRIPTION REQUEST LINES

Subscription message request lines specify the information to send in the return data message. The general formats used for request lines are described in "Request Lines" on page 43.

Some subscription request lines are the same as those used in request messages. NETWORK, STATION, CHANNEL, BEAM, RESPONSE, OUTAGE, and COMMENT are not used at all in subscriptions. SUBSCRIBE, UNSUBSCRIBE, SUBSCR_PROD, CHANGE, SUBSCR_RESEND, and SUBSCR_LOG are unique to subscriptions. Tables 6 and 7 give the applicable environments for the subscription request lines.

TABLE 6: S/H/I SUBSCRIPTION REQUEST ENVIRONMENTS

	Request Lines													
Environments[1]	**arrival**	**bulletin**	**change**	**chan_status**	**comm_status[2]**	**event**	**origin**	**sta_status**	**subscribe**	**subscr_log**	**subscr_prod**	**subscr_resend**	**unsubscribe**	**waveform**
bull_type	r	r					r							
chan_list														o
delivid_list												r		
depth		o[3]				o	o							
depth_conf		o[4]												
depth_kvalue		o[4]												
depth_minus_error		o[3]				o	o							
depth_thresh		o[4]												
event_sta_dist		o[3]				o	o							
hydro_cp_thresh		o[4]												
hydro_te_thresh		o[4]												
lat		o[3]				o	o							
loc_conf		o[4]												
lon		o[3]				o	o							
mag		o[3]				o	o							
mag_type		o[3]				o	o							
mb_err		o[4]												

TABLE 6: S/H/I SUBSCRIPTION REQUEST ENVIRONMENTS (CONTINUED)

Environments[1]	Request Lines: arrival	bulletin	change	chan_status	comm_status[2]	event	origin	sta_status	subscribe	subscr_log	subscr_prod	subscr_resend	unsubscribe	waveform
mb_minus_ms		o[3]				o	o							
mbms_conf		o[4]												
mbms_slope		o[4]												
mbms_thresh		o[4]												
min_dp_snr		o[4]												
min_mb		o[4]												
min_moveout		o[4]												
min_ndef		o[4]												
min_ndp		o[4]												
min_nsta_ms		o[4]												
min_wdepth_thresh		o[4]												
ms_err		o[4]												
prodid_list			*							o	o	*	*	
reg_conf		o[4]												
relative_to														o
sta_list	r	o[3]				o	o	o						o
subscr_list			*							o	o	*	*	
subscr_name			*						r	o	o	*	*	

1. r = required, * = one required, o = optional
2. Not supported at the IDC.
3. Not used for subscribing to NEB or NSEB products.
4. Used only to establish a NEB or NSEB.

TABLE 7: RMS SUBSCRIPTION REQUEST ENVIRONMENTS

Environments[1]	Request Lines																			
	alert_*	arr	blankphd	calibphd	change	detbkphd	gasbkphd	qcphd	rmssoh	rmps	rlr	rrr	sphdf	sphdp	ssreb	subscribe	subscr_log	subscr_prod	subscr_resend	unsubscribe
delivid_list																			r	
prodid_list					*												o	o	*	*
sta_list	o	o	o	o		o	o	o	o	o	o	o	o	o	o					
subscr_list					*												o	o	*	*
subscr_name					*											r	o	o	*	*

1. r = required, * = one required, o = optional

The following sections describe the possible request lines and the applicable environment variables. The environment variables that must be explicitly specified to obtain a result are in **bold** type.

ALERT_FLOW

This data type is one of several radionuclide data products available from the IDC. The ALERT_FLOW indicates that a sampler flow rate is above or below a specified threshold. See "Alerts" on page 244 for a complete description and "ALERT_FLOW" on page B2 for an example.

Environment

```
sta_list
```

Example

The following example requests ALERT_FLOW messages for all radionuclide stations. Because the STA_LIST environment is not specified, the default (all stations) is used.

```
begin ims2.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq immediate
alert_flow
stop
```

ALERT_SYSTEM

This data type is one of several radionuclide data products available from the IDC. The ALERT_SYSTEM indicates that the computer controlling the sampler/acquisition system is being rebooted or that the system is shutting down. See "Alerts" on page 244 for a complete description and "ALERT_SYSTEM" on page B2 for an example.

Environment

```
sta_list
```

Example

The following example requests ALERT_SYSTEM messages for all radionuclide stations in the Russian Federation.

```
begin ims2.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq immediate
```

```
sta_list RU*
alert_system
stop
```

ALERT_TEMP

This data type is one of several radionuclide data products available from the IDC. The ALERT_TEMP indicates that a system temperature is outside the required IMS temperature range for that parameter. See "Alerts" on page 244 for a complete description and "ALERT_TEMP" on page B2 for an example.

Environment

```
sta_list
```

Example

The following example requests ALERT_TEMP messages from station ARP01.

```
begin ims2.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq immediate
sta_list ARP01
alert_temp
stop
```

ALERT_UPS

This data type is one of several radionuclide data products available from the IDC. The ALERT_UPS indicates a problem with the UPS. See "Alerts" on page 244 for a complete description and "ALERT_UPS" on page B2 for an example.

Environment

```
sta_list
```

Example

The following example requests time-stamped ALERT_UPS messages from all radionuclide stations in Australia.

```
begin ims2.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq immediate
sta_list AU*
alert_ups
stop
```

ARR

This data type is one of several radionuclide data products available from the IDC. The ARR, or Automated Radionuclide Report, includes results from the automated analysis of a radionuclide sample. See "ARR" on page 250 for a complete description and "ARR – Noble Gas Version" on page B3 and "ARR – Particulate Version" on page B4 for examples.

Environment

```
sta_list
```

Example

The following message requests ARR messages with no restraints:

```
begin ims2.0
msg_type subscription
msg_id example any_ndc
```

```
e-mail name@my.computer
freq immediate
ARR
stop
```

ARRIVAL

An ARRIVAL line requests arrival information from specific S/H/I stations relative to events in a S/H/I bulletin. The amount of information that is returned depends on the amount of processing that has been applied to the data. The different stages of processing are expressed using subtypes to the arrival request lines as follows: `arrival:automatic`, `arrival:reviewed`,[2] `arrival:associated`, `arrival:grouped`,[2] and `arrival:unassociated`[2] (see "ARRIVAL/SLSD" on page 50 for definitions).

Environment

bull_type, **sta_list**

Example

The following subscription message requests automatic arrivals from S/H/I stations `ABC` and `DEF` from the SEL1 bulletin each day:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq daily
sta_list ABC,DEF
bull_type sel1
arrival:automatic ims1.0
stop
```

2. The REVIEWED, GROUPED, and UNASSOCIATED subtypes are not supported at the IDC.

BULLETIN

A BULLETIN request line in a subscription message can either request bulletin information for S/H/I events satisfying the environmental conditions or establish the screening parameters for an NEB or NSEB.

Environment

When subscribing to an existing bulletin product (with the exception of NEBs and NSEBs), the following environments are valid:

`bull_type`,
`depth`, `depth_minus_error`, `event_sta_dist`, `lat`, `lon`, `mag`,
`mag_type`, `mb_minus_ms`, `sta_list`

When subscribing to a NEB or NSEB, only the BULL_TYPE environment is valid:

`bull_type`

When establishing an NEB or NSEB bulletin product, the following environments are valid:

`bull_type`,
`depth`, `depth_conf`, `depth_kvalue`, `depth_minus_error`,
`depth_thresh`, `event_sta_dist`, `hydro_cp_thresh`,
`hydro_te_thresh`, `lat`, `loc_conf`, `lon`, `mag`, `mag_type`, `mb_err`,
`mb_minus_ms`, `mbms_conf`, `mbms_slope`, `mbms_thresh`, `min_dp_snr`,
`min_mb`, `min_moveout`, `min_ndef`, `min_ndp`, `min_nsta_ms`,
`min_wdepth_thresh`, `ms_err`, `reg_conf`, `reg_min_psnr`,
`reg_min_ssnr`, `sta_list`

Example

The following subscription message requests the daily REB with no constraints:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
```

```
e-mail name@my.computer
freq daily
bull_type reb
bulletin ims1.0
stop
```

The following subscription message requests the immediate SEL1 and SEL2. Soon after an event has been located (about two hours after real time for the SEL1 and about six hours after real time for the SEL2), the subscription software forwards the results to the user. In the example, messages would be sent to the user as often as once every 20 minutes, because the request has no constraints. This arrangement would be appropriate for an NDC system that processes the data automatically.

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq immediate
bull_type sel1
bulletin ims1.0
bull_type sel2
bulletin ims1.0
stop
```

The following subscription message requests the daily REB for events with depths less than 30 km, between magnitudes 3.5 and 4.5, and within the two areas defined by the latitude and longitude ranges:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq daily
bull_type reb
mag 3.5 to 4.5
depth to 30
```

```
lat -30 to -20
lon -180 to -140
bulletin ims1.0
lat 75 to 79
lon 110 to 140
bulletin ims1.0
stop
```

The following subscription message establishes a national event bulletin for France (NEB_FR01). Event characterization parameters will be based on the environments given in this message and the default values of the environments not listed.

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq daily
depth_conf 0.990
depth_kvalue 30.0
depth_thresh 20.0
loc_conf 0.99
mb_err 0.35
mbms_conf 0.99
mbms_slope 1.50
mbms_thresh 3.50
min_dp_snr 1.5
min_mb 4.0
min_moveout 2.5
min_ndef 1
min_ndp 1
min_nsta_ms 2
min_wdepth_thresh 0.7
ms_err 0.35
reg_conf 0.990
reg_min_psnr 1.5
reg_min_ssnr 1.5
time_stamp
```

```
bull_type NEB_FR01
bulletin ims1.0
stop
```

CALIBPHD

This data type is one of several PHD types available for radionuclide samples. It contains the PHD of a standard calibration source as well as other information. See "Pulse Height Data" on page 201 for a description of the PHD types and "CALIB-PHD" on page B16 for an example.

Environment

```
sta_list
```

Example

The following message requests CALIBPHD messages from all RMS stations to be sent as they become available:

```
begin ims2.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq immediate
calibphd
stop
```

CHANGE

After a subscription is established, it can be modified through the CHANGE request line. The subscription being changed is specified in the SUBSCR_LIST, PRODID_LIST, or SUBSCR_NAME environment. This line is followed by the CHANGE request line, then a listing of the changed environments and new values, and finally the applicable product. After the change, the subscription identifier will remain the same, but the product identifier and the delivery identifier will change.

Environment

prodid_list | subscr_list | subscr_name

Example

The following subscription message requests a change to the LAT and LON environments for the BULLETIN subscription number 52:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
subscr_list 52
change
lat 12 to 22
lon 18 to 28
bulletin ims1.0
stop
```

CHAN_STATUS

CHAN_STATUS requests channel status information.

Environment

chan_list,[3] freq, sta_list[3]

Example

The following subscription message requests the daily channel status reports:

3. The CHAN_LIST and STA_LIST environments are not supported for CHAN_STATUS subscriptions at the IDC.

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq daily
chan_status ims1.0
stop
```

COMM_STATUS

COMM_STATUS requests communications status information for the S/H/I communications links.[4] A verbose communications status report listing individual circuit dropouts is obtained by using the `verbose` subformat.

Environment

`freq`, `sta_list`

Example

The following subscription message requests the verbose communications status reports for all links:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq daily
comm_status ims1.0:verbose
stop
```

4. COMM_STATUS subscriptions are not supported at the IDC.

DETBKPHD

This data type is one of several PHD types available for radionuclide samples. It contains the PHD of an empty detector chamber as well as other important information. See "Pulse Height Data" on page 201 for a description of the various PHD types and "DETBKPHD" on page B19 for an example.

Environment

```
sta_list
```

Example

The following message requests DETBKPHDs from all Russian stations to be sent as they become available:

```
begin ims2.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq immediate
sta_list RU*
detbkphd
stop
```

EVENT

EVENT requests S/H/I event information for preferred origins satisfying the environmental constraints.

Environment

```
bull_type,
depth, depth_minus_error, event_sta_dist, lat, lon, mag,
mag_type, mb_minus_ms, sta_list
```

Example

The following subscription message requests all of the REB events within regional distance (20 degrees) of stations `ABC` and `DEF`:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq daily
bull_type reb
sta_list ABC,DEF
event_sta_dist 0.0 to 20.0
event ims1.0
stop
```

GASBKPHD

This data type is one of several radionuclide data products available from the IDC. The GASBKPHD contains the pulse height data of an empty plastic scintillation gas cell. At present, only noble gas monitoring systems that utilize beta-gamma coincidence counting have plastic scintillation gas cells. The GASBKPHD is acquired after a sample has been evacuated from the gas cell and before the next sample acquisition. The purpose of the GASBKPHD is to enable the quantification of radioxenon atoms that are adsorbed onto the walls of the plastic scintillation gas cell. See "Pulse Height Data" on page 201 for a complete description and "GASBKPHD" on page B23 for an example.

Environment

```
sta_list
```

Example

The following example requests GASBKPHD messages for station DEG33.

```
begin ims2.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq immediate
sta_list DEG33
gasbkphd
stop
```

MET

This data type is one of several radionuclide data products available from the IDC. The MET message contains meteorological data recorded at an RMS station. See "Meteorological Data" on page 244 for a complete description and "MET" on page B26 for an example.

Environment

```
sta_list
```

Example

The following example requests time-stamped MET messages for station CAP14.

```
begin ims2.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq immediate
sta_list CAP14
met
stop
```

ORIGIN

Origins are solutions to the location and time of a S/H/I source. Several origins may be determined for any one source. The ORIGIN line requests information for those origins that satisfy the environment constraints.

Environment

bull_type,
depth, depth_minus_error, event_sta_dist, lat, lon, mag,
mag_type, mb_minus_ms, sta_list

Example

The following subscription message requests origin information for the daily REB delivered when the REB is ready for distribution:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq daily
bull_type reb
origin ims1.0
stop
```

The following subscription message requests origin information for events in the daily REB limited to a specific geographic region:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq daily
lat -60 to 10.0
lon -81 to -34
```

```
bull_type reb
origin ims1.0
stop
```

QCPHD

This data type is one of several PHD types available for radionuclide samples. It contains the PHD of a 15 minute sample acquisition as well as other important information. See "Pulse Height Data" on page 201 for a description of the PHD types and "QCPHD" on page B28 for an example.

Environment

```
sta_list
```

Example

The following message requests QCPHD messages from TZP64 to be sent as they become available:

```
begin ims2.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq immediate
sta_list TZP64
qcphd
stop
```

RLR

This data type is one of several radionuclide data products available from the IDC. The RLR contains sample analysis results from a certified radionuclide laboratory. See "Data Products" on page 249 for a complete description and "RLR" on page B30 for an example.

Environment

```
sta_list
```

Example

The following example requests time-stamped RLR messages from radionuclide lab AUL02.

```
begin ims2.0
msg_type subscription
msg_id example any_ndc
email name@my.computer
sta_list AUL02
rlr
stop
```

RMSSOH

This data type is one of several radionuclide data products available from the IDC. The RMSSOH message describes the state of health of the collection, processing, and acquisition equipment at the IMS radionuclide stations. See "State of Health Data" on page 228 for a complete description and "RMSSOH" on page B32 for an example.

Environment

```
sta_list
```

Example

The following example requests RMSSOH messages from all radionuclide stations in the United Kingdom of Great Britain and Northern Ireland.

```
begin ims2.0
msg_type subscription
msg_id example any_ndc
```

```
email name@my.computer
sta_list GB*
rmssoh
stop
```

RNPS

This data type is one of several radionuclide data products available from the IDC. The RNPS is "a compilation of the status of collection, processing, and analysis of particulate and noble gas data from all radionuclide stations" [WGB00]. The RNPS is produced daily and summarizes the results for each station over the past three days. See "RNPS" on page 261 for a complete description and "RNPS" on page B33 for an example.

Environment

```
sta_list
```

Example

The following example requests time-stamped RNPSs from all radionuclide stations. Because the STA_LIST environment is not specified, the default (all stations) is used.

```
begin ims2.0
msg_type subscription
msg_id example any_ndc
email name@my.computer
rnps
stop
```

RRR

This data type is one of several radionuclide data products available from the IDC. The RRR, or Reviewed Radionuclide Report, is a revised version of the ARR, or Automated Radionuclide Report, and is generated after manual review of a radionuclide sample is complete. See “RRR” on page 260 for a complete description and “RRR – Noble Gas Version” on page B33 and “RRR – Particulate Version” on page B35 for examples.

Environment

```
sta_list
```

Example

The following subscription message requests daily RRR messages from stations in New Zealand. The frequency is not specifically identified because the default transmittal rate is daily.

```
begin ims2.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
sta_list NZ*
RRR
stop
```

SPHDF/P

The Sample Pulse Height Data – Full (SPHDF) and Sample Pulse Height Data – Preliminary (SPHDP) data types are two of several PHD types available for radionuclide samples. The SPHDP contains PHD from a sample acquired for a time shorter than that of the full acquisition time. The SPHDF contains PHD from a sample acquired for the IDC-defined full acquisition time. Like the other PHD types, the SPHDF and SPHDP also include other important information. See “Pulse Height Data” on page 201 for a description of the PHD types and “SAMPLEPHD – Noble Gas Version” on page B42 and “SAMPLEPHD – Particulate Version” on page B44 for examples.

Environment

```
sta_list
```

Example

The following message requests SPHDF messages from radionuclide stations located in Australia:

```
begin ims2.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq immediate
sta_list AU*
sphdf
stop
```

SSREB

This data type is one of several radionuclide data products available from the IDC. The SSREB, or Standard Screened Radionuclide Event Bulletin, is generated by the IDC when fission or activation products are detected at a radionuclide station above normal limits. An SSREB contains RRRs from the stations that detect the fission product(s), information identifying the fission product(s), an estimate of the source location and time, as well as any sample analysis results from certified laboratories. See "SSREB" on page 260 for a description of the SSREB and "SSREB" on page B46 for an example.

Environment

```
sta_list
```

Example

The following message requests all SSREB messages to be sent immediately:

```
begin ims2.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq immediate
ssreb
stop
```

STA_STATUS

STA_STATUS requests the station status for the S/H/I stations in the STA_LIST environment.

Environment

```
sta_list
```

Example

The following subscription message requests the daily station status reports for all S/H/I stations:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq daily
sta_list *
sta_status ims1.0
stop
```

SUBSCRIBE

SUBSCRIBE is a request to initiate a new subscription for each standard product given by the SUBSCR_NAME environment.

Environment

```
subscr_name
```

Example

The following subscription message requests a subscription to the standard product SEB:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
subscr_name seb
subscribe
stop
```

SUBSCR_LOG

SUBSCR_LOG requests a log of all of the user's changes to the subscriptions. The subscriber's email address determines the subscriptions to which a user is subscribed. Based on the email address, a log of all changes is sent out. The SUBSCR_LOG can be further constrained by use of the environments SUBSCR_LIST, PRODID_LIST, or SUBSCR_NAME.

Environment

```
subscr_list | prodid_list | subscr_name
```

Example

The following subscription message requests a log of subscription 74:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
subscr_list 74
```

```
e-mail name@my.computer
subscr_log
stop
```

The response to the preceding message is as follows:

```
begin ims1.0
msg_type data
msg_id response_example ctbo_idc
ref_id example any_ndc
data_type log ims1.0
  subscription id: 74
  product id: 52
      was added at 1997/01/09 19:36:00
      freq immediate
      bull_type reb
      bulletin ims1.0
  subscription id: 74
  product id: 94
      was changed at 1997/01/21 15:24:13
      the new product constraints are:
      freq immediate
      lat 12.00 to 22.00
      lon 18.00 to 28.00
      bull_type reb
      bulletin ims1.0
stop
```

SUBSCR_PROD

SUBSCR_PROD requests a list of the products currently subscribed to by the user. The response to this request includes the subscription identifier, product identifier, subscription name (where applicable), and a listing of the environment and request lines that define the specific product. The response is sent as a LOG data message. If SUBSCR_LIST, PRODID_LIST, or SUBSCR_NAME environments are not specified, then all products currently subscribed to by the user are provided.

Environment

subscr_list | prodid_list | subscr_name

Example

The following subscription message requests the current list of subscriptions that are in effect for the user:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
subscr_prod
stop
```

The response to this message is a LOG data message from the IDC:

```
begin ims1.0
msg_type data
msg_id response_example ctbo_idc
ref_id example any_ndc
data_type log ims1.0
 the following data products are subscribed
 to by name@my.computer:
 subscription id: 52
 product id: 74
   freq daily
   bull_type reb
   bulletin ims1.0
 subscription id: 57
 product id: 78
   freq immediate
   lat 0.0 to 10.0
   lon 120.0 to 140.0
   bull_type sel2
   bulletin ims1.0
stop
```

SUBSCR_RESEND

The SUBSCR_RESEND request causes a subscribed product to be re-delivered. This command gives the subscriber the ability to re-request delivery of a product.

Environment

`delivid_list`, `prodid_list` | `subscr_list` | `subscr_name`

Example

The following subscription message requests that delivery 32 of subscription 52 be resent to the user:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
subscr_list 52
delivid_list 32
subscr_resend
stop
```

UNSUBSCRIBE

The UNSUBSCRIBE request informs the IDC that the user wishes to remove the subscriptions referenced by the SUBSCR_LIST, PRODID_LIST, or SUBSCR_NAME environments. A LOG data message is sent confirming that the subscription has been cancelled.

Environment

`subscr_list` | `prodid_list` | `subscr_name`

Example

The following subscription message requests that subscriptions 52 and 57 be discontinued:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
subscr_list 52, 57
unsubscribe
stop
```

A confirming LOG data message from the IDC to the subscription user will be sent verifying that the subscription has been terminated:

```
begin ims1.0
msg_type data
msg_id response_example ctbo_idc
ref_id example any_ndc
data_type log ims1.0
 the following data products have been removed
 by name@my.computer:
 subscription id: 52
 product id: 94
   freq daily
   bull_type reb
   bulletin ims1.0
 subscription id: 57
 product id: 101
   freq immediate
   bull_type sel2
   bulletin ims1.0
stop
```

WAVEFORM

Waveforms are the digital timeseries data. WAVEFORM requests will typically accept subformats that specify the format of digital data within the general format of the waveform data type. The available formats for waveform data from the IDC subscription service are continuous data format for continuous data and IMS1.0 format for all other waveform data. The available subformats are `int`, `cm6`, `cm8`, and `csf`.

Environment

`chan_list`, `sta_list`, `relative_to`

Examples

The following subscription message requests continuous data from the short-period, high-gain, vertical channels of the `ABAR` array and from the central site (`CDA0`) of the `CDAR` array:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq continuous
sta_list ABAR,CDA0
chan_list shz
waveform ims1.0
stop
```

The following subscription message requests any waveform segments from auxiliary station `ABC` as soon as they are received by the IDC:

```
begin ims1.0
msg_type subscription
msg_id example any_ndc
e-mail name@my.computer
freq immediate
```

```
sta_list ABC
waveform ims1.0
stop
```

Chapter 4: S/H/I Data Messages

This chapter describes the request message formats and includes the following topics:

- Introduction
- Station Information
- Waveform Data
- Processing Products
- Status Information
- Logs

Chapter 4: S/H/I Data Messages

INTRODUCTION

IMS1.0 data formats provide a common format for data and data product exchange. The data formats all contain ASCII options that allow the exchange of information via email (even for waveforms). Waveforms in binary format may also be sent using the IMS1.0 message format, but the transmission of data messages with binary information must be via FTP.

Each data message contains the required information for all IMS1.0 messages. All data messages must contain the BEGIN line and be followed by a MSG_TYPE line and a MSG_ID line using the proper formats for the arguments. The MSG_TYPE for data messages is `data`. Because a data message may be a response to a request, a REF_ID line may also appear. If the data message is a response to a subscription, then a PROD_ID line will be included. Sections of data-specific information follow the identification line(s).

Many types of data can be exchanged by using the message formats described in this chapter. These types of data include timeseries, bulletins, station information, and others. The main data format supported by the IDC *AutoDRM* is IMS1.0. Subformats may also be available within a specific data type. The type of data that is included in a data section and the format of the data are designated with a DATA_TYPE line.

DATA_TYPE

Data sections must begin with a DATA_TYPE line. The arguments to DATA_TYPE are the type of data that follows (for example, WAVEFORM or BULLETIN) and the format (IMS1.0). The *subtype* and *sub_format* allow more precise selection of the data type and format, respectively.

Syntax

`data_type` *data_type*[`:`*subtype*] *format*[`:`*sub_format*]

data_type	type of data that follows; typical examples are WAVEFORM, BULLETIN, and RESPONSE
subtype	subtype to use with this data type. *subtype* is used primarily for ARRIVAL data types.
format	general format of the data (IMS1.0)
sub_format	internal format to use with this data type. *sub_format* is used primarily for BULLETIN and WAVEFORM data types.

Example

```
data_type waveform IMS1.0:cm6
```

The end of a data section is implied by another DATA_TYPE line or a STOP line.

The following sections give the formats for data messages. Examples of these data formats are provided in "Appendix B: Data Message Examples" on page B1.

STATION INFORMATION

Data types for S/H/I stations describe the stations through their locations, instrumentation, channels, and so on.

CHANNEL

The CHANNEL data type contains information describing the sensors and their emplacement. Table 8 gives the format for the CHANNEL data message, and an example is provided in "Channel" on page B18.

TABLE 8: CHANNEL FORMAT

Record	Position	Format	Description
1 (header)	1–3	a3	`Net`
	11–13	a3	`Sta`
	16–19	a4	`Chan`
	21–23	a3	`Aux`
	27–34	a8	`Latitude`
	36–45	a9	`Longitude`
	47–55	a9	`Coord Sys`
	63–66	a4	`Elev`
	70–74	a5	`Depth`
	78–81	a4	`Hang`
	84–87	a4	`Vang`
	89–99	a11	`Sample Rate`
	101–104	a4	`Inst`
	111–117	a7	`On Date`
	122–128	a7	`Off Date`
2–*n* (data)	1–9	a9	network code
	11–15	a5	station code
	17–19	a3	FDSN channel code
	21–24	a4	auxiliary code
	26–34	f9.5	latitude (degrees, South is negative)
	36–45	f10.5	longitude (degrees, West is negative)
	47–58	a12	coordinate system (for example, WGS-84)
	60–64	f5.3	elevation (km)
	66–70	f5.3	emplacement depth (km)

TABLE 8: CHANNEL FORMAT (CONTINUED)

Record	Position	Format	Description
2–*n* (data)	72–77	f6.1	horizontal angle of emplacement (positive degrees clockwise from North, –1.0 if vertical)
	79–83	f5.1	vertical angle of emplacement (degrees from vertical, 90.0 if horizontal)
	85–95	f11.6	sample rate (samples/sec)
	97–103	a6	instrument type
	105–114	i4,a1,i2,a1,i2	start date of channel operation (*yyyy/mm/dd*)
	116–125	i4,a1,i2,a1,i2	end date of channel operation (*yyyy/mm/dd*)

NETWORK

The NETWORK data type provides a descriptive name for each network code. Table 9 shows the format for the NETWORK data message. An example is provided in "Network" on page B26.

TABLE 9: NETWORK FORMAT

Record	Position	Format	Description
1 (header)	1–3	a3	`Net`
	11–21	a11	`Description`
2–*n* (data)	1–9	a9	network code
	11–74	a64	descriptive network name

STATION

The STATION data type describes the site, location, and dates of operation. For arrays, the unique array code that defines a reference point (used for beam) is given along with the information from each element. Table 10 shows the format for the STATION data message. An example is provided in "Station" on page B47.

TABLE 10: STATION FORMAT

Record	Position	Format	Description
1 (header)	1–3	a3	`Net`
	11–13	a3	`Sta`
	17–20	a4	`Type`
	23–30	a8	`Latitude`
	33–41	a9	`Longitude`
	43–51	a9	`Coord Sys`
	57–60	a4	`Elev`
	64–70	a7	`On Date`
	74–81	a8	`Off Date`
2–*n* (data)	1–9	a9	network code
	11–15	a5	station code
	17–20	a4	`1C` = single component `3C` = three component `hfa` = high-frequency array `lpa` = long-period array
	22–30	f9.5	latitude (degrees, South is negative)
	32–41	f10.5	longitude (degrees, West is negative)
	43–54	a12	coordinate system (for example, WGS-84)
	56–60	f5.3	elevation (km)
	62–71	i4,a1,i2,a1,i2	start of station operation (*yyyy/mm/dd*)
	73–82	i4,a1,i2,a1,i2	end of station operation (*yyyy/mm/dd*)

WAVEFORM DATA

Data types for waveforms include the response of the instrumentation and the waveform data formats.

RESPONSE

The RESPONSE data type allows the complete response to be given as a series of response groups that can be cascaded. Modern instruments are composed of several different components, each with its own response. This format mimics the actual configuration of the instrumentation.

A complete response description is made up of the `CAL2` block (Table 11) plus one or more of the `PAZ2`, `FAP2`, `GEN2`, `DIG2`, and `FIR2` response blocks in any order (Tables 12–16). The response blocks should be given sequential stage numbers (beginning with 1) in the order that they occur in the system response.

Each response block is comprised of a header line and sufficient occurrences of the values lines to provide all required coefficients. The `DIG2` block may occur only once per response. Comments may be inserted after the `CAL2` block and after any response section as desired, provided that they are enclosed with parenthesis beginning in column 2. Successive channel responses should also be separated by blank lines for readability.

The input of the earth to seismic stations is in nanometers of displacement (all of the responses are displacement responses). For hydroacoustic and infrasonic, the input is units=pressure=(micro-Pascal). Velocity or acceleration responses can be obtained by multiplying the response curve by $i\omega$ or $-\omega^2$, respectively. An example of the RESPONSE data message is provided in "Response" on page B29.

The `CAL2` block gives general information about the response information that follows (see Table 11).

TABLE 11: CALIBRATION IDENTIFICATION BLOCK FORMAT

Record	Position	Format	Description
1 (data)	1–4	a4	CAL2
	6–10	a5	station code
	12–14	a3	FDSN channel code
	16–19	a4	auxiliary identification code
	21–26	a6	instrument type
	28–42	e15.8	system sensitivity (nm/count) at calibration reference period[1]
	44–50	f7.3	calibration reference period (seconds)
	52–62	f11.5	system output sample rate (Hz)
	64–73	i4,a1,i2,a1,i2	effective start date (*yyyy*/*mm*/*dd*)
	75–79	i2,a1,i2	effective start time (*hh*:*mm*)
	81–90	i4,a1,i2,a1,i2	effective end date (*yyyy*/*mm*/*dd*)[2]
	92–96	i2,a1,i2	effective end time (*hh*:*mm*)

1. System sensitivity, calibration reference period, and sample rate should be the same as in the wid2 block.
2. The start/end date/times specify the time period for which the response is valid. If the response is still valid, the end date/time should be left blank.

A poles and zeros block (PAZ2) can be used for either an analog filter or an infinite impulse response (IIR) filter. In the data section, poles are always given first followed by zeros (see Table 12).

TABLE 12: POLES AND ZEROS BLOCK FORMAT

Record	Position	Format	Description
1 (data)	1–4	a4	PAZ2
	6–7	i2	stage sequence number
	9	a1	output units code (V = volts, A = amps, C = counts)
	11–25	e15.8	scale factor
	27–30	i4	decimation (blank if analog)
	32–39	f8.3	group correction applied (seconds)
	41–43	i3	number of poles
	45–47	i3	number of zeros
	49–73	a25	description
2–*n* (data)	2–16	e15.8	real part of pole or zero
	18–32	e15.8	imaginary part of pole or zero

Like PAZ2, the frequency, amplitude, phase (FAP2) block can be used to specify the response of analog or digital filters, or some combination of them including a complete system response (see Table 13).

TABLE 13: FREQUENCY, AMPLITUDE, AND PHASE BLOCK FORMAT

Record	Position	Format	Description
1 (data)	1–4	a4	FAP2
	6–7	i2	stage sequence number
	9	a1	output units code (V = volts, A = amps, C = counts)
	11–14	i4	decimation (blank if analog)
	16–23	f8.3	group correction applied (seconds)
	25–27	i3	number of frequency, amplitude, phase triplets
	29–53	a25	description
2–*n* (data)	2–11	f10.5	frequency (Hz)
	13–27	e15.8	amplitude (input units/output units)
	29–32	i4	phase delay (degrees)

The generic response block (GEN2) can specify the response of analog or digital filters, or some combination of them, including a complete system response (see Table 14).

TABLE 14: GENERIC RESPONSE BLOCK FORMAT

Record	Position	Format	Description
1 (data)	1–4	a4	`GEN2`
	6–7	i2	stage sequence number
	9	a1	output units code (`V` = volts, `A` = amps, `C` = counts)
	11–25	e15.8	section sensitivity (input units/output units)
	27–32	f7.3	calibration reference period (seconds)
	35–38	i4	decimation (blank if analog)
	40–47	f8.3	group correction applied (seconds)
	49–51	i3	number of corners
	53–77	a25	description
2–*n* (data)	2–12	f11.5	corner frequency (Hz)
	14–19	f6.2	slope above corner (dB/decade)

The digitizer block (`DIG2`) specifies the digitizer sample rate and sensitivity. It also provides a description field to identify the model of digitizer being used (Table 15).

TABLE 15: DIGITIZER RESPONSE BLOCK FORMAT

Record	Position	Format	Description
1 (data)	1–4	a4	`DIG2`
	6–7	i2	stage sequence number
	9–23	e15.8	sensitivity (counts/input unit)
	25–35	f11.5	digitizer sample rate (Hz)
	37–61	a25	description

The finite impulse response block (`FIR2`) is used to describe the response of FIR digital filters (see Table 16).

TABLE 16: FINITE IMPULSE RESPONSE BLOCK FORMAT

Record	Position	Format	Description
1 (data)	1–4	a4	FIR2
	6–7	i2	stage sequence number
	9–18	e10.2	filter gain (relative factor, *not* in dB)
	20–23	i4	decimation (blank if analog)
	25–32	f8.3	group correction applied (seconds)
	34	a1	symmetry flag (A = asymmetric, B = symmetric [odd], C = symmetric [even])
	36–39	i4	number of factors
	41–65	a25	description
	2–16	e15.8	factor(i)
	18–32	e15.8	factor(i+1)
2–*n* (data)	34–48	e15.8	factor(i+2)
	50–64	e15.8	factor(i+3)
	66–80	e15.8	factor(i+4)

Comments on the response of an instrument are enclosed in parentheses (Table 17).

TABLE 17: RESPONSE COMMENT BLOCK FORMAT

Record	Position	Format	Description
1	2	a1	(
	3–n	a<n–1>	Comment
	n+1	a1	)

WAVEFORM

The format for WAVEFORM data messages consists of a waveform identification (WID2) block (Table 18), followed by the station (STA2) block (Table 19), the waveform data (DAT2) block (Table 20), and a checksum (CHK2) block (Table 21). Each DAT2 block should be followed by a CHK2 block so that the validity (or otherwise) of the data can be verified.

TABLE 18: WAVEFORM IDENTIFICATION BLOCK FORMAT

Record	Position	Format	Description
1	1–4	a4	WID2
	6–15	i4,a1,i2,a1,i2	date of the first sample (*yyyy/mm/dd*)
	17–28	i2,a1,i2,a1,f6.3	time of the first sample (*hh*:*mm*:*ss*.*sss*)
	30–34	a5	station code
	36–38	a3	FDSN channel code
	40–43	a4	auxiliary identification code
	45–47	a3	INT, CM*n*, or CSF INT is free-format integers as ASCII characters. CM denotes compressed data, and *n* is either 6 (6-bit compression), or 8 (8-bit binary compression) CSF is a signed format
	49–56	i8	number of samples
	58–68	f11.6	data sampling rate (Hz)
	70–79	e10.2	system sensitivity (nm/count) at the calibration reference period, the ground motion in nanometers per digital count at calibration period (calper)
	81–87	f7.3	calibration reference period; the period in seconds at which the system sensitivity is valid; calper should be near the flat part of the response curve (in most cases, 1 second)

TABLE 18: WAVEFORM IDENTIFICATION BLOCK FORMAT (CONTINUED)

Record	Position	Format	Description
1	89–94	a6	instrument type (from Table A-5 on page A17)
	96–100	f5.1	horizontal orientation of sensor, measured in positive degrees clockwise from North (–1.0 if vertical)
	102–105	f4.1	vertical orientation of sensor, measured in degrees from vertical (90.0 if horizontal)

TABLE 19: STATION BLOCK FORMAT

Record	Position	Format	Description
1	1–4	a4	STA2
	6–14	a9	network identifier
	16–24	f9.5	latitude (degrees, South is negative)
	26–35	f10.5	longitude (degrees, West is negative)
	37–48	a12	reference coordinate system (for example, WGS-84)
	50–54	f5.3	elevation (km)
	56–60	f5.3	emplacement depth (km)

TABLE 20: WAVEFORM DATA BLOCK FORMAT

Record	Position	Format	Description
1	1–4	a4	DAT2
2–*n* (data)	1–1024 *variable*	i, a, or f	data values

TABLE 21: CHECKSUM BLOCK FORMAT

Record	Position	Format	Description
1 (data)	1–4	a4	`CHK2`
	6–13	i8	checksum

The `WID2` block gives the following information:

- date and time of the first data sample
- station, channel, and auxiliary codes
- subformat of the data
- number of samples and sample rate
- calibration of the instrument represented as the number of nanometers per digital count at the calibration period
- type of instrument (shown in Table A-5 on page A17)
- horizontal and vertical orientation of the instrument

The auxiliary code will be blank in most cases; the code is only used when two data streams with the same station and channel codes conflict. Instrument response information must be obtained separately using a RESPONSE request.

Data following the `DAT2` block may be in any of four different subformats recognized in the IMS1.0 waveform format: `int`, `cm6`, `cm8`, and `csf`. `int` in a simple ASCII subformat; the `cm-` subformats are for compressed data, and the `cfs` subformat is for authenticated data. All of the *AutoDRM* formats represent the numbers as integers.

A checksum must be computed for the waveform data in the IMS1.0 waveform format. The checksum is computed from integer data values prior to converting them to any of the subformats. Figure 1 shows the FORTRAN subroutine for computing `CHK2` checksum, and Figure 2 shows the C function for computing the `CHK2` checksum. To prevent overflow, the checksum is computed modulo 100,000,000 and stored as an eight-digit integer without a sign.

The line length limits for *AutoDRM* messages are enforced for the IMS1.0 data formats; no line may be longer than 1,024 bytes. The line continuation character (\) is not used in waveform data lines.

Examples of the `cm6` and `int` subformats of the WAVEFORM data message are provided in "Waveform (IMS1.0:cm6 format)" on page B48 and "Waveform (IMS1.0:int format)" on page B49.

Using the `OUT2` and `DLY2` blocks, the WAVEFORM data type can also be used to respond that no data are available for a request or that the response to the request will be delayed. Table 22 shows how the blocks are used (see also Table 23 and Table 24). In addition, the `STA2` block contains station information. This block is mandatory and must immediately follow the `WID2`, `OUT2`, and `DLY2` blocks.

```
 subroutine compute_checksum(signal_int,number_of_samples,checksum)
c*****************************************************************
c  This subroutine computes ims1.0 checksum used in the CHK2 line
c*****************************************************************
c  declarations
c
      implicit none
c
      integer*4 signal_int(*)        ! (input)  seismic signal
                                     !         (counts, integer values)
      integer*4 number_of_samples    ! (input)  number of used samples
      integer*4 checksum             ! (output) computed checksum
      integer*4 i_sample                ! index
      integer*4 sample_value            ! value of one sample after
                                        ! sample overflow check
      integer*4 modulo                  ! overflow protection value
      integer*4 MODULO_VALUE            ! overflow protection value
      parameter (MODULO_VALUE = 100 000 000)
c
c  initialize the checksum
      checksum = 0
c
c  use modulo variable besides MODULO_VALUE parameter to suppress
c  optimizing compilers to bypass local modulo division computation
      modulo = MODULO_VALUE
c
c  loop over all samples (counts, integer values)
c
      do i_sample = 1, number_of_samples
c
c  check on sample value overflow
c
          sample_value = signal_int(i_sample)
          if(abs(sample_value) .ge. modulo)then
              sample_value = sample_value-
     *        (sample_value/modulo)*modulo
          endif
```

FIGURE 1. FORTRAN SUBROUTINE FOR COMPUTING CHK2 CHECKSUM

```
#include <stdlib.h>
#include <math.h>

/*
    This function computes the ims1.0 checksum used in the CHK2 line
*/
void
compute_checksum(signal_int, number_of_samples, _checksum)
        int     *signal_int;
        int     number_of_samples;
        int     *_checksum;
{
        int     i_sample;
        int     sample_value;
        int     modulo;
        int     checksum;

        int     MODULO_VALUE = 100000000;

        checksum = 0;

        modulo = MODULO_VALUE;

        for (i_sample=0; i_sample < number_of_samples; i_sample++)
        {
                /* check on sample value overflow */

                sample_value = signal_int[i_sample];

                if (abs(sample_value) >= modulo)
                {
                        sample_value = sample_value -
                                (sample_value/modulo)*modulo;
```

FIGURE 2. C FUNCTION FOR COMPUTING CHK2 CHECKSUM

TABLE 22: APPLICABLE BLOCKS FOR WAVEFORM MESSAGES

Waveform Message	Block[1]							
	WID2	OUT2	DLY2	STA2	EID2	BEA2	DAT2	CHK2
waveform data message	r			r	o	o	r	r
no data message		r		r				
data delayed message			r	r				

1. r = required, o = optional

TABLE 23: OUT2 BLOCK FORMAT

Record	Position	Format	Description
1	1–4	a4	`OUT2`
	6–15	i4,a1,i2,a1,i2	date of the first missing sample (*yyyy*/*mm*/*dd*)
	17–28	i2,a1,i2,a1,f6.3	time of the first missing sample (*hh*:*mm*:*ss*.*sss*)
	30–34	a5	station code
	36–38	a3	FDSN channel code
	40–43	a4	auxiliary identification code
	45–55	f11.3	duration that data are unavailable (seconds)

TABLE 24: DLY2 BLOCK FORMAT

Record	Position	Format	Description
1	1–4	a4	`DLY2`
	6–15	i4,a1,i2,a1,i2	date of the first delayed sample (*yyyy*/*mm*/*dd*)
	17–28	i2,a1,i2,a1,f6.3	time of the first delayed sample (*hh*:*mm*:*ss*.*sss*)
	30–34	a5	station code
	36–38	a3	FDSN channel code
	40–43	a4	auxiliary identification code
	45–55	f11.3	estimated duration of queue (seconds)

The optional `EID2` block specifies to which event(s) a waveform is associated (see Table 25). This block is used when waveforms are requested from a bulletin with the RELATIVE_TO environment. The `EID2` block may be repeated for each event to which a waveform is associated.

TABLE 25: EID2 BLOCK FORMAT

Record	Position	Format	Description
1	1–4	a4	`EID2`
	6–13	a8	event identification of associated event
	15–23	a9	bulletin type

The optional `BEA2` block specifies how a beamed waveform was formed (see Table 26). This block is only used when the waveform is the result of beaming.

TABLE 26: BEA2 BLOCK FORMAT

Record	Position	Format	Description
1	1–4	a4	BEA2
	6–17	a12	beam identification for the waveform
	19–23	f5.1	azimuth used to steer the beam (measured in positive degrees clockwise from North)
	25–29	f5.1	slowness used to steer the beam (s/degree, –999.0 if vertical beam)

Subformat INT

The INT waveform subformat represents integer data as blank or newline delimited ASCII characters. The number of blank spaces between samples is unspecified, and an individual sample value may not be continued on the next line.

Waveform Compression Schemes

Two different compression schemes are recognized in the IMS1.0 waveform format: CM6 and CM8.

For waveform data, the difference between data samples is usually much smaller than the instantaneous magnitudes. The difference of the differences (the second difference) is even smaller. Transmitting the second difference requires fewer significant bits. Reductions in the message length can be achieved if the number of bits to convey the information is reduced when the signal level is small and expanded when the signal level rises. Because samples will take a variable number of bits, an index is required to specify the number of bits in each sample.

Both compression schemes use second differences as a first step in reducing the number of significant bits required to convey the information in the timeseries. A first difference is computed as the difference between successive samples. A second difference is the difference between the differences. The first value in both steps keeps its absolute value (see the following sections).

The following paragraphs describe the compression schemes to reduce the number of bits and/or to make transmission easy.

Subformat CM6

The `CM6` compression scheme is a six-bit compression of second differences. The advantage of this method is in its conversion of binary integer data to ASCII characters that can be successfully transmitted using email. The compression algorithm converts waveforms into a set of printable ASCII characters carefully avoiding those that have been found to cause problems to either communications circuits or the computers connected to them. The algorithm uses only the 64 characters +, –, 0 – 9, A – Z and a – z.

Initially, all data samples in the packet are represented as 32-bit, 2's complement integers, with a range of $-(2^{31})$ to $+(2^{31}-1)$. Second difference samples are encoded as the difference between the first differences and can be computed for the jth sample using the following formula:

$$D_2(j) = S(j) - 2S(j-1) + S(j-2)$$

where zero and negative indices are ignored. Thus, the second difference data for N samples are as follows:

$$S(1), S(2) - 2S(1), S(3) - 2S(2) + S(1), \ldots, S(N) - 2S(N-1) + S(N-2)$$

To compress the numbers, the second differences are converted from 2's complement to sign and magnitude. These numbers are then fit into a variable number of bytes in which only the six most significant bits (MSB) are used. The most significant usable bit of each byte is used as a flag or control bit, which, if set, signifies that the following byte also contains information relating to the same sample. The second most significant bit is used as a sign bit in the first byte pertaining to a sample and as a data bit in all following bytes of the sample. All other bits are used to represent the value of the second difference of the sample. These numbers are then fit into a variable number of bytes in which only the six most significant bits are used (see Table 27).

TABLE 27: BIT POSITIONS FOR CM6

Most Significant Bit							Least Significant Bit
control	sign/data	data	data	data	data	unused	unused

These six-bit bytes are then used to refer to a lookup table (see Table 28) from which one of 64 different ASCII characters (+, –, 0–9, A–Z, a–z) is extracted.

TABLE 28: ASCII REPRESENTATION OF BIT PATTERNS FOR CM6

Bit Pattern	Char[1]	Bit Pattern	Char	Bit Pattern	Char	Bit Pattern	Char
000000	+	010000	E	100000	U	110000	k
000001	–	010001	F	100001	V	110001	l
000010	0	010010	G	100010	W	110010	m
000011	1	010011	H	100011	X	110011	n
000100	2	010100	I	100100	Y	110100	o
000101	3	010101	J	100101	Z	110101	p
000110	4	010110	K	100110	a	110110	q
000111	5	010111	L	100111	b	110111	r
001000	6	011000	M	101000	c	111000	s
001001	7	011001	N	101001	d	111001	t
001010	8	011010	O	101010	e	111010	u
001011	9	011011	P	101011	f	111011	v
001100	A	011100	Q	101100	g	111100	w
001101	B	011101	R	101101	h	111101	x
001110	C	011110	S	101110	i	111110	y
001111	D	011111	T	101111	j	111111	z

1. char = character

Subformat CM8

The CM8 subformat is similar to the CM6 subformat. The same algorithm is used, but the compression is more efficient than the 6-bit subformat because all bits are used. The 8-bit scheme is a binary format that cannot be transmitted using email; FTP must be used.

The second-difference integers are first converted from 2's complement to sign and magnitude. These numbers are then fit into a variable number of bytes in which all eight significant bits are used. The most significant usable bit of each byte is used as a flag or control bit, which, if set, is used to signify that the following byte also contains information relating to the same sample. The second most significant bit is used as a sign bit in the first byte pertaining to a sample and as data in all following bytes. All other bits are used to represent the value of the second difference (Table 29).

TABLE 29: BIT POSITIONS FOR CM8

Most Significant Bit						Least Significant Bit	
control	sign/data	data	data	data	data	data	data

Subformat CSF

Waveform data that have been signed for data verification must contain the raw data that were authenticated along with the digital signatures. To deliver the data as authenticated at the station (or sensor), the incoming continuous data format for channel subframes (see [IDC3.4.3]) must be used. To send the channel subframes in an email message, the sequence of channel subframes are sent as base-64 representation of the binary data.

PROCESSING PRODUCTS

Data types used for the processing products include the results of the various stages of S/H/I processing from arrivals through events.

ARRIVAL

The ARRIVAL data types are divided into five subtypes (AUTOMATIC, REVIEWED, GROUPED, ASSOCIATED, and UNASSOCIATED) to reflect the different processing stages.

Automatic Arrivals

The AUTOMATIC subtype provides the result of a detection process run on waveforms. The format for the AUTOMATIC data subtype are given in Table 30, and an example is provided in "Arrival:automatic" on page B9.

TABLE 30: AUTOMATIC ARRIVAL FORMAT

Record	Position	Format	Description
1 (header)	1–3	a3	`Net`
	11–13	a3	`Sta`
	17–22	a6	`BeamID`
	33–36	a4	`Date`
	44–47	a4	`Time`
	54–58	a5	`Phase`
	64–67	a4	`Azim`
	70–73	a4	`Slow`
	77–79	a3	`SNR`
	87–89	a3	`Amp`
	93–95	a3	`Per`
	99–101	a3	`STA`
	105–107	a3	`Dur`
	109–114	a6	`Author`
	122–126	a5	`DetID`

TABLE 30: AUTOMATIC ARRIVAL FORMAT (CONTINUED)

Record	Position	Format	Description
2–*n* (data)	1–9	a9	network code
	11–15	a5	station code
	17–28	a12	beam identifier
	30–39	i4,a1,i2,a1,i2	detection date (*yyyy*/*mm*/*dd*)
	41–52	i2,a1,i2,a1,f6.3	detection time (*hh*:*mm*:*ss*.*sss*)
	54–61	a8	preliminary phase code
	63–67	f5.1	observed azimuth (degrees)
	69–73	f5.1	observed slowness (seconds/degree)
	75–79	f5.1	signal-to-noise ratio
	81–89	f9.1	amplitude (nanometers)
	91–95	f5.2	period (seconds)
	97–101	f5.1	short-term average
	103–107	f5.1	detection duration (seconds)
	109–117	a9	author of the detection
	119–126	a8	detection identifier

Reviewed Arrivals

The REVIEWED subtype is used for arrivals that have been reviewed and assigned phase names.[1] Phase names are not expected to have been verified by location. Table 31 gives the format for the REVIEWED data subtype, and an example is provided in "Arrival:reviewed" on page B10.

1. ARRIVAL:REVIEWED is not supported by the IDC.

TABLE 31: REVIEWED ARRIVAL FORMAT

Record	Position	Format	Description
1 (header)	1–3	a3	`Net`
	11–13	a3	`Sta`
	16–19	a4	`Chan`
	22–24	a3	`Aux`
	30–33	a4	`Date`
	40–43	a4	`Time`
	50–54	a5	`Phase`
	60–63	a4	`Azim`
	66–69	a4	`Slow`
	73–75	a3	`SNR`
	83–85	a3	`Amp`
	89–91	a3	`Per`
	93–96	a4	`Qual`
	98–103	a6	`Author`
	110–114	a5	`ArrID`
2–*n* (data)	1–9	a9	network code
	11–15	a5	station code
	17–19	a3	FDSN channel code
	21–24	a4	auxiliary identification code
	26–35	i4,a1,i2,a1,i2	arrival date (*yyyy*/*mm*/*dd*)
	37–48	i2,a1,i2,a1,f6.3	arrival time (*hh*:*mm*:*ss*.*sss*)

TABLE 31: REVIEWED ARRIVAL FORMAT (CONTINUED)

Record	Position	Format	Description
2–*n* (data)	50–57	a8	phase code
	59–63	f5.1	observed azimuth (degrees)
	65–69	f5.1	observed slowness (seconds/degree)
	71–75	f5.1	signal-to-noise ratio
	77–85	f9.1	amplitude (nanometers)
	87–91	f5.2	period (seconds)
	93	a1	type of pick (`a` = automatic, `m` = manual)
	94	a1	direction of short period motion (`c` = compression, `d` = dilatation, _ = null)
	95	a1	detection character (`i` = impulsive, `e` = emergent, `q` = questionable, _ = null [see Table 8])
	97–105	a9	author of the arrival
	107–114	a8	arrival identification

TABLE 32: DETECTION CHARACTER FROM UNCERTAINTY

Detection Character	Uncertainty for Local Phases	Uncertainty for Regional/ Teleseismic Phases
i	< 0.05 sec	< 0.2 sec
e	< 0.25 sec	< 1.0 sec
q	> 0.25 sec	> 1.0 sec

Grouped Arrivals

The GROUPED subtype is used for arrivals that have phase names and have been grouped together, with the implication that they were generated by the same seismic event.[2] Table 33 gives the format for the GROUPED data subtype, and an example is provided in "Arrival:grouped" on page B10.

TABLE 33: GROUPED ARRIVAL FORMAT

Record	Position	Format	Description
1 (header)	1-3	a3	`Net`
	11-13	a3	`Sta`
	16-19	a4	`Chan`
	21-23	a3	`Aux`
	29-32	a4	`Date`
	39-42	a4	`Time`
	50-54	a5	`Phase`
	60-63	a4	`Azim`
	66-69	a4	`Slow`
	73-75	a3	`SNR`
	83-85	a3	`Amp`
	89-91	a3	`Per`
	93-96	a4	`Qual`
	100-104	a5	`Group`
	106	a1	`C`
	108-113	a6	`Author`
	121-125	a5	`ArrID`

2. The GROUPED ARRIVAL data type is not supported at the IDC. [ISC99] includes a grouped arrival information subblock.

TABLE 33: GROUPED ARRIVAL FORMAT (CONTINUED)

Record	Position	Format	Description
2-*n* (data)	1-9	a9	network code
	11-15	a5	station code
	17-19	a3	FDSN channel code
	21-24	a4	auxiliary identification code
	26-35	i4,a1,i2,a1,i2	arrival date (*yyyy/mm/dd*)
	37-48	i2,a1,i2,a1,f6.3	arrival time (*hh:mm:ss.sss*)
	50-57	a8	phase code
	59-63	f5.1	observed azimuth (degrees)
	65-69	f5.1	observed slowness (seconds/degree)
	71-75	f5.1	signal-to-noise ratio
	77-85	f9.1	amplitude (nanometers)
	87-91	f5.2	period (seconds)
	93	a1	type of pick (`a` = automatic, `m` = manual)
	94	a1	direction of short period motion (`c` = compression, `d` = dilatation, _ = null)
	95	a1	detection quality (`i` = impulsive, `e` = emergent, `q` = questionable, _ = null)
	97-104	a8	group identification
	106	i1	conflict flag (number of times an arrival belongs to more than one group; blank if arrival only belongs to one group)
	108-116	a9	author of the arrival
	118-125	a8	arrival identification

Associated Arrivals

The ASSOCIATED subtype is used for arrivals that have been run through a location program and have formed a seismic event. If multiple magnitude measurements have been made on an arrival, the subsequent magnitudes will appear on lines immediately after the arrival. Table 34 gives the format for the ASSOCIATED data subtype, and an example is provided in "Arrival:associated" on page B9.

TABLE 34: ASSOCIATED ARRIVAL FORMAT

Record	Position	Format	Description
1 (header)	1–3	a3	`Net`
	11–13	a3	`Sta`
	19–22	a4	`Dist`
	25–28	a4	`EvAz`
	30–34	a5	`Phase`
	41–44	a4	`Date`
	53–56	a4	`Time`
	64–67	a4	`TRes`
	70–73	a4	`Azim`
	75–79	a5	`AzRes`
	82–85	a4	`Slow`
	88–91	a4	`SRes`
	93–95	a3	`Def`
	99–101	a3	`SNR`
	109–111	a3	`Amp`
	115–117	a3	`Per`
	119–122	a4	`Qual`

TABLE 34: ASSOCIATED ARRIVAL FORMAT (CONTINUED)

Record	Position	Format	Description
1 (header)	124–132	a9	`Magnitude`
	136–141	a6	`OrigID`
	143–148	a6	`Author`
	156–160	a5	`ArrID`
2–*n* (data)	1–9	a9	network code
	11–15	a5	station code
	17–22	f6.2	station to event distance (degrees)
	24–28	f5.1	event to station azimuth (degrees)
	30–37	a8	phase code
	39–48	i4,a1,i2,a1,i2	arrival date (*yyyy*/*mm*/*dd*)
	50–61	i2,a1,i2,a1,f6.3	arrival time (*hh*:*mm*:*ss*.*sss*)
	63–67	f5.1	time residual (seconds)
	69–73	f5.1	observed backazimuth (degrees)
	75–79	f5.1	azimuth residual (degrees)
	81–85	f5.1	observed slowness (seconds/degree)
	87–91	f5.1	slowness residual (seconds/degree)
	93	a1	time defining flag (`T` or _)
	94	a1	azimuth defining flag (`A` or _)
	95	a1	slowness defining flag (`S` or _)
	97–101	f5.1	signal-to-noise ratio
	103–111	f9.1	amplitude (nanometers)
	113–117	f5.2	period (seconds)
	119	a1	type of pick (`a` = automatic, `m` = manual)

TABLE 34: ASSOCIATED ARRIVAL FORMAT (CONTINUED)

Record	Position	Format	Description
2–*n* (data)	120	a1	direction of short period motion (`c` = compression, `d` = dilatation, _ = null)
	121	a1	onset quality (`i` = impulsive, `e` = emergent, `q` = questionable, _ = null)
	123–127	a5	magnitude type (`mb`, `Ms`, `ML`, `mbmle`, `msmle`)
	128	a1	min max indicator (<, >, or blank)
	129–132	f4.1	magnitude value
	134–141	a8	origin identification
	143–151	a9	author of the arrival
	153–160	a8	arrival identification

Unassociated Arrivals

The UNASSOCIATED subtype is used for arrivals that have been detected and reviewed, but have not been not associated with a seismic origin.[3] The format of the UNASSOCIATED subtype line is the same as the format for the AUTOMATIC subtype as shown in Table 30. An example is provided in "Arrival:unassociated" on page B10.

BULLETIN

Bulletins are composed of origin and arrival information. The information is provided in a series of data blocks as shown in Table 35: bulletin title block (Table 36), event title block (Table 37), origin block (Table 38), phase block[4] (Table 39), phase correction block (under development), event screening block (Table 40), and event

3. The UNASSOCIATED ARRIVAL subtype is not supported at the IDC.
4. [ISC99] defines a phase information subblock to compliment the phase block.

characterization arrival block (Table 41). The verbosity of a bulletin can be controlled by specifying the subformat, which can be SHORT or LONG. The default is SHORT.

The BULL_TYPE environment and the subformat control the blocks of information that appear in a bulletin. Table 35 lists the blocks that are included for each BULL_TYPE and subformat.

A BULLETIN data message contains one bulletin title block and one set of the other block types for each event. The blocks in a BULLETIN data message appear in the order given in Table 35. Examples of the SHORT and LONG subformats for bulletins are provided in "Bulletin (IMS1.0:short Format)" on page B13 and "Bulletin (IMS1.0:long Format)" on page B13.

TABLE 35: BLOCKS USED IN BULLETIN FORMATS[1]

Block Name	SEL1, SEL2, SEL3, REB subformats		SEB, SSEB, NEB, NSEB subformats	
	SHORT	LONG	SHORT	LONG
bulletin title block	r	r	r	r
event title block	r	r	r	r
origin block	r	r	r	r
phase block	r	r	r	r
phase correction block		r		r
event screening block			r	r
event characterization arrival block				r

1. [ISC99] defines additional block formats including effects and reference.

TABLE 36: BULLETIN TITLE BLOCK FORMAT

Record	Position	Format	Description
1	1–136	a136	bulletin title

TABLE 37: EVENT TITLE BLOCK FORMAT

Record	Position	Format	Description
1	1–5	a5	`Event`
	7–14	a8	event identification number
	16–80	a65	geographic region

TABLE 38: ORIGIN BLOCK FORMAT

Record	Position	Format	Description
Origin Sub-block			
1 (header)	4–7	a4	`Date`
	15–18	a4	`Time`
	27–29	a3	`Err`
	33–35	a3	`RMS`
	37–44	a8	`Latitude`
	46–54	a9	`Longitude`
	57–60	a4	`Smaj`
	63–66	a4	`Smin`
	69–70	a2	`Az`
	72–76	a5	`Depth`
	80–82	a3	`Err`
	84–87	a4	`Ndef`
	89–92	a4	`Nst`
	94–96	a3	`Gap`
	99–103	a5	`mdist`

TABLE 38: ORIGIN BLOCK FORMAT (CONTINUED)

Record	Position	Format	Description
1 (header)	106–110	a5	`Mdist`
	112–115	a4	`Qual`
	19–124	a6	`Author`
	131–136	a6	`OrigID`
2–*n* (data)	1–10	i4,a1,i2,a1,i2	epicenter date (*yyyy*/*mm*/*dd*)
	12–22	i2,a1,i2,a1,f5.2	epicenter time (*hh*:*mm*:*ss*.*ss*)
	23	a1	fixed flag (`f` = fixed origin time solution, blank if not a fixed origin time)
	25–29	f5.2	origin time error (seconds; blank if fixed origin time)
	31–35	f5.2	root mean square of time residuals (seconds)
	37–44	f8.4	latitude (negative for South)
	46–54	f9.4	longitude (negative for West)
	55	a1	fixed flag (`f` = fixed epicenter solution, blank if not a fixed epicenter solution)
	57–60	f4.1	semi-major axis of 90% ellipse or its estimate (km, blank if fixed epicenter)
	62–66	f5.1	semi-minor axis of 90% ellipse or its estimate (km, blank if fixed epicenter)
	68–70	i3	strike (0 <= x <= 360) of error ellipse clock-wise from North (degrees)
	72–76	f5.1	depth (km)
	77	a1	fixed flag (`f` = fixed depth station, `d` = depth phases, blank if not a fixed depth)
	79–82	f4.1	depth error 90% (km; blank if fixed depth)
	84–87	i4	number of defining phases

TABLE 38: ORIGIN BLOCK FORMAT (CONTINUED)

Record	Position	Format	Description
2–*n* (data)	89–92	i4	number of defining stations
	94–96	i3	gap in azimuth coverage (degrees)
	98–103	f6.2	distance to closest station (degrees)
	105–110	f6.2	distance to furthest station (degrees)
	112	a1	analysis type: (`a` = automatic, `m` = manual, `g` = guess)
	114	a1	location method: (`i` = inversion, `p` = pattern recognition, `g` = ground truth, `o` = other)
	116–117	a2	event type: `uk` = unknown `ke` = known earthquake `se` = suspected earthquake `kr` = known rockburst `sr` = suspected rockburst `ki` = known induced event si = suspected induced event `km` = known mine explosion `sm` = suspected mine explosion `kx` = known experimental explosion `sx` = suspected experimental explosion `kn` = known nuclear explosion `sn` = suspected nuclear explosion `ls` = landslide
	119–127	a9	author of the origin
	129–136	a8	origin identification
Magnitude Sub-block			
1 (header)	1–9	a9	`Magnitude`
	12–14	a3	`Err`
	16–19	a4	`Nsta`
	21–26	a6	`Author`
	33–38	a6	`OrigID`

TABLE 38: ORIGIN BLOCK FORMAT (CONTINUED)

Record	Position	Format	Description
2–*n* (data)	1–5	a5	magnitude type (`mb`, `Ms`, `ML`, `mbmle`, `msmle`)
	6	a1	*min max* indicator (<, >, or blank)
	7–10	f4.1	magnitude value
	12–14	f3.1	standard magnitude error
	16–19	i4	number of stations used to calculate magnitude
	21–29	a9	author of the origin
	31–38	a8	origin identification
Comment Sub-block			
1	2	a1	(
	3–M	a(*M*–2)	comment
	M+1	a1	)

TABLE 39: PHASE BLOCK FORMAT

Record	Position	Format	Description
1 (header)	1–3	a3	`Sta`
	9–12	a4	`Dist`
	15–18	a4	`EvAz`
	20–24	a5	`Phase`
	33–36	a4	`Time`
	43–46	a4	`TRes`
	49–52	a4	`Azim`
	54–58	a5	`AzRes`
	62–65	a4	`Slow`
	69–72	a4	`SRes`
	74–76	a3	`Def`
	80–82	a3	`SNR`
	90–92	a3	`Amp`
	96–98	a3	`Per`
	100–103	a4	`Qual`
	105–113	a9	`Magnitude`
	118–122	a5	`ArrID`

TABLE 39: PHASE BLOCK FORMAT (CONTINUED)

Record	Position	Format	Description
2–*n* (data)	1–5	a5	station code
	7–12	f6.2	station-to-event distance (degrees)
	14–18	f5.1	event-to-station azimuth (degrees)
	20–27	a8	phase code
	29–40	i2,a1,i2,a1,f6.3	arrival time (*hh*:*mm*:*ss*.*sss*)
	42–46	f5.1	time residual (seconds)
	48–52	f5.1	observed azimuth (degrees)
	54–58	f5.1	azimuth residual (degrees)
	60–65	f5.1	observed slowness (seconds/degree)
	67–72	f5.1	slowness residual (seconds/degree)
	74	a1	time defining flag (T or _)
	75	a1	azimuth defining flag (A or _)
	76	a1	slowness defining flag (S or _)
	78–82	f5.1	signal-to-noise ratio
	84–92	f9.1	amplitude (nanometers)
	94–98	f5.2	period (seconds)
	100	a1	type of pick (a = automatic, m = manual)
	101	a1	direction of short period motion (c = compression, d = dilatation, _= null)
	102	a1	onset quality (i = impulsive, e = emergent, q = questionable, _ = null)
	104–108	a5	magnitude type (mb, Ms, ML, mbmle, msmle)
	109	a1	min max indicator (<, >, or blank)
	110–113	f4.1	magnitude value
	115–122	a8	arrival identification

The format of the EVENT SCREENING block follows in Table 40. The block has been extended to include station-specific hydroacoustic and regional measurements. In the table, assume *n* = number of hydro measurement stations, *m* = number of regional measurement stations.

TABLE 40: EVENT SCREENING BLOCK FORMAT

Record	Position	Format	Description
Event Screening Summary Sub-block			
1 (title)	1–15	a15	`EVENT SCREENING`
2 (header)	1–8	a8	`Category`
	11–15	a5	`Score`
	17–22	a6	`Dscore`
	24–29	a6	`Mscore`
	31–36	a6	`Rscore`
	38–43	a6	`Hscore`
	45–51	a7	`Smaj_sc`
	53–59	a7	`Smin_sc`
	61–65	a5	`Depth`
	68–71	a4	`Sdep`
	74–77	a4	`mbms`
	79–83	a5	`Smbms`
	91–96	a6	`Foffsh`
	98–102	a5	`MinWD`
	104–106	a3	`Clr`

TABLE 40: EVENT SCREENING BLOCK FORMAT (CONTINUED)

Record	Position	Format	Description
3 (data)	1–8	a2,a1,a5	Screening Category: NC (Not Considered) IS (Insufficient Data) NS (Not Screened Out) SO (Screened Out) / Offsh (Offshore) Onsh (Onshore) Mixed (Mixed onshore and offshore)
	10–15	f6.2	composite screening score
	17–22	f6.2	depth screening score
	24–29	f6.2	$A*m_b–M_s$ screening score
	31–36	f6.2	regional seismic score
	38–43	f6.2	hydroacoustic screening score
	45–51	f7.1	scaled semi-major axis of location error ellipse
	53–59	f7.1	scaled semi-minor axis of location error ellipse
	61–65	f5.1	depth estimate (km)
	67–71	f5.1	depth confidence interval (km)
	73–77	f5.2	$A*m_b–M_s$ (including slope term, A)
	79–83	f5.2	$A*m_b–M_s$ confidence interval
	92–96	f5.2	percent of scaled location error ellipse off-shore (normalized)
	98–102	f5.0	minimum water depth in scaled error ellipse
	106	i1	clear path flag for hydroacoustic signal(s) (clear = 1, not clear = 0)
4	(blank line)		

TABLE 40: EVENT SCREENING BLOCK FORMAT (CONTINUED)

Record	Position	Format	Description
Hydroacoustic Screening Sub-block			
1 (title)	1–23	a23	`HYDROACOUSTIC SCREENING`
2 (header)	1–3	a3	`Sta`
	8–10	a3	`Clr`
	14–17	a4	`CPS8`
	21–24	a4	`SNR7`
	28–31	a4	`Noi7`
	35–43	a9	`Sta_score`
3–*n* (data)	1–5	a5	station name
	10	a1	station clear flag (‘`y`’ or ‘`n`’)
	12–17	f6.2	cepstral peak from band 8 (2–80 Hz)
	19–24	f6.2	snr of hydroacoustic total energy measurement
	26–31	f6.2	noise of hydroacoustic total energy measurement
	38–43	f6.2	station-specific hydroacoustic score
n+1	(blank line)		
Regional Screening Sub-block			
1 (title)	1–18	a18	`REGIONAL SCREENING`
2 (header)	1–3	a3	`Sta`
	8–13	a6	`PNSMX5`
	15–20	a6	`PNSMX7`
3–*n* (data)	1–5	a5	station name
	8–13	f6.2	pnsmax value in the 4–6 Hz band
	15–20	f6.2	pnsmax value in the 6–8 Hz band

TABLE 41: EVENT CHARACTERIZATION ARRIVAL BLOCK FORMAT

Record	Position	Format	Description
Cepstral Peak Analysis Sub-block			
1 (title)	1–22	a22	`CEPSTRAL PEAK ANALYSIS`
2 (header)	1–3	a3	`Sta`
	8–14	a7	`PeakAmp`
	16–23	a8	`PeakQuef`
3–*n* (data)	1–5	a5	station code
	8–14	f7.5	peak amplitude
	16–23	f8.4	peak quefrency
Energy Ratio Sub-block			
1 (title)	1–37	a37	`SHORT-PERIOD/LONG-PERIOD ENERGY RATIO`
2 (header)	1–3	a3	`Sta`
	13–17	a5	`Ratio`
3–*n* (data)	1–5	a5	station code
	8–17	f10.8	short-period/long-period energy ratio
Frequency Dependent Phase Amplitude Sub-block			
1 (title)	1–41	a41	`FREQUENCY-DEPENDENT PHASE AMPLITUDE BLOCK`
	44-46	i3	block number (i^{th} block)
	48-49	a2	`of`
	51-53	i3	total number of Frequency Dependent Phase Amplitude Sub-blocks

TABLE 41: EVENT CHARACTERIZATION ARRIVAL BLOCK FORMAT (CONTINUED)

Record	Position	Format	Description
2 (header)	1–3	a3	Sta
	7–11	a5	Phase
	18–20	a3	Amp
	28–30	a3	SNR
	38–40	a3	Amp
	48–50	a3	SNR
	58–60	a3	Amp
	68–70	a3	SNR
	78–80	a3	Amp
	88–90	a3	SNR
3 (header)	17–22	f6.1	min(FreqBand(i-1)*4+1)
	24–25	a2	to
	27–32	f6.1	max(FreqBand(i-1)*4+1)
	37–42	f6.1	min(FreqBand(i-1)*4+2)
	44–45	a2	to
	47–52	f6.1	max(FreqBand(i-1)*4+2)
	57–62	f6.1	min(FreqBand(i-1)*4+3)
	64–65	a2	to
	67–72	f6.1	max(FreqBand(i-1)*4+3)
	77–82	f6.1	min(FreqBand(n-1)*4+4)
	84–85	a2	to
	87–92	f6.1	max(FreqBand(n-1)*4+4)

TABLE 41: EVENT CHARACTERIZATION ARRIVAL BLOCK FORMAT (CONTINUED)

Record	Position	Format	Description
4–*n* (data)	1–5	a5	station code
	7–10	a8	associated phase (Note: an“!” indicates that reported values are based on predicted values instead of observed values)
	12–20	f9.1	amplitude in FreqBand(i-1)*4+1
	26–30	f5.1	snr in FreqBand(i-1)*4+1
	32–40	f9.1	amplitude FreqBand(i-1)*4+2
	46–50	f5.1	snr in FreqBand(i-1)*4+2
	52–60	f9.1	amplitude in FreqBand(i-1)*4+3
	66–70	f5.1	snr in FreqBand(i-1)*4+3
	72–80	f9.1	amplitude in FreqBand(i-1)*4+4
	86–90	f5.1	snr in FreqBand(i-1)*4+4
Spectral Variance Sub-block			
1 (title)	1–47	a47	`SPECTRAL VARIANCE OF THE DETRENDED LOG SPECTRUM`
2 (header)	1–3	a3	`Sta`
	7–11	a5	`Phase`
	13–19	a7	`MinFreq`
	21–27	a7	`MaxFreq`
	35–41	a7	`SpecVar`
3–*n* (data)	1–5	a5	station code
	7–14	a8	associated phase
	16–22	f7.2	minimum frequency
	24–30	f7.2	maximum frequency
	32–43	f12.6	spectral variance of detrended log spectrum

TABLE 41: EVENT CHARACTERIZATION ARRIVAL BLOCK FORMAT (CONTINUED)

Record	Position	Format	Description
Complexity Sub-block			
1 (title)	1–10	a10	`COMPLEXITY`
2 (header)	1–3	a3	`Sta`
	7–11	a5	`Phase`
	17–26	a10	`Complexity`
	30–32	a3	`SNR`
3–*n* (data)	1–5	a5	station code
	7–14	a8	associated phase
	16–26	f11.4	complexity
	28–32	f5.1	snr of complexity
Third of Frequency Sub-block			
1 (title)	1–25	a25	`THIRD MOMENT OF FREQUENCY`
2 (header)	1–3	a3	`Sta`
	12–14	a3	`TMF`
3–*n* (data)	1–5	a5	station code
	7–14	f8.1	third moment of frequency
Time Frequency Sub-block			
1 (title)	1–25	a25	`TIME FREQUENCY PARAMETERS`
2 (header)	1–3	a3	`Sta`
	9–14	a6	`ZAVPCT`
	20–25	a6	`ZAVCEP`
	31–36	a6	`ZAVCOR`

TABLE 41: EVENT CHARACTERIZATION ARRIVAL BLOCK FORMAT (CONTINUED)

Record	Position	Format	Description
3–*n* (data)	1–5	a5	station code
	7–14	f8.4	average ratio of bad points to the total of the vertical component traces
	19-25	f6.1	average maximum value of the 2-D cepstrum of the vertical component traces
	29-35	f6.4	average autocorrelation along the time axis across all frequencies excluding randomized points of the vertical component traces

COMMENT

The first line of the COMMENT data type provides a mechanism for associating the comment to a station, arrival, origin, event, and so on. If no association is needed, then this line may be left blank. The comment is written in free format and can be up to 1,024 characters. Table 42 gives the format for the COMMENT data message, and an example is provided in "Comment" on page B19.

TABLE 42: COMMENT FORMAT

Record	Position	Format	Description
1	1–10	a10	identification type (`Station`, `Arrival`, `Origin`, `Event`)
	12–19	a8	identification string of the identification type
2	1–1024	a1024	free-format comment

EVENT

Any S/H/I event can have several estimates of the location, origin time, and size (origins). The format for events places these different origins into separate origin blocks. The bulletin title block at the beginning of the data section must include the name of the bulletin used as the basis for associating the separate origin estimates. The events data messages include:

- one bulletin title block (see Table 36)
- *n* origin blocks (see Table 38)

An example of the EVENT data message is provided in "Event" on page B22.

ORIGIN

The ORIGIN data type consists of a number of origin blocks (Table 38). Multiple magnitudes may be given for the same origin. An example of the ORIGIN data message is provided in "Origin" on page B27.

STATUS INFORMATION

Several data types provide status information. Status information is available for authentication, stations, channels, communications, and data availability.

AUTH_STATUS

Some data channels contain authentication signatures that are verified at the IDC.[5] The AUTH_STATUS data type provides statistics on the authentication process over the time of the report. The first block (Table 43) of the report gives the number of packets tested (Table 44), the number that passed, and the number that failed by station. The second block contains a list of the failures grouped as intervals for each data channel that failed to verify the authentication signature. An example of the AUTH_STATUS data message is provided in "Auth_status" on page A11.

5. The AUTH_STATUS data type are not supported at the IDC.

TABLE 43: REPORT PERIOD BLOCK FORMAT

Record	Position	Format	Description
1	1-18	a18	`Report period`
	20-29	i4,a1,i2,a1,i2	date (*yyyy/mm/dd*)
	31-40	i2,a1,i2,a1,f4.1	time (*hh:mm:ss.s*)
	42-43	a2	`to`
	45-54	i4,a1,i2,a1,i2	date (*yyyy/mm/dd*)
	56-65	i2,a1,i2,a1,f4.1	time (*hh:mm:ss.s*)
2 (header)	1-3	a3	`Net`
	11-13	a3	`Sta`
	16-19	a4	`Chan`
	21-23	a3	`Aux`
	27-40	a14	`Packets_Tested`
	43-56	a14	`Packets_Failed`
3-*n* (data)	1-9	a9	network code
	11-15	a5	station code
	17-19	a3	FSDN channel code
	21-24	a4	auxiliary identification code
	22-40	i8	number of packets tested
	49-56	i8	number of packets failing verification

TABLE 44: AUTHENTICATION LIST BLOCK FORMAT

Record	Position	Format	Description
1 (title)	1-23	a23	`Failed Packet Intervals`
2 (header)	1-3	a3	`Net`
	11-13	a3	`Sta`
	16-19	a4	`Chan`
	21-23	a3	`Aux`
	31-40	a10	`Start_Time`
	55-61	a8	`End_Time`
	71-77	a7	`Comment`
3-*n* (data)	1-9	a9	network code
	11-15	a5	station code
	17-19	a3	channel code
	21-24	a4	auxiliary identification code
	26-35	i4,a1,i2,a1,i2	start date of failure interval (*yyyy/mm/dd*)
	37-46	i2,a1,i2,a1,f4.1	start time of failure interval (*hh:mm:ss.s)*
	49-58	i4,a1,i2,a1,i2	end date of failure interval (*yyyy/mm/dd*)
	60-69	i2,a1,i2,a1,f4.1	end time of failure interval (*hh:mm:ss.s*)
	71-132	a62	comment

CHAN_STATUS

The CHAN_STATUS data type gives specific information on the data that have been received at the IDC by station and channel. Detailed statistics on data gaps and timeliness are included. The first block of the report provides the following information (see Table 45):

- reporting period over which the statistics are calculated

- data availability statistics with the station, channel, and auxiliary codes that identify the reporting data stream
- amount of data expected for the data stream
- availability of the data at the IDC as a percentage of the data that were expected over the report period
- total number of gaps followed by the median, mean, standard deviation, and minimum and maximum gap size

The second block of the report provides the following information (see Table 46):

- data timeliness statistics with the station, channel, and auxiliary codes that identify the reporting data stream
- amount of data expected for the data stream
- median, mean, standard deviation, and minimum and maximum delay times for data arriving at the IDC

For readability, the information is grouped by station with a blank line between stations in each of the sections. An example of the CHAN_STATUS data message is provided in "Chan_status" on page B18.

TABLE 45: CHANNEL STATISTICS BLOCK FORMAT

Record	Position	Format	Description
1	1–18	a18	`Report period from`
	20–29	i4,a1,i2,a1,i2	date (*yyyy*/*mm*/*dd*)
	31–40	i2,a1,i2,a1,f4.1	time (*hh*:*mm*:*ss*.*s*)
	42–43	a2	`to`
	45–54	i4,a1,i2,a1,i2	date (*yyyy*/*mm*/*dd*)
	56–65	i2,a1,i2,a1,f4.1	time (*hh*:*mm*:*ss*.*s*)
2 (title)	1–28	a28	`Data Availability Statistics`

TABLE 45: CHANNEL STATISTICS BLOCK FORMAT (CONTINUED)

Record	Position	Format	Description
3 (header)	1–3	a3	`Net`
	11–13	a3	`Sta`
	17–20	a4	`Chan`
	22–24	a3	`Aux`
	29–40	a12	`Max_Exp_Time`
	46–52	a6	`%_Avail`
	55–58	a4	`Gaps`
	64–69	a6	`Median`
	78–80	a3	`Min`
	91–93	a3	`Max`
4–*n* (data)	1–9	a9	network code
	11–15	a5	station code
	18–20	a3	FDSN channel code
	22–25	a4	auxiliary identification code
	27–40	i3,a1,i2,a1,i2, a1,f4.1	maximum data time possible (*ddd hh*:*mm*:*ss*.*s*)
	46–52	f7.3	percent of data available at the IDC
	54–58	i5	number of data gaps
	61–71	13,a1,i2,a1,f4.1	median length of data gaps (*hh*:*mm*:*ss*.*s*)
	74–84	13,a1,i2,a1,f4.1	minimum length of data gaps (*hh*:*mm*:*ss*.*s*)
	87–97	13,a1,i2,a1,f4.1	maximum length of data gaps (*hh*:*mm*:*ss*.*s*)

TABLE 46: DATA TIMELINESS BLOCK FORMAT

Record	Position	Format	Description
1 (title)	1–26	a26	`Data Timeliness Statistics`
2 (header)	1–3	a3	`Net`
	11–13	a3	`Sta`
	17–20	a4	`Chan`
	22–24	a3	`Aux`
	29–40	a12	`Max_Exp_Time`
	44–52	a9	`Delay_Med`
	60–63	a4	`Mean`
	71–77	a7	`Std_Dev`
	86–88	a3	`Min`
	99–101	a3	`Max`
3–*n* (data)	1–9	a9	network code
	11–15	a5	station code
	18–20	a3	channel code
	22–25	a4	auxiliary code
	27–40	i3,a1,i2,a1,i2, a1,f4.1	maximum data time possible (*ddd hh*:*mm*:*ss*.*s*)
	43–53	i3,a1,i2,a1,f4.1	median delay time (*hh*:*mm*:*ss*.*s*)
	56–66	i3,a1,i2,a1,f4.1	mean delay time (*hh*:*mm*:*ss*.*s*)
	69–79	i3,a1,i2,a1,f4.1	standard deviation of delay time (*hh*:*mm*:*ss*.*s*)
	82–92	i3,a1,i2,a1,f4.1	minimum delay time (*hh*:*mm*:*ss*.*s*)
	95–105	i3,a1,i2,a1,f4.1	maximum delay time (*hh*:*mm*:*ss*.*s*)

COMM_STATUS

Communications status is given over the time interval specified in the TIME or FREQ environments for *AutoDRM* or subscription requests, respectively.[6] The report is comprised of a communications statistics block giving the report period and a summary section in which each link is described with statistics of link performance for the reporting period (see Table 47). The next block is a list of the link outages for each link (see Table 48). The link outages block is included only in the `long` subformat. An example of the COMM_STATUS data message is provided in "Comm_status" on page A19.

TABLE 47: COMMUNICATIONS STATISTICS BLOCK FORMAT

Record	Position	Format	Description
1	1-18	a18	`Report period from`
	20-29	i4,a1,i2,a1,i2	start date (*yyyy/mm/dd*)
	31-40	i2,a1,i2,a1,f4.1	start time (*hh:mm:ss.s*)
	42-43	a2	`to`
	45-54	i4,a1,i2,a1,i2	end date (*yyyy/mm/dd*)
	56-65	i2,a1,i2,a1,f4.1	end time (*hh:mm:ss.s*)
2 (header)	1-4	a4	`Link`
	22-29	a8	`Nom_kbps`
	32-35	a4	`Mode`
	38-41	a4	`%_up`
	44-47	a4	`From`
	54-57	a4	`Util`
	60-63	a4	`From`
	70-73	a4	`Util`

6. COMM_STATUS data types are not supported at the IDC.

TABLE 47: COMMUNICATIONS STATISTICS BLOCK FORMAT (CONTINUED)

Record	Position	Format	Description
3-*n* (data)	1-9	a9	link code (farthest from IDC)
	11	a1	–
	13-21	a9	link code (closest to IDC)
	24-29	f6.1	nominal speed of link in kbps
	32-35	a4	`full` for full-duplex or `half` for half-duplex
	37-41	f5.1	percent uptime
	44-52	a9	link code (farthest from IDC)
	54-57	f4.2	use of link (dat_rate/speed)
	60-68	a9	link code (closest to IDC)
	70-73	f4.2	use of link (dat_rate/speed)

TABLE 48: COMMUNICATIONS OUTAGE BLOCK FORMAT

Record	Position	Format	Description
1 (title)	1-9	a8	link code (farthest from IDC)
	11	a1	–
	13-21	a9	link code (closest to IDC)
	23-34	a12	`link outages`
2 (header)	10-13	a4	`From`
	30-36	a7	`Through`
	50-57	a8	`Duration`

TABLE 48: COMMUNICATIONS OUTAGE BLOCK FORMAT (CONTINUED)

Record	Position	Format	Description
3-*n* (data)	1-10	i4,a1,i2,a1,i2	date of beginning of outage (*yyyy/mm/dd*)
	12-21	i2,a1,i2,a1,f4.1	time of beginning of outage (*hh:mm:ss.s)*
	24-33	i4,a1,i2,a1,i2	date of end of outage (*yyyy/mm/dd*)
	35-44	i2,a1,i2,a1,f4.1	time of end of outage (*hh:mm:ss.s*)
	47-60	i3,a1,i2,a1,i2, a1,f4.1	duration of outage (*ddd hh:mm:ss.s*)

OUTAGE

The OUTAGE data type provides information on the dates and times of data gaps. Table 49 gives the format for the OUTAGE data message, and an example is provided in "Outage" on page B27.

TABLE 49: OUTAGE FORMAT

Record	Position	Format	Description
1	1–18	a18	`Report period from`
	20–29	i4,a1,i2,a1,i2	date (*yyyy*/*mm*/*dd*)
	31–42	i2,a1,i2,a1,f6.3	time (*hh*:*mm*:*ss*.*sss*)
	44–45	a2	`to`
	47–56	i4,a1,i2,a1,i2	date (*yyyy*/*mm*/*dd*)
	58–67	i2,a1,i2,a1,f6.3	time (*hh*:*mm*:*ss*.*sss*)

TABLE 49: OUTAGE FORMAT (CONTINUED)

Record	Position	Format	Description
2 (header)	1–3	a3	`Net`
	11–13	a3	`Sta`
	16–19	a4	`Chan`
	21–23	a3	`Aux`
	30–44	a15	`Start Date Time`
	55–67	a13	`End Date Time`
	76–83	a8	`Duration`
	85–91	a7	`Comment`
3–*n* (data)	1–9	a9	network code
	11–15	a5	station code
	17–19	a3	FDSN channel code
	21–24	a4	auxiliary identification code
	26–35	i4,a1,i2,a1,i2	date of last sample before outage interval or start date of report period[1]
	37–48	i2,a1,i2,a1,f6.3	time of last sample before outage interval
	50–59	i4,a1,i2,a1,i2	date of first sample after outage interval[2]
	61–72	i2,a1,i2,a1,f6.3	time of first sample after outage interval or end time of the report period
	74–83	f10.3	duration of interval (seconds)
	85–132	a48	comment

1. Time of last available sample preceding the outage or the start time of the report period.
2. Time of first available sample after the outage or the end time of the report period.

STA_STATUS

Station status is given over the time interval specified in the TIME or FREQ environments for *AutoDRM* or subscription requests, respectively. The report is comprised of statistics that can be used to evaluate the overall performance of one or more stations. The first record of the report gives the report period. The status records give the station code and the nominal number of channels for the station. This record is followed by the station capability entries in which station problems are grouped into four categories depending on the impact each failure has on the capability of that station. Station capability is assessed relative to the maximum performance of that particular station based on instrument configuration and site characteristics.

In the context of assessing station status, the station consists of the sensors, digitizers, communications within the site, and data loggers. Station status is assessed at the IDC based on data that are available there and may therefore include the effects of problems with communications, problems at a NDC, or Data Relay Center. Moreover, because data may arrive late at the IDC, the station status assessment is a snapshot of station capability at a single time.

Station capability is categorized as follows:

- Fully capable

  The system is operating and contributing data to the mission at the level for which it was designed.

- Partially capable

  The system is impaired and contributing significant data to the mission but of degraded quality, reduced quantity, or reduced operational capability.

- Low capability

  The system is severely impaired and is contributing data that do not meet minimum requirements for the designed mission but are still useful for the global monitoring network.

- Not capable

  The system is completely inoperative, or the data being contributed are not useful for the global monitoring network in any way.

For arrays, capability is estimated based on the theoretical array gain for the available channels relative to maximum array gain with all channels operational. The array gain is estimated from the square root of the number of channels; the geometry of the active channels and the relative values of individual array elements are neglected.

Station mission capability may be estimated based on data available at the IDC. Problems not affiliated with stations, such as outages of long-haul or tail communication circuits, and problems with forwarding the data from NDCs will be folded into the capability estimates. Problems affecting the quality or timing of seismic waveforms will not be included in the automated station capability estimate, at least in the first instance, and thus capability may be overestimated (see Table 50).

TABLE 50: STATION CAPABILITY CRITERIA

Station Type	Fully Capable	Partial Capability	Low Capability	Non-Capable
SP or HF array	array gain ≥ 90% max	70% ≤ array gain < 90% max	array gain < 70% max, at least one channel operational	no channels operational
3-C BB station	all channels operational	one vertical and one horizontal operational	one channel operational	no channel operational

TABLE 50: STATION CAPABILITY CRITERIA (CONTINUED)

Station Type	Fully Capable	Partial Capability	Low Capability	Non-Capable
Examples:	**(operational channels)**			
25-element array	21–25	13–20	1–12	0
19-element array	16–19	10–15	1–9	0
16-element array	13–16	8–12	1–7	0
9-element array	8–9	5–7	1–4	0
7-element array	6–7	4–5	1–3	0

The maximum data time, which is the cumulative amount of time for which data are expected for this station, follows the station capability entries. For primary stations, this time will be the entire report period; for auxiliary stations, this time will be the sum of the requested data segment time intervals. Availability indicates the percent of data that are available at the IDC relative to that expected. If an array with 10 channels sends 9 channels of data to the IDC for the entire period, then the data availability would be 90.0 percent (even though the data capability may be fully capable 100 percent of the time). The median delay measures the time delay between ground motion and receipt of data at the IDC for primary stations and the delay between request and receipt for auxiliary stations. Finally, the number of successful retrievals of data from the auxiliary stations and the number of retrieval attempts are given. Table 51 gives the station status format, and an example is provided in "Sta_status" on page B48.

TABLE 51: STA_STATUS FORMAT

Record	Position	Format	Description
1	1–18	a18	`Report period from`
	20–29	i4,a1,i2,a1,i2	start date (*yyyy*/*mm*/*dd*)
	31–40	i2,a1,i2,a1,f4.1	start time (*hh*:*mm*:*ss*.*s*)
	42–43	a2	`to`
	45–54	i4,a1,i2,a1,i2	end date (*yyyy*/*mm*/*dd*)
	56–65	i2,a1,i2,a1,f4.1	end time (*hh*:*mm*:*ss*.*s*)
2 (title)	28–45	a18	`Station Capability`
3 (header)	1–3	a3	`Net`
	11–13	a3	`Sta`
	17–18	a2	`Ch`
	21–24	a4	`Full`
	31–34	a4	`Part`
	40–42	a3	`Low`
	48–50	a3	`Non`
	54–65	a12	`Max_Exp_Time`
	69–73	a5	`Avail`
	80–88	a9	`Med_Delay`
	90–92	a3	`Att`
	94–96	a3	`Suc`
	98–100	a3	`Pnd`

TABLE 51: STA_STATUS FORMAT (CONTINUED)

Record	Position	Format	Description
4–*n* (data)	1–9	a9	network code
	11–15	a5	station code
	17–18	i2	nominal number of channels
	20–26	f7.3	full station capability (% of report period)
	28–34	f7.3	partial station capability (% of report period)
	36–42	f7.3	low station capability (% of report period)
	44–50	f7.3	noncapable station (% of report period)
	52–65	i3,a1,i2,a1,i2, a1,f4.1	maximum data time possible (*ddd hh*:*mm*:*ss*.*s*)
	67–73	f7.3	percent of data available at the IDC
	75–88	i3,a1,i2,a1,f4.1	median delay of data from station to IDC (*ddd hh*:*mm*:*ss*.*s*)
	90–92	i3	number of IDC attempts to retrieve data
	94–96	i3	number of successful attempts to retrieve data from station
	98–100	i3	number of IDC pending data retrievals

LOGS

LOG data types are used primarily as administrative messages.

ERROR_LOG

The ERROR_LOG data type are reserved for responses to request messages that contain errors. Specific formats have not been defined at this time, although the request message can be given with the line or lines causing the error identified. The information is provided in free-format comment lines in which the first character is blank. An example of an ERROR_LOG is provided in "Error_log" on page B21.

FTP_LOG

In response to a large data request, data are provided via FTP, and the user receives an email message containing information about the location of the file to be retrieved by the requestor using FTP. The FTP_LOG data type are used to convey this information in a consistent manner so that automated data retrieval programs can easily obtain the data.

Common conventions (for example, `.Z` and `.gz`) exist for expressing that a file is compressed. All files should be compressed.

The FTP_LOG data type consists of a free-format FTP_FILE line followed by comment lines, which have a blank as the first character. This data type must contain the information necessary for retrieving the message file.

Syntax

`ftp_file` *net_address login_mode directory file*

net_address	address of machine where data reside (although names are preferred, the IP number may be used)
login_mode	`user` | `guest`; if `user`, then the requestor should log in as a user to FTP the data (an account is required); if `guest`, the requestor should log in as anonymous to FTP the data (an account is not required)
directory	directory in which the message file will reside (case sensitive)
file	name of the file that contains the message (case sensitive)

An example of the FTP_LOG data message is provided in "Ftp_log" on page B23.

LOG

The LOG data type includes free-format comment lines in which the first character of the line is blank. The exact content of the logs is unspecified. An example of the LOG data message is provided in "Log" on page B26.

Chapter 5: Radionuclide Data Messages

This chapter describes the radionuclide data message formats and includes the following topics:

- Preface
- Introduction
- Pulse Height Data
- State of Health Data
- Meteorological Data
- Data Products

Chapter 5: Radionuclide Data Messages

PREFACE

This chapter describes formats for radionuclide data that are acceptable for the certification of IMS radionuclide stations. The IMS version number of this data format is IMS2.0. Significant changes have been made between this format and its predecessor, IMS1.0. Most notable is the incorporation of formats for reporting noble gas data, state of health (SOH) data, and radionuclide laboratory results. Below is a summary of the format changes made since IMS1.0:

- Pulse Height Data (PHD) messages have been greatly modified.
  - Formats for station codes and detector codes have been changed.
  - The data blocks below have been renamed.

    ```
    #Energy     → #g_Energy
    #Resolution → #g_Resolution
    #Efficiency → #g_Efficiency
    #Spectrum   → #g_Spectrum
    ```
  - The following data blocks have been added to the formats for reporting three-dimensional (3-D) β-γ coincidence from noble gas stations.

    ```
    #b_Energy
    #b_Resolution
    #ROI_Limits
    #b-gEfficiency
    #Ratios
    #b_Spectrum
    #Histogram
    ```

- The `#Processing` block has been added for reporting processing information from noble gas stations.
- Several modifications have been made to the `#Header` block.
- Small changes have been made to the `#Sample` and `#Certificate` blocks.
- The `#Profile` block has been removed from the radionuclide data formats.

- Formats for SOH data from particulate radionuclide stations have been added.
- Flow messages have been removed from the radionuclide formats. Flow rates are now reported as part of SOH data.
- Formats for MET and ALERT messages have been modified.
- Formats for the new Radionuclide Laboratory Report (RLR) message have been included.

Future radionuclide message formats are expected and will include requests for data from stations and state of health data from noble gas stations.

INTRODUCTION

Data messages provide a common format for data and data product exchange. Many different types of radionuclide data may be exchanged using the message formats described herein.

A data message consists of the basic message structure:

- BEGIN line
- MSG_TYPE line
- MSG_ID line
- message body
- STOP line

See “Message Structure” on page 13 of this document for a description of the BEGIN line, the MSG-TYPE line, the MSG_ID line, and the STOP line. All four of these lines, along with the message body, must be present for the data message to be valid.

Within the message body, several data types may be present. The type of data included in a data section is designated with a DATA_TYPE line. Each data section is composed of distinct data blocks that contain required and supplemental data.

The data types described in this chapter enable the transmittal and processing of data from both particulate and noble gas stations. Additional formats will be added in the future to enable the transmittal of β-gated γ-spectra from noble gas stations.

DATA_TYPE

Data sections must begin with a DATA_TYPE line. The argument of the DATA_TYPE command designates the type of data that are included in the message section. The processing code determines the data format based upon certain characteristics found within the data message. No designated line type is used to end a data section. The end of the section is implied by another DATA_TYPE line or a STOP line.

Syntax

`data_type` *data_type*

data_type the type of IMS data that follows

Possible data types for radionuclide data messages and the generator location are described in Table 52. Data messages can be generated at a radionuclide station, a certified laboratory, or at the IDC. Descriptions of formats for each data type are included in this chapter. Examples of each data type are located in “Appendix B: Data Message Examples.”

TABLE 52: DATA TYPES FOR RADIONUCLIDE DATA MESSAGES

Data Message	Data Type	Generator Location
ALERT_FLOW	Alert	Station
ALERT_SYS	Alert	Station
ALERT_TEMP	Alert	Station
ALERT_UPS	Alert	Station
ARR	Data Product	IDC
BLANKPHD	Pulse Height Data	Station or Laboratory
CALIBPHD	Pulse Height Data	Station or Laboratory
DETBKPHD	Pulse Height Data	Station or Laboratory
GASBKPHD	Pulse Height Data	Station or Laboratory
MET	Meteorological Data	Station
QCPHD	Pulse Height Data	Station or Laboratory
RLR	Radionuclide Lab Report	Laboratory
RMSSOH	State of Health Data	Station
RNPS	Data Product	IDC
RRR	Data Product	IDC
SAMPLEPHD	Pulse Height Data	Station or Laboratory
SSREB	Data Product	IDC

PULSE HEIGHT DATA

The six types of pulse height data (PHD) are:

- SAMPLEPHD

  This data type contains pulse height data acquired by counting a gas or particulate sample.

- BLANKPHD

  This data type contains pulse height data acquired by counting an unexposed filter paper on an HPGe detector. Because gas samples are not collected on a material matrix (for example, an air filter for particulate samples), BLANKPHD messages are not sent from noble gas stations.

- DETBKPHD

  This data type contains pulse height data acquired by performing a background count with a detector system. Background counts are performed using an empty detector chamber with a closed shield for typically long count times. Noble gas systems with "memory effects" should allow adsorbed atoms to decay before detector background PHD is acquired.

- GASBKPHD

  This data type is sent by noble gas monitoring systems that are subject to memory effects during sample acquisition due to atoms from the previous sample adsorbed onto the walls of the gas cell. The counts from the memory effect must be subtracted from the sample counts for accurate activity quantification. A DETBKPHD is different than a GASBKPHD in that a DETBKPHD is acquired using new gas cells or cells that have been allowed to decay.

- CALIBPHD

  This data type contains PHD acquired by counting a known standard source with a detector system.

- QCPHD

  This data type contains PHD acquired from a brief count of a known standard source with a detector system.

Each PHD type is composed of a number of data blocks. The start of a data block is designated by a line containing the block name. All data block names begin with the pound (#) sign. Depending on the DATA_TYPE and the detector acquisition system, some data blocks are required, and some are optional. If a data section does not contain the required data blocks, it cannot be processed. Table 53 lists the required and optional data blocks for PHD messages from particulate and gas stations employing high-resolution γ-spectrometry. Table 54 is an addition to the previously defined formats, and includes required and optional data blocks for noble gas stations reporting 3-D β-γ coincidence data.[1] Formats for 2-D β-γ data are not available at this time.

TABLE 53: DATA BLOCKS FOR PHD FROM SITES SENDING HIGH-RESOLUTION γ-SPECTROMETRY DATA

r = required, o = optional	SAMPLEPHD	BLANKPHD[1]	DETBKPHD	CALIBPHD	QCPHD
#Header	r	r	r	r	r
#Comment	o	o	o	o	o
#Collection	r				
#Acquisition	r	r	r	r	r
#Processing	r[2]				
#Sample	o	o		o	o
#g_Energy	r	r	r	r	r
#g_Resolution	r	r	r	r	r
#g_Efficiency	r	r	r	r	r
#TotalEff	o	o	o	o	o
#g_Spectrum	r	r	r	r	r
#Calibration	o	o	o	r	r
#Certificate				r	r

1. BLANKPHDs are required only from particulate stations.
2. The `#Processing` block is required only in SAMPLEPHD from noble gas monitoring stations.

1. 3-D β-γ coincidence data are defined as counts from channel bins with finite γ and β energy ranges. A γ-gated β-spectrum is considered as 2-D β-γ coincidence data, because the β-energy range is not split into two or more energy channels.

TABLE 54: DATA BLOCKS FOR PHD FROM SITES SENDING 3-D β-γ COINCIDENCE DATA

r = required, o = optional	SAMPLEPHD	GASBKPHD	DETBKPHD	CALIBPHD	QCPHD
#Header	r	r	r	r	r
#Comment	o	o	o	o	o
#Collection	r				
#Acquisition	r	r	r	r	r
#Processing	r				
#Sample	o	o		o	o
#g_Energy	r	r	r	r	r
#b_Energy	r	r	r	r	r
#g_Resolution	r	r	r	r	r
#b_Resolution	r	r	r	r	r
#g_Efficiency	o	o	o	o	o
#ROI_Limits	r	r	r	r	r
#b-gEfficiency	r	r	r	r	r
#TotalEff	o	o	o	o	o
#Ratios	r	r	r	r	r
#g_Spectrum[1]	r	r	r	r	r
#b_Spectrum[1]	r	r	r	r	r
#Histogram	r	r	r	r	r
#Calibration	o	o	o	r	r
#Certificate				r	r

1. This data block should contain a non-coincident spectrum.

The formats of the data blocks listed in Tables 53 and 54 are described in more detail in Tables 55–76. (See "Fixed-format Lines" on page 5.) Data blocks may require several records for completion; for example, at least three records must be present in a `#g_Energy` block for it to be valid. The `#Header` block (Table 55) must be the first data block in any PHD message because it specifies the system type. No requirements on the order of the remaining data blocks are necessary.

TABLE 55: #HEADER BLOCK FORMAT

Record	Position	Format	Description
1	1–7	a7	`#Header`
	9–18	a10	designator
2	1–5	a5	site code
	7–15	a9	detector code[1]
	17	a1	system type: `P` for particulate; `G` for gas with high-resolution γ-spectrometry; `B` for gas with 3-D β-γ coincidence detection
	19–35	a17	sample geometry
	37–40	a4	spectrum qualifier: preliminary (`PREL`) or full (`FULL`)
3	1–16	a16	sample reference identification
4	1–31	a31	measurement identification
	33–63	a31	detector background measurement identification
	65–95	a31	gas background measurement identification (memory effect)[2]
5	1–10	i4,a1,i2,a1,i2	transmit date (*yyyy*/*mm*/*dd*)
	12–21	i2,a1,i2,a1,f4.1	transmit time (*hh*:*mm*:*ss*.*s*)

1. For β-γ coincidence systems with multiple gas cells, each gas cell is considered a separate detector and should be assigned a unique detector code.
2. This field is required only for β-γ coincidence systems that have a memory effect, that is, systems with plastic gas cell scintillation counters.

The formats of the data blocks listed in Tables 53 and 54 are described in the tables that follow. Clarifications of parameters and records are included after each table when necessary. If a required data block is shown as having an undetermined number of possible records (denoted by, for example, *2–n*), the minimum number of records is one, unless specified otherwise. Examples of each PHD message type are included in “Appendix B: Data Message Examples.”

Designator

This new parameter is located within the first record. It contains the number of the format version identifier for IMS 2.0 formats and protocols. It should be filled with the number three (3). The designator is used internally at the IDC for version control.

Site Code

Radionuclide site codes are five-character codes assigned to each site, as explained in “Radionuclide Site Codes” on page 8 of this document. A list of site codes for all particulate stations, certified labs, and tentative noble gas stations is provided in “Radionuclide Site Codes” on page A10.

Detector Code

Radionuclide detector codes enable easy identification of a unique detector and its location. Detector codes contain nine characters; see “Radionuclide Detector Codes” on page 9 of this document for a complete description and examples.

System Type

This field was previously named “sample type.” It has become apparent that a more specific parameter is required to indicate the type of analysis required for data enclosed within a PHD message. The three choices for the system type are: “`P`” for particulate, “`G`” for noble gas systems employing high resolution γ-spectrometry, and "B" for noble gas monitoring systems acquiring 3-D β-γ coincidence data. At present, no choices are available for two-dimensional (2-D) β-γ coincidence data.

Sample Geometry

This field describes the sample geometry used during data acquisition, and should not be confused with detector geometry. At present, there are no pre-set choices for this field. Consequently, discretion is given to the data sender in adequately describing the sample geometry in 17 characters or less. No blank spaces are allowed. This field can include information on the filter type and compression method used.

Example

The following is a possible sample geometry for a particulate station that collects samples on type RFM-1.7 Petrianov filters and counts the samples after thermal compression of the filters.

```
PET-RFM1.7th.comp
```

Spectral Qualifier

Valid values for the spectral qualifier field are preliminary (PREL) and full (FULL). The FULL count represents the data acquired over the full acquisition time. Preliminary counts are recorded and transmitted before the full acquisition time has elapsed. More than one preliminary count may be transmitted during sample acquisition.

Sample Reference Identification

The Sample Reference Identification (SRID) aids in the identification of a unique physical entity for which PHD was collected. This allows the matching of a physical entity to the data that describes it. For particulate radionuclide stations equipped with bar-coding systems, the bar code for each air filter should match the SRID reported in the PHD message. In the case of air filters with pre-printed barcodes where the SRID format described below is impossible to follow, a unique SRID for every air filter will be considered valid. The pre-printed barcode should be reported as the SRID.

The format of the SRID is a 14 or 15-character code, depending on the source of the PHD (either a particulate or gas station). The first two numbers of the SRID are the CTBT station number as defined in the CTBT text. The syntax for the remaining digits differs for samples, blanks, quality control (QC) check sources, and calibration sources. (This field is not required for DETBKPHD and GASBKPHD counts, and can be zero-filled, as described in "Missing Data" on page 6 of this document.) If the PHD is collected at a gas station, the SRID ends with G. The various SRID syntaxes are described below.

Sample Syntax (SAMPLEPHD)

ccyyyymmddhhPpT

cc	CTBT station number
yyyymmddhh	year, month, date, and hour of collection start
Pp	split identifier: *P* = split number, *p* = total number of splits
T	station type: G for noble gas station, leave blank for particulate stations

The split identifier (*Pp*) is coded 11 for all radionuclide samples before any splitting is performed. When a sample is split into multiple parts, the split number *P* is the part number and *p* is the total number of pieces. For example, a sample split into three parts is assigned the following split identifiers: 13 for the first piece, 23 for the second piece, and 33 for the third piece. If all the sample splits are counted together, the split number *P* is assigned the number '9.' Therefore, if the three sample splits from the previous example are counted together at a station, the split identifier reported in the SRID field is 93.

Blank Filters Syntax (BLANKPHD)

*cc*00000000*xxxxT*

cc	CTBT station number
00000000	identifier that indicates a blank filter
xxxx	a sequential number (0001, 0002, …)
T	station type: G for noble gas station, leave blank for particulate stations

QC Check Sources Syntax (QCPHD)

*cc*88888888*xxxxT*

cc	CTBT station number
88888888	identifier that indicates a check source
xxxx	a sequential number (0001, 0002, …)
T	station type: G for noble gas station, leave blank for particulate stations

Calibration Sources Syntax (CALIBPHD)

*cc*99999999*xxxxT*

cc	CTBT station number
99999999	identifier that indicates a calibration source
xxxx	a sequential number (0001, 0002, …)
T	station type: G for noble gas station, leave blank for particulate stations

Examples

The following is a SRID for a particulate sample counted at the IMS station in Rio de Janeiro, Brazil. The collection start time and date is 6 a.m., 1 April, 2001.

```
04200104010611
```

The following is a SRID for a blank filter counted at the IMS station in Quezon City, Philippines, and is the third blank counted at that station.

```
52000000000003
```

The following is a SRID for a QC check source counted by a SPALAX gas unit at the IMS station in Reunion, France, and is the check source used for routine QC counts.

```
29888888880001G
```

The following is a SRID for a calibration source counted by an ARSA gas unit at the IMS station at Oahu, Hawaii, and is the third unique calibration source counted at that station.

```
79999999990003G
```

Measurement Identification

The measurement identification (MID) uniquely identifies the results of each detector acquisition. The first nine characters are the detector code, the tenth character is a dash, and the remaining characters are the date and time of the acquisition start.

Examples

The following is a possible MID for a noble gas sample from the IMS station in Rio de Janeiro, Brazil. The sample acquisition start is 6 February, 2000 at 20:00 UTC.

```
BRG11_001-2000/02/06-20:00
```

The following is a possible MID for a calibration count performed on a HPGe detector at AWE Blacknest in Chilton, England. The acquisition start is 2 November, 2010 at 9:37:30.0 UTC.

```
GBL15_005-2010/11/02-09:37:30
```

Detector Background Measurement Identification

The detector background measurement identification specifies the MID of the PHD message containing the relevant background count data. If no relevant detector background count exists, this field should be filled with a zero.

Gas Background Measurement Identification (Memory Effect)

This field is required for noble gas systems that are subject to memory effects. To account for the extra activity in the gas cell, a detector acquisition is performed upon sample evacuation and before the next sample count. The data from this acquisition is reported in the GASBKPHD. The gas background measurement identification field contains the MID of the GASBKPHD associated with the current sample.

Transmit Date and Time

The transmit date and time are the date and time (in UTC) at which the data are sent from the site to the IDC (Table 56).

TABLE 56: #COMMENT BLOCK FORMAT[1]

Record	Position	Format	Description
1	1–8	a8	`#Comment`
2–*n*	1–80	a80	free text

1. There must be at least one record in a `#Comment` block.

TABLE 57: #COLLECTION BLOCK FORMAT

Record	Position	Format	Description
1	1–11	a11	`#Collection`
2	1–10	i4,a1,i2,a1,i2	collection start date (*yyyy*/*mm*/*dd*)
	12–21	i2,a1,i2,a1,f4.1	collection start time (*hh*:*mm*:*ss*.*s*)
	23–32	i4,a1,i2,a1,i2	collection stop date (*yyyy*/*mm*/*dd*)
	34–43	i2,a1,i2,a1,f4.1	collection stop time (*hh*:*mm*:*ss*.*s*)
	45–54	f10	total air volume sampled (standard cubic meters [scm])

Total Air Volume Sampled

For particulate IMS stations, this parameter in the `#Collection` Block (Table 57) is calculated by multiplying the average collection flow rate (scm/hr) by the collection time (hr). For noble gas stations, the sample volume of stable xenon (Xe) must be used to calculate the total air volume sampled. This is because some of the collected air is used for unit processes. The following equation determines total air volume from the sample Xe volume:

$$V_{air} = \frac{V_{Xe}}{0.087}$$

where V_{air} is the total air volume in scm and V_{Xe} is the sample volume of ambient Xe in cm^3 (see `#Processing` block in Table 59 for sample volume of Xe).

TABLE 58: #ACQUISITION BLOCK FORMAT

Record	Position	Format	Description
1	1–12	a12	`#Acquisition`

TABLE 58: #ACQUISITION BLOCK FORMAT (CONTINUED)

Record	Position	Format	Description
2	1–10	i4,a1,i2,a1,i2	acquisition start date (*yyyy/mm/dd*)
	12–21	i2,a1,i2,a1,f4.1	acquisition start time (*hh*:*mm*:*ss*.*s*)
	23–36	f14	acquisition real time (s)
	38–51	f14	acquisition live time (s)

TABLE 59: #PROCESSING BLOCK FORMAT

Record	Position	Format	Description
1	1–11	a11	`#Processing`
2	1–8	f8.5	sample volume of Xe (cm^3)
	10–17	f8.5	uncertainty (cm^3)
3[1]	1–8	f8.5	Xe collection yield (Xe gas in sample/total Xe gas sampled)
	10–17	f8.5	uncertainty (Xe gas in sample/total Xe gas sampled)
4	1–2	a2	archive bottle identification

1. The fields of this record are optional and may be zero-filled if the information is unavailable.

The `#Sample` Block (Table 60) is optional and describes the physical dimensions of the sample. For particulate stations, these fields should correspond in some way to the dimensions of the filter. For example, in the RASA system, the filter is wrapped around the outside of a cylindrical HPGe detector. The diameter of the detector would be recorded as the sample diameter and the thickness of the filter paper would be recorded as the sample thickness. The filter length can then be inferred by the detector circumference. For noble gas stations, the inner diameter and length of the gas cell are reported in the `#Sample` block.

TABLE 60: #SAMPLE BLOCK FORMAT

Record	Position	Format	Description
1	1–7	a7	`#Sample`
2	1–5	f5.2	diameter (cm)
	7–11	f5.2	length or thickness (cm)

The `#g_Energy` data block (Table 61) is required for all detector systems, regardless of sample type. The 'g' prefix indicates that this block contains the energy/channel pairs required to formulate a relationship between channel and γ-energy (versus β-energy). The data contained in this block should be actual peak energies with their corresponding centroid channels, not data points from a fitted calibration equation.

TABLE 61: #G_ENERGY BLOCK FORMAT[1]

Record	Position	Format	Description
1	1–9	a9	`#g_Energy`
2–*n*	1–16	f16	γ-energy (keV)
	18–33	f16	centroid channel
	35–50	f16	uncertainty (channels)

1. There must be at least three records in a `#g_Energy` block.

The `#b_Energy` block (Table 62) is required only for systems reporting 3-D β-γ coincidence data. Contained within the block are the energy/channel pairs needed to create a relationship between channel and β-energy. Data pairs may be reported for β-particle distributions or conversion electrons. In the case of a β-particle distribution, the maximum channel and energy are reported. These should be original data pairs and not points from a fitted calibration equation.

TABLE 62: #B_ENERGY BLOCK FORMAT[1]

Record	Position	Format	Description
1	1–9	a9	`#b_Energy`
2–*n*	1–16	f16	electron energy (keV)
	18	a1	decay mode descriptor: B for β-particle, C for conversion electron (CE)
	20–35	f16	maximum channel of β-particle distribution or centroid channel of CE (channels)
	37–52	f16	uncertainty (channels)

1. There must be at least two records in a `#b_Energy` block.

The `#g_Resolution` data block (Table 63) is required for all detector systems, regardless of sample type. The 'g' prefix indicates that this block contains the energy/FWHM pairs required to formulate a relationship between channel and γ-energy. These should be original data pairs and not points from a fitted calibration equation.

TABLE 63: #G_RESOLUTION BLOCK FORMAT[1]

Record	Position	Format	Description
1	1–13	a13	`#g_Resolution`
2–*n*	1–16	f16	γ-energy (keV)
	18–33	f16	FWHM (keV)
	35–50	f16	uncertainty (keV)

1. There must be at least three records in a `#g_Resolution` block.

The `#b_Resolution` block (Table 64) is required only for systems reporting 3-D β-γ coincidence data. Contained within the block are the energy/FWHM pairs needed to create a relationship between resolution and β-energy. These should be original data pairs and not points from a fitted calibration equation.

TABLE 64: #B_RESOLUTION BLOCK FORMAT[1]

Record	Position	Format	Description
1	1–13	a13	`#b_Resolution`
2–*n*	1–16	f16	electron energy (keV)
	18–33	f16	FWHM (keV)
	35–50	f16	uncertainty (keV)

1. There must be at least two records in a `#b_Resolution` block.

The `#g_Efficiency` data block (Table 65) is required for all detector systems, regardless of sample type. The 'g' prefix indicates that this block contains the energy/efficiency pairs required to formulate a relationship between peak efficiency and γ-energy. These should be original data pairs and not points from a fitted calibration equation.

TABLE 65: #G_EFFICIENCY BLOCK FORMAT[1]

Record	Position	Format	Description
1	1–13	a13	`#g_Efficiency`
2–*n*	1–16	f16	γ-energy (keV)
	18–33	f16	efficiency (counts in peak/photon emitted)
	35–50	f16	uncertainty (counts in peak/photon emitted)

1. There must be at least three records in a `#g_Efficiency` block.

The `#ROI_Limits` block in Table 66 is new and required only for systems reporting 3-D β-γ coincidence data. Counts from such systems are primarily recorded in the `#Histogram` block. A histogram contains the counts collected for a specific β-γ energy pair in a matrix format where each row corresponds to a γ-channel and each column corresponds to a β-channel. The counts are plotted on the z-axis, giving the data a 3-D nature. Regions of interest (ROIs) for this type of data are 2-D rectangles as shown in Figure 3.

TABLE 66: #ROI_LIMITS[1]

Record	Position	Format	Description
1	1–14	a14	`#ROI_Limits`
2–7	2	a2	ROI number
	4–13	f10	2-D ROI β-range start, x_1 (keV)
	15–24	f10	2-D ROI β-range stop, x_2 (keV)
	26–35	f10	2-D ROI γ-range start, y_1 (keV)
	37–46	f10	2-D ROI γ-range stop, y_2 (keV)

1. There must be records for the numbered ROIs shown in Figure 4.

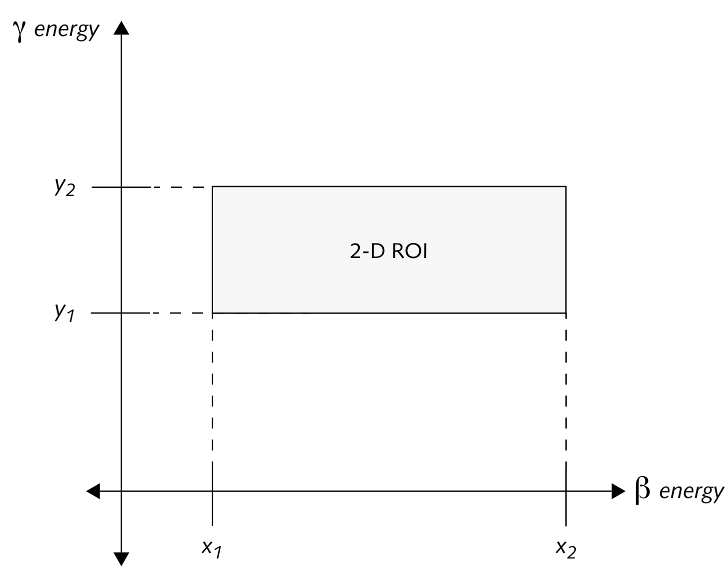

FIGURE 3. TWO-DIMENSIONAL ROI IN β-γ ENERGY SPACE

Because noble gas samples undergo chemical processing before counting, there is a limited number of nuclides that can be present in the counting chamber. These include noble gas isotopes (Xe, Rn, and so on) and their progeny (for example, ^{214}Pb). Because there are so few possible nuclides and the possible nuclide signatures are known *a priori*, predefining the energy limits of the possible ROIs makes for efficient sample analysis. The activity concentration can be determined from the net counts in a 2-D ROI. The `#ROI_Limits` block contains the 2-D coordinates that define the ROIs, that is, the equivalents of x_1, x_2, y_1, and y_2 in Figure 3.

ROI Number

In Table 66, the ROI number is a unique identifier for the required ROI. These numbers are assigned and illustrated in Figure 4.

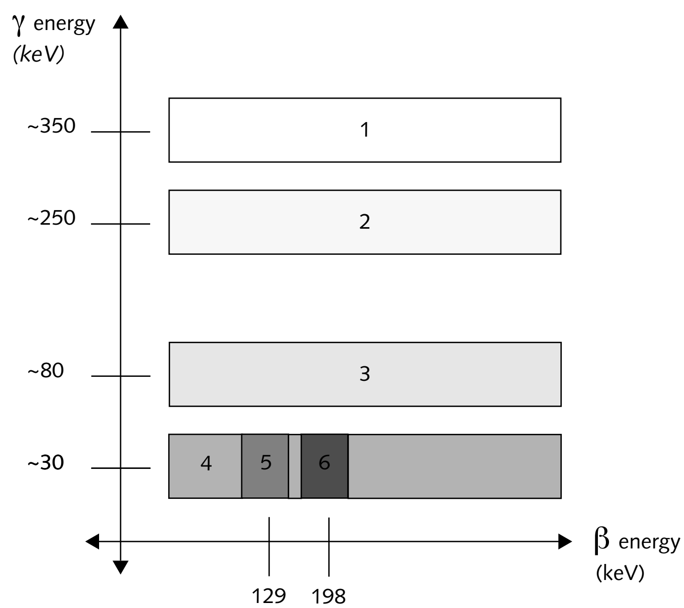

FIGURE 4. REQUIRED REGIONS OF INTEREST WITH THEIR UNIQUE ROI NUMBERS (NOT TO SCALE)

Table 67 summarizes the possible nuclide signals in each ROI and the nuclides quantified by determining the net counts. The exact values for the ROI γ and β-energy ranges are not defined explicitly in this document because they depend on each detector's calibration, capabilities, and characteristics (for example, resolution). The ROI limits specified in the `#ROI_Limits` block should be the same as those used for determining the β-γ coincidence efficiencies reported in the `#b-gEfficiency` block (Table 68).

TABLE 67: ROI CHARACTERIZATION

ROI No.	Nuclides Possible	Quantification Use	Centroid γ-Energy (keV)	Centroid β-Energy (keV)
1	^{214}Pb	n/a[1]	351.9	–
2	^{214}Pb, ^{135}Xe	^{135}Xe	249.8	–
3	^{214}Pb, ^{133}Xe	^{133}Xe	81.0	–
4	^{131m}Xe, ^{133m}Xe, ^{133}Xe, ^{135}Xe	none[2]	30.0	–
5	^{131m}Xe, ^{133}Xe	^{131m}Xe	30.0	129.4
6	^{133m}Xe, ^{133}Xe	^{133m}Xe	30.0	198.7

1. The counts in this ROI are used only for determining interference from ^{214}Pb in ROIs #2 and #3.
2. This ROI will likely be used in the future with ROI #3 for quantification of ^{133}Xe.

TABLE 68: #B-GEFFICIENCY BLOCK FORMAT[1]

Record	Position	Format	Description
1	1–14	a14	`#b-gEfficiency`

TABLE 68: #B-GEFFICIENCY BLOCK FORMAT[1] (CONTINUED)

Record	Position	Format	Description
2–6	1–8	a8	ROI number
	10–19	f10	nuclide name
	21–30	f10	β-γ coincidence efficiency (counts in ROI/β-γ pair emitted)
	32–41	f10	uncertainty (counts in ROI/β-γ pair emitted)

1. There must be records for the following nuclides and β-γ pairs in a `#b-gEfficiency` block:
   - ^{135}Xe: 249.9 keV γ + assorted β^-'s and CE's (ROI #2)
   - ^{133}Xe: 81 keV γ + assorted β^-'s and CE's (ROI #3)
   - ^{133}Xe: ~30keV X-rays + assorted β^-'s and CE's (ROI #4)
   - ^{133m}Xe: ~30keV X-rays + 198.6 keV CE (ROI #5)
   - ^{131m}Xe: ~30keV X-rays + CE's (ROI #6)

The `#b-gEfficiency` block is required only for 3-D β-γ coincidence systems. It contains system efficiency values for the detection of specific β-γ pairs within the predefined 2-D ROI energy bounds. This information is required to quantify radioxenon activity concentrations from the net 2-D ROI counts. This block should not be used for reporting β-gated γ-efficiencies because this is a different type of efficiency altogether.

Nuclide Name

The nuclide name is formed by listing the 2-character element symbol from the periodic table of the elements followed by a dash (–), and then the mass number. An `M` may be placed at the end to designate a metastable state.

Examples

```
XE-131M
XE-133
XE-133M
XE-135
PB-214
```

The `#Totaleff` data block (Table 69) is optional. The "total efficiency" is the ratio of the number of pulses in the entire energy spectrum due to a photon of a given energy, E, to the number of photons emitted by a source for a specified source-to-detector distance. "The total efficiency can be affected by the shield design due to photon scattering."[2] This parameter is required for cascade summing corrections, which is not yet implemented in the analysis code.

TABLE 69: #TOTALEFF BLOCK FORMAT[1]

Record	Position	Format	Description
1	1–9	a9	`#Efficiency`
2–*n*	1–16	f16	γ-energy (keV)
	18–33	f16	total efficiency (counts/photon emitted)
	35–50	f16	uncertainty (counts/photon emitted)

1. There must be at least three records in a `#Totaleff` block.

The `#Ratios` data block (Table 70) is required only for 3-D β-γ coincidence systems. It contains the information necessary for stripping counts due to interfering isotopes from the signals of interest. Count stripping will be performed using a priori count ratios. For example, ^{214}Pb, a Rn progeny, has an interference-free β-γ coincidence signal at a γ-energy of 352 keV (ROI #1). (See Figure 4.) Another β-γ coincidence signal from ^{214}Pb, associated with its 242 keV γ, interferes with the β-γ coincidence signal of ^{135}Xe at a γ-energy of 249.8 keV (ROI #2). If ^{214}Pb is

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present, then the counts associated with this nuclide that fall within ROI #2 must be removed to quantify the amount of ^{135}Xe. The number of counts in ROI #2 from ^{214}Pb ($C_{ROI\#2}|_{Pb-214}$) is determined from the counts in ROI #1 ($C_{ROI\#1}$)and the a priori count ratio for ^{214}Pb, $\zeta_{Pb\text{-}214}$, as follows:

$$C_{ROI\#2}|_{Pb-214} = C_{ROI\#1} \cdot \zeta_{Pb-214}$$

Therefore,

$$\zeta_{Pb-214} = \left(\frac{C_{ROI\#2}}{C_{ROI\#1}}\right)_{Pb-214}$$

TABLE 70: #RATIOS BLOCK FORMAT[1]

Record	Position	Format	Description
1	1–7	a7	`#Ratios`
2–8	1–15	a15	ratio identifier (see Table 71)
	17–18	a2	ROI number for the higher γ-energy ROI
	20–21	a2	ROI number for the lower γ-energy ROI
	23–32	f10	count ratio (counts in higher γ-energy ROI/counts in lower γ-energy ROI)
	34–39	f6	count ratio uncertainty (percent)

1. Five records are required in a `#Ratios` block. See Table 71 for a list of the count ratios required.

The count ratios listed in Table 71 are required in the `#Ratios` block. The ROI numbers correspond to those assigned in Figure 4. The exact ratio identifiers specified in Table 71 must be used in the `#Ratios` block for the data to be parsed and stored correctly.

TABLE 71: REQUIRED COUNT RATIOS

Ratio Identifier	Interference Isotope	Equation of Count Ratio, ζ
PB214_352:242	^{214}Pb	$\left(\frac{C_{ROI\#2}}{C_{ROI\#1}}\right)_{Pb-214}$
PB214_352:80	^{214}Pb	$\left(\frac{C_{ROI\#3}}{C_{ROI\#1}}\right)_{Pb-214}$
XE133-1_81:30[1]	^{133}Xe	$\left(\frac{C_{ROI\#4}}{C_{ROI\#3}}\right)_{Xe-133}$
XE133-2_81:30	^{133}Xe	$\left(\frac{C_{ROI\#5}}{C_{ROI\#3}}\right)_{Xe-133}$
XE133-3_81:30	^{133}Xe	$\left(\frac{C_{ROI\#6}}{C_{ROI\#3}}\right)_{Xe-133}$

1. Not currently used by the automatic analysis algorithm, but will be used in some form in Release 4 of the RMS software.

Ratio Identifier

This ratio identifier is the unique name for the count ratio, ζ, and is composed of the interfering nuclide (minus the dash character) followed by the higher γ-energy and the lower γ-energy that characterize the ROIs comprising ζ. The two γ-energies are separated by a colon while the nuclide name is separated from the γ-energies by an underscore. In cases where a nuclide has more than one count ratio for the same set of γ-energies but different β-energies (for example, ^{133}Xe), consecutive numbers are placed after the nuclide name to distinguish between them.

TABLE 72: #G_SPECTRUM BLOCK FORMAT[1]

Record	Position	Format	Description
1	1–11	a11	#g_Spectrum
2	1–5	i5	number of γ channels
	7–10	i4	γ-energy span (keV)

TABLE 72: #G_SPECTRUM BLOCK FORMAT[1] (CONTINUED)

Record	Position	Format	Description
3–*n*	1–5	i5	channel[2]
	7–16	i10	count at channel + 0
	18–27	i10	count at channel + 1
	29–38	i10	count at channel + 2
	40–49	i10	count at channel + 3
	51–60	i10	count at channel + 4

1. For particulate data, counts must be reported for at least 4096 γ channels in a `#Spectrum` block.
2. The first channel for which counts are reported should be zero.

For HPGe systems, the `#g_Spectrum` block contains the γ-spectrum acquired during a count (Table 72). For β-γ coincidence systems, this block contains the non coincident γ-spectrum.

Energy Span

The γ-energy span is the maximum photon energy that the γ-spectrum represents, rounded to the nearest hundred keV. For example, the γ-energy span for particulate samples is usually 2000 or 3000 keV, while for noble gas samples it is usually 1000 keV or less.

TABLE 73: #B_SPECTRUM BLOCK FORMAT[1]

Record	Position	Format	Description
1	1–11	a11	`#b_Spectrum`
2	1–5	i5	number of β-channels
	7–10	i4	β-energy span (keV)

TABLE 73: #B_SPECTRUM BLOCK FORMAT[1] (CONTINUED)

Record	Position	Format	Description
3–*n*	1–5	i5	channel[2]
	7–16	i10	count at channel + 0
	18–27	i10	count at channel + 1
	29–38	i10	count at channel + 2
	40–49	i10	count at channel + 3
	51–60	i10	count at channel + 4

1. Currently there is no requirement on the number of β channels to be reported.
2. The first channel reported should be zero.

The non coincident β-spectrum is reported in the `#b_Spectrum` data block (Table 73).

TABLE 74: #HISTOGRAM BLOCK FORMAT[1]

Record	Position	Format	Description
1	1–10	a10	`#Histogram`
2	1–5	i5	γ-channels (= *a*)
	7–11	i5	β-channels (= *b*)
	13–16	i4	γ-energy span (keV)
	18–21	i4	β-energy span (keV)
3	2	i1–i10	counts at channels (x,y) = (0,0)[3]
	3	i1–i10	counts at channels (1,0)
	3	i1–i10	counts at channels (2,0)
	3	i1–i10	…
	3	i1–i10	counts at channels (*a*-1,0)

TABLE 74: #HISTOGRAM BLOCK FORMAT[1] (CONTINUED)

Record	Position	Format	Description
4	[3]	i1–i10	counts at channels (0,1)
	[3]	i1–i10	counts at channels (1,1)
	[3]	i1–i10	counts at channels (2,1)
	[3]	i1–i10	…
	[3]	i1–i10	counts at channels (*a*–1,1)
…	[3]	i1–i10	…
b+2	[3]	i1–i10	counts at channels (0,*b*–1)
	[3]	i1–i10	counts at channels (1,*b*–1)
	[3]	i1–i10	counts at channels (2,*b*–1)
	[3]	i1–i10	…
	[3]	i1–i10	counts at channels (*a*–1,*b*–1)

1. No requirements on the number of γ and β-channels to be reported are currently necessary.
2. Fields are separated by at least one blank space. Records are ended with a carriage return and may be longer than 80 characters.
3. x = β-channel ordinate, y = γ-channel ordinate.

The `#Histogram` data block (Table 74) is required for systems reporting 3-D β-γ coincidence data. This block contains the counts (up to 10 characters) in each β-γ energy bin within a 2-D matrix format. Each row consists of a single γ-channel over the entire span of the β-channel axis. Each column consists of a single β-channel over the entire span of the γ-channel axis. To reduce the size of the PHD message, only one blank space is required between reported counts in consecutive energy bins (β-channels) within the same row (γ-channel). However, each record is separated by a carriage return and may be longer than 80 characters. See the example "SAMPLEPHD – Noble Gas Version" on page B42 for reference. Each row represents a γ-channel while each column represents a β-channel. Adding the counts in each row results in the β-gated γ-spectrum while adding the counts in each column results in the γ-gated β-spectrum. Do not include non coincident data in the `#Histogram` block. All non coincident data should be reported using the `#g_Spectrum` or `#b_Spectrum` data blocks (Tables 72 and 73).

TABLE 75: #CALIBRATION BLOCK FORMAT

Record	Position	Format	Description
1	1–12	a12	`#Calibration`
2	1–10	i4,a1,i2,a1,i2	date of last calibration (*yyyy*/*mm*/*dd*)
	12–21	i2,a1,i2,a1,f4.1	time of last calibration (*hh*:*mm*:*ss*.*s*)

TABLE 76: #CERTIFICATE BLOCK FORMAT[1]

Record	Position	Format	Description
1	1–15	a15	`#Certificate`
2	1–10	i10	total source activity (Bq)
	12–21	i4,a1,i2,a1,i2	assay date (*yyyy*/*mm*/*dd*)
	23–32	i2,a1,i2,a1,f4.1	assay time (*hh*:*mm*:*ss*.*s*)
3–*n*	1–8	a8	nuclide name
	10–22	a13	half-life in seconds, hours, days, or years
	24–31	f8.3	activity of nuclide at time of assay (Bq)
	33–39	f7.3	uncertainty (Bq)
	41–48	f8.3	γ-energy (keV)
	50–56	f7.3	γ-intensity (percent)
	58	a1	electron decay mode descriptor: B for β particle or C for conversion electron (CE), 0 for none (that is, γ-only source)
	60–67	f8.3	maximum β-particle energy or CE energy (keV)
	69–75	f7.3	intensity of β-particle (percent)

1. There must be at least three records in a `#Certificate` block.

The #Certificate block (Table 76) allows the reporting of information on the standard radioactive source used in the acquisition of energy, resolution, efficiency, and total efficiency calibration data. This data block is required only in QCPHD and CALIBPHD data messages.

This block has been redesigned to handle γ-sources, β-sources, as well as β-γ coincidence sources. For γ-only sources, the last three fields in records 3–*n* should be zero-filled. For β-only sources, the γ-energy and γ-intensity fields in records 3–*n* should be zero-filled. For β-γ coincidence sources, all fields should be filled with data. Three records are required in this data block where before there were only two.

Half-life

This field is free-format, but certain rules should be followed when specifying the half-life. The first entry in this field should be a number. This number can be an integer, a decimal number, or a number in exponential format. Following the number is a blank and a unit designator such as S for seconds, H for hours, D for days, or Y for years.

Examples

```
11.84 D
1.89E+05 S
```

STATE OF HEALTH DATA

Data messages of DATA_TYPE RMSSOH contain blocks of data that describe or allow the evaluation of the state of health (SOH) of the collection, processing, and acquisition equipment at an IMS particulate radionuclide station.

Each RMSSOH data message is composed of a number of data blocks. The start of a data block is designated by a line containing the block name. Like PHD messages, all RMSSOH data block names begin with the pound (#) sign. The specific data blocks required in an RMSSOH message depend on the equipment inventory of the radionuclide station or certified laboratory. For example, radionuclide particulate stations that have air sampling equipment but no detector (samples are sent to a certified lab for analysis) need include only data blocks related to the SOH of the collection system. IMS sites with detectors must also include data blocks related to the SOH of the acquisition system. RMSSOH messages that do not contain all required data blocks cannot be processed by the IDC software. Table 77 summarizes the data blocks required in a RMSSOH message according to the equipment inventory at a site. No required order for the data blocks within an RMSSOH message is necessary. See "RMSSOH" on page B32 for an example of an RMSSOH message.

TABLE 77: DATA BLOCKS FOR RMSSOH MESSAGES FROM SITES REPORTING PARTICULATE DATA

	Equipment Present at Site		
r = at least one block required, o = optional	**Air Sampler**	**Detector**	**Air Sampler and Detector**
#Header	r	r	r
#AirSamplerFlow	r		r
#AirSamplerEnv	r[1]		r[1]
#DetEnv		r	r
#NIMBIN	o	o	o
#PowerSupply	r	r	r
#EquipStatus	r	r	r
#TamperEnv	o	o	o

1. This data block is required only for stations where air is heated at the inlet.

Data blocks in RMSSOH messages have fixed formats. The formats are described in more detail in Tables 78–86. Clarifications of parameters and records are included after each table when necessary.

TABLE 78: #HEADER BLOCK FORMAT

Record	Position	Format	Description
1	1–7	a7	`#Header`
	9–18	a10	designator
2	1–5	a5	station or laboratory code
	7–15	a9	detector code or `NA` if not applicable
3	1–10	i4,a1,i2,a1,i2	SOH data sampling period start date (*yyyy*/*mm*/*dd*)
	12–21	i2,a1,i2,a1,f4.1	SOH data sampling period start time (*hh*:*mm*:*ss*.*s*)
	23–32	i4,a1,i2,a1,i2	SOH data sampling period end date (*yyyy*/*mm*/*dd*)
	34–43	i2,a1,i2,a1,f4.1	SOH data sampling period end time (*hh*:*mm*:*ss*.*s*)
	45–54	i4,a1,i2,a1,i2	transmit date (*yyyy*/*mm*/*dd*)
	56–65	i2,a1,i2,a1,f4.1	transmit time (*hh*:*mm*:*ss*.*s*)

Detector Code

If the site does not have a detector, but only collects samples, this field is filled with `NA` for *non-applicable*.

SOH Data Sampling Period

A SOH data sampling period is defined as the total time duration in which the SOH data in the entire RMSSOH message are acquired. SOH is characterized by a start date and time as well as an end date and time. The SOH data sampling period consists of consecutive data sampling intervals.

TABLE 79: #AIRSAMPLERFLOW BLOCK FORMAT

Record	Position	Format	Description
1	1–15	a15	#AirSamplerFlow
2–*n*	1–10	f10.4	average flow rate (standard cubic meters per hour (scm/h))
	12–22	f11.6	flow rate standard deviation (scm/h)
	24–33	i4,a1,i2,a1,i2	SOH data sampling interval start date (*yyyy*/*mm*/*dd*)
	35–44	i2,a1,i2,a1,f4.1	SOH data sampling interval start time (*hh*:*mm*:*ss*.*s*)
	46–51	i6	SOH data sampling interval duration (s)

SOH Data Sampling Interval

The SOH data sampling period consists of consecutive SOH data sampling intervals. The interval start date and time indicates when the sampling interval begins. The interval duration describes how long the sampling interval lasts until the next one starts.

Example

A SOH data sampling interval begins on 5 November, 2000 at 13:30:30 UTC and ends on 5 November, 2000 at 13:30:35 UTC. During this time, an average flow rate of 500 ± 25 scm/h is measured. The record describing this SOH data sampling interval in the #AirSamplerFlow block (Table 79) would look like:

```
500        25          2000/11/05 13:30:30   5
```

TABLE 80: #AIRSAMPLERENV BLOCK FORMAT

Record	Position	Format	Description
1	1–14	a14	`#AirSamplerEnv`
2–*n*	1–5	f5.1	average air temperature after sample filter (°C)
	7–13	f7.2	average static air pressure after sample filter (hPa)
	15–24	i4,a1,i2,a1,i2	date (*yyyy/mm/dd*)
	26–35	i2,a1,i2,a1,f4.1	time (*hh*:*mm*:*ss*.*s*)
	37–42	i6	SOH data sampling interval duration (s)

Example

A SOH data sampling interval begins on 17 November, 2000 at 10:25:44 UTC and ends 30 seconds later. During this time, the average air temperature after the sample filter is 20 °C and the average static air pressure after the sample filter is 950 hPa. The `#AirSamplerEnv` block (Table 80) describing this SOH data sampling interval would look like:

```
#AirSamplerEnv
20    950     2000/11/17 10:25:44   30
```

TABLE 81: #DETENV BLOCK FORMAT

Record	Position	Format	Description
1	1–7	a7	`#DetEnv`

TABLE 81: #DETENV BLOCK FORMAT (CONTINUED)

Record	Position	Format	Description
2–*n*	1–5	f5.1	average room temperature (°C)
	7–12	a6	detector shield status (`OPEN` or `CLOSED`)
	14–16	i3	average room humidity (in percent relative humidity)[1]
	18–22	i5	power supply output voltage[1] (V)
	24–27	i4	average crystal temperature (°C)[1]
	29–31	a3	electric cooler status (`ON` or `OFF`) [2]
	33–36	f4.2	liquid nitrogen fill-fraction[1]
	38–43	f6.3	detector leakage current [1] (nanoamperes [nA])
	45–54	i4,a1,i2,a1,i2	date (*yyyy*/*mm*/*dd*)
	56–65	i2,a1,i2,a1,f4.1	time (*hh*:*mm*:*ss*.*s*)
	67–72	i6	SOH data sampling interval duration (s)

1. An optional parameter is indicated.
2. This parameter is required for stations with electrically cooled detectors.

Power Supply Output Voltage

This field contains the voltage that is applied across the detector crystal by the high voltage power supply and sometimes called the bias voltage.

Liquid Nitrogen Fill-fraction

This field contains the volume fraction of liquid nitrogen remaining (usually in a dewar) for cooling the detector crystal. For example, a full dewar would have a liquid nitrogen fill-fraction of 1.00. A half-full dewar would have a liquid nitrogen fill-fraction of 0.50.

Detector Leakage Current

This field contains the steady-state leakage current of the detector crystal during normal operations.

Example

An IMS station writes a record in the `#DetEnv` block (Table 81) every 10 minutes or upon a change in the shield status and electric cooler status. The events in Table 82 occurred from 9:00:00 to 10:00:00 UTC on 13 December, 2000.

TABLE 82: EXAMPLE DETECTOR ENVIRONMENT EVENTS AT AN IMS STATION

Time	Event
9:10:45	The detector shield is opened.
9:21:30	The detector shield is closed.
9:34:30	The electro cooler fails.

During this time, the average room temperature was 21.0 °C, the average room humidity was 54.0 percent, and the average crystal temperature was –196 °C. Accordingly, the following records are written in the `#DetEnv` block. To improve readability, parameter changes are in bold font.

```
21.0  CLOSED 54  13    -196  ON —999 5.9    2000/12/13 9:10:45    540
21.0    OPEN 54  13    -196  ON -999 5.9    2000/12/13 9:19:45    105
21.0  CLOSED 54  13    -196  ON -999 5.9    2000/12/13 9:21:30    600
21.0  CLOSED 54  13    -196  ON -999 5.9    2000/12/13 9:31:30    180
21.0  CLOSED 54  13    -196 OFF -999 6.0    2000/12/13 9:34:30    600
21.0  CLOSED 54  13    -196 OFF -999 6.0    2000/12/13 9:44:30    600
```

The liquid nitrogen fill-fraction is not applicable to a detector system that is electrically cooled. The field, however, must be filled with data or else the parsing program will fail. This scenario is considered to be a case of missing data. Because the electric cooler status field is formatted as f4.2, the missing data are replaced with `-999` as described in "Missing Data" on page 6 of this document.

TABLE 83: #NIMBIN STATUS BLOCK FORMAT

Record	Position	Format	Description
1	1–6	a6	`#NIMBIN`
2–*n*	1–3	a3	`+/–`
	5–6	i2	average NIMBIN voltage (V)
	8–17	i4,a1,i2,a1,i2	date (*yyyy*/*mm*/*dd*)
	19–28	i2,a1,i2,a1,f4.1	time (*hh*:*mm*:*ss*.*s*)
	30–35	i6	SOH data sampling interval duration (s)

NIMBIN Voltage

This field contains the output voltage of the NIMBIN and is usually ±6 V, ±12 V, or ±24 V (Table 83).

Example

A SOH data sampling interval begins on 22 January, 2001 at 04:56:02 UTC and ends on 22 January, 2001 at 05:06:02 UTC. During this time, the average NIMBIN voltage is 12 V. The record describing this SOH data sampling interval in the `#NIMBIN` block (Table 83) would look like:

```
+/– 12 2001/01/22 04:56:02   600
```

An IMS station should write a record in the `#PowerSupply` block (Table 84) every 10 minutes or upon a change in the status of any of the three power supplies (MAIN, AUX, UPS).

TABLE 84: #POWERSUPPLY BLOCK FORMAT

Record	Position	Format	Description
1	1–12	a12	`#PowerSupply`
2–*n*	1–4	a4	`MAIN` (for MAIN power supply)
	6–8	a3	status of main power supply (`ON`/`OFF`)
	10–12	a3	`AUX` (for AUXiliary power supply)
	14–16	a3	status of auxiliary power supply (`ON`/`OFF`)[1]
	18–20	a3	`UPS` (for Uninterrupted Power Supply)
	22–24	a3	status of uninterruptedly power supply (`ON`/`OFF`)
	26–35	i4,a1,i2,a1,i2	date (*yyyy*/*mm*/*dd*)
	37–46	i2,a1,i2,a1,f4.1	time (*hh*:*mm*:*ss*.*s*)
	48–53	i6	SOH data sampling interval duration (s)

1. This parameter is optional.

Status of Uninterrupted Power Supply

An UPS status of `ON` indicates the internal UPS batteries are being used to power the station.

Example

A SOH data sampling interval begins at a certain station on 10 February, 2001 at 08:09:01 UTC. At this time, the MAIN power supply is ON while the AUX and UPS supplies are OFF. At 08:11:32 UTC, the MAIN power shuts off due to effects from a nearby storm. To compensate, the UPS power automatically turns ON until the AUX power supply takes over at 08:14:16 UTC. The MAIN power comes back online at 08:30:27 UTC. The IMS station writes a record in the `#PowerSupply` block every 10 minutes or upon a change in status of any of the MAIN, UPS, or AUX power supplies. Accordingly, the following records are written in the `#PowerSupply` block. To improve readability, parameter changes are in bold font.

```
MAIN ON  AUX OFF UPS OFF 2000/02/10 08:09:01   151
MAIN OFF AUX OFF UPS ON  2000/02/10 08:11:32   164
MAIN OFF AUX ON  UPS OFF 2000/02/10 08:14:16   600
MAIN OFF AUX ON  UPS OFF 2000/02/10 08:24:16   371
MAIN ON  AUX OFF UPS OFF 2000/02/10 08:30:27   600
```

Note that only one of three power supplies can be `ON` at a time.

TABLE 85: #EQUIPSTATUS BLOCK FORMAT

Record	Position	Format	Description
1	1–12	a12	`#EquipStatus`
2–*n*	1–2	a2	`C:` (for collection/sampling system)
	4–19	a16	status of sampling system (`ON`/`OFF`) or the SRID of the sample being collected[1]
	21–22	a2	`P:` (for sample preparation, processing, or decay)
	24–39	a16	status of sample preparation, processing, or decay (`ON`/`OFF`) or the SRID of the sample being processed or decayed
	41–42	a2	`A:` (for data acquisition)
	44–59	a16	status of detector system (`ON`/`OFF`) or the SRID of the sample being counted[2]
	61–70	i4,a1,i2,a1,i2	date (*yyyy*/*mm*/*dd*)
	72–81	i2,a1,i2,a1,f4.1	time (*hh*:*mm*:*ss*.*s*)
	83–88	i6	SOH data sampling interval duration (s)

1. Required only for sites that have sample collection systems.
2. Required only for sites that have detector systems.

Example

The sampling methodology at IMS radionuclide station 03 for particulate samples is 23 hours collection time, 23 hours decay time, and 23 hours count time. The SOH data at this station are recorded every 10 minutes or at a status change, and is transmitted every 2 hours. A sample is collected from 12:56:12 UTC on 24 February, 2001 to 11:56:12 UTC on 25 December, 2001. Accordingly, the following records are written in the `#EquipStatus` block (Table 85) of the RMSSOH messages indicated to specify the status changes.

The RMSSOH messages are labelled with consecutive numbers: the first RMSSOH message containing equipment status records for this sample is labelled as #1. The continuation dots indicate that the status is unchanged for the records above and below those displayed. To improve readability, parameter changes are in bold font.

RMSSOH message #1

Data Sampling Period Start Date and Time: 24 February, 2001 at 12:00:00 UTC

```
...
C: 03200102230111   P: 03200102220211   A: 03200102210311   2001/02/24 12:46:12   600
C: 03200102241211   P: 03200102230111   A: 03200102220211   2001/02/24 12:56:12   600
C: 03200102241211   P: 03200102230111   A: 03200102220211   2001/02/24 13:06:12   600
…
```

RMSSOH message #12

Data Sampling Period Start Date and Time: 25 December, 2001 at 10:00:00 UTC

```
...
C: 03200102241211   P: 03200102230111   A: 03200102220211   2001/02/25 11:46:12   600
C: 03200102251111   P: 03200102241211   A: 03200102230111   2001/02/25 11:56:12   600
C: 03200102251111   P: 03200102241211   A: 03200102230111   2001/02/25 12:06:12   600
…
```

RMSSOH message #24

Data Sampling Period Start Date and Time: 26 December, 2001 at 10:00:00 UTC

```
...
C: 03200102251111   P: 03200102241211   A: 03200102230111   2001/02/26 10:46:12   600
C: 03200102261011   P: 03200102251111   A: 03200102241211   2001/02/26 10:56:12   600
C: 03200102261011   P: 03200102251111   A: 03200102241211   2001/02/26 11:06:12   600
…
```

TABLE 86: #TAMPERENV BLOCK FORMAT

Record	Position	Format	Description
1	1–10	a10	#TamperEnv
2–*n*	1–20	a20	tamper sensor name
	22–27	a6	tamper sensor status (OPEN or CLOSED)
	29–38	i4,a1,i2,a1,i2	date (*yyyy*/*mm*/*dd*)
	40–49	i2,a1,i2,a1,f4.1	time (*hh*:*mm*:*ss*.*s*)
	51–56	i6	SOH data sampling interval duration (s)

Tamper Sensor Name

Valid names for tamper sensors are listed in Table 87. Stations should send data for the tamper sensors they have. Some stations may have more tamper sensors than those currently recognized by the IDC. If an invalid name or extra sensor is listed in the #TamperEnv block (Table 86), the record will saved at the IDC but not parsed into the database tables. In the future, more sensor names may be added.

TABLE 87: TAMPER SENSOR NAMES RECOGNIZED BY IDC PARSING SOFTWARE

Name	Tamper Sensor Location
door1	main entrance
door2	second door
door3	third door
fence	fence entrance
aslid	air sampler lid
aspanel	air sampler panel

TABLE 87: TAMPER SENSOR NAMES RECOGNIZED BY IDC PARSING SOFTWARE (CONTINUED)

Name	Tamper Sensor Location
fscab	filter storage cabinet
decaycab	decay cabinet
equipcab	equipment cabinet – primarily for automated stations

Example

An IMS station has tamper sensors at a fence entrance, the only station door, the air sampler lid, the filter storage cabinet, a leaded cabinet containing calibration sources, an equipment cabinet, and a breaker box. A maintenance person arrives at the station on 1 March, 2001 at 09:01:23 UTC to perform a monthly inventory of the station supplies. Table 88 summarizes events that the tamper sensors recorded during the visit.

TABLE 88: EXAMPLE TAMPER SENSOR EVENTS AT AN IMS STATION

Time	Event
9:05:55	The fence surrounding the IMS station is unlocked and opened.
9:06:00	The fence is shut.
9:07:37	The only door to the IMS station housing is opened.
9:07:40	The only door to the IMS station is closed.
9:13:11	The filter storage cabinet is opened.
9:20:24	The filter storage cabinet is closed.
9:25:07	The decay cabinet is opened.
9:27:50	The decay cabinet is closed.
9:31:43	The equipment cabinet is opened.
9:43:28	The equipment cabinet is closed.

TABLE 88: EXAMPLE TAMPER SENSOR EVENTS AT AN IMS STATION (CONTINUED)

Time	Event
9:50:51	The only door to the IMS station housing is opened.
9:50:54	The only door to the IMS station is closed.
9:52:33	The fence surrounding the IMS station is opened.
9:52:38	The fence is shut and locked.

The SOH data at this station are recorded every 10 minutes or at a status change, and is transmitted every 2 hours. Accordingly, the following records are written in the `#TamperEnv` block. To improve readability, parameter changes are in bold font.

```
door1        CLOSED   2001/03/01 09:00:00 355
fence        CLOSED   2001/03/01 09:00:00 355
aslid        CLOSED   2001/03/01 09:00:00 355
fscab        CLOSED   2001/03/01 09:00:00 355
decaycab     CLOSED   2001/03/01 09:00:00 355
equipcab     CLOSED   2001/03/01 09:00:00 355
breakerbox   CLOSED   2001/03/01 09:00:00 355
door1        CLOSED   2001/03/01 09:05:55   5
fence          OPEN   2001/03/01 09:05:55   5
aslid        CLOSED   2001/03/01 09:05:55   5
fscab        CLOSED   2001/03/01 09:05:55   5
decaycab     CLOSED   2001/03/01 09:05:55   5
equipcab     CLOSED   2001/03/01 09:05:55   5
breakerbox   CLOSED   2001/03/01 09:05:55   5
door1        CLOSED   2001/03/01 09:06:00  97
fence        CLOSED   2001/03/01 09:06:00  97
aslid        CLOSED   2001/03/01 09:06:00  97
fscab        CLOSED   2001/03/01 09:06:00  97
decaycab     CLOSED   2001/03/01 09:06:00  97
equipcab     CLOSED   2001/03/01 09:06:00  97
breakerbox   CLOSED   2001/03/01 09:06:00  97
door1          OPEN   2001/03/01 09:07:37   3
fence        CLOSED   2001/03/01 09:07:37   3
aslid        CLOSED   2001/03/01 09:07:37   3
fscab        CLOSED   2001/03/01 09:07:37   3
decaycab     CLOSED   2001/03/01 09:07:37   3
```

```
equipcab    CLOSED   2001/03/01 09:07:37   3
breakerbox  CLOSED   2001/03/01 09:07:37   3
door1       CLOSED   2001/03/01 09:07:40 331
fence       CLOSED   2001/03/01 09:07:40 331
aslid       CLOSED   2001/03/01 09:07:40 331
fscab       CLOSED   2001/03/01 09:07:40 331
decaycab    CLOSED   2001/03/01 09:07:40 331
equipcab    CLOSED   2001/03/01 09:07:40 331
breakerbox  CLOSED   2001/03/01 09:07:40 331
door1       CLOSED   2001/03/01 09:13:11 433
fence       CLOSED   2001/03/01 09:13:11 433
aslid       CLOSED   2001/03/01 09:13:11 433
fscab         OPEN   2001/03/01 09:13:11 433
decaycab    CLOSED   2001/03/01 09:13:11 433
equipcab    CLOSED   2001/03/01 09:13:11 433
breakerbox  CLOSED   2001/03/01 09:13:11 433
door1       CLOSED   2001/03/01 09:20:24 283
fence       CLOSED   2001/03/01 09:20:24 283
aslid       CLOSED   2001/03/01 09:20:24 283
fscab       CLOSED   2001/03/01 09:20:24 283
decaycab    CLOSED   2001/03/01 09:20:24 283
equipcab    CLOSED   2001/03/01 09:20:24 283
breakerbox  CLOSED   2001/03/01 09:20:24 283
door1       CLOSED   2001/03/01 09:25:07 163
fence       CLOSED   2001/03/01 09:25:07 163
aslid       CLOSED   2001/03/01 09:25:07 163
fscab       CLOSED   2001/03/01 09:25:07 163
decaycab      OPEN   2001/03/01 09:25:07 163
equipcab    CLOSED   2001/03/01 09:25:07 163
breakerbox  CLOSED   2001/03/01 09:25:07 163
door1       CLOSED   2001/03/01 09:27:50 233
fence       CLOSED   2001/03/01 09:27:50 233
aslid       CLOSED   2001/03/01 09:27:50 233
fscab       CLOSED   2001/03/01 09:27:50 233
decaycab    CLOSED   2001/03/01 09:27:50 233
equipcab    CLOSED   2001/03/01 09:27:50 233
breakerbox  CLOSED   2001/03/01 09:27:50 233
door1       CLOSED   2001/03/01 09:31:43 600
fence       CLOSED   2001/03/01 09:31:43 600
aslid       CLOSED   2001/03/01 09:31:43 600
fscab       CLOSED   2001/03/01 09:31:43 600
decaycab    CLOSED   2001/03/01 09:31:43 600
equipcab      OPEN   2001/03/01 09:31:43 600
breakerbox  CLOSED   2001/03/01 09:31:43 600
door1       CLOSED   2001/03/01 09:41:43 105
```

```
fence        CLOSED   2001/03/01 09:41:43 105
aslid        CLOSED   2001/03/01 09:41:43 105
fscab        CLOSED   2001/03/01 09:41:43 105
decaycab     CLOSED   2001/03/01 09:41:43 105
equipcab       OPEN   2001/03/01 09:41:43 105
breakerbox   CLOSED   2001/03/01 09:41:43 105
door1        CLOSED   2001/03/01 09:43:28 443
fence        CLOSED   2001/03/01 09:43:28 443
aslid        CLOSED   2001/03/01 09:43:28 443
fscab        CLOSED   2001/03/01 09:43:28 443
decaycab     CLOSED   2001/03/01 09:43:28 443
equipcab     CLOSED   2001/03/01 09:43:28 443
breakerbox   CLOSED   2001/03/01 09:43:28 443
door1          OPEN   2001/03/01 09:50:51   3
fence        CLOSED   2001/03/01 09:50:51   3
aslid        CLOSED   2001/03/01 09:50:51   3
fscab        CLOSED   2001/03/01 09:50:51   3
decaycab     CLOSED   2001/03/01 09:50:51   3
equipcab     CLOSED   2001/03/01 09:50:51   3
breakerbox   CLOSED   2001/03/01 09:50:51   3
door1        CLOSED   2001/03/01 09:50:54  99
fence        CLOSED   2001/03/01 09:50:54  99
aslid        CLOSED   2001/03/01 09:50:54  99
fscab        CLOSED   2001/03/01 09:50:54  99
decaycab     CLOSED   2001/03/01 09:50:54  99
equipcab     CLOSED   2001/03/01 09:50:54  99
breakerbox   CLOSED   2001/03/01 09:50:54  99
door1        CLOSED   2001/03/01 09:52:33   5
fence          OPEN   2001/03/01 09:52:33   5
aslid        CLOSED   2001/03/01 09:52:33   5
fscab        CLOSED   2001/03/01 09:52:33   5
decaycab     CLOSED   2001/03/01 09:52:33   5
equipcab     CLOSED   2001/03/01 09:52:33   5
breakerbox   CLOSED   2001/03/01 09:52:33   5
door1        CLOSED   2001/03/01 09:52:38 600
fence        CLOSED   2001/03/01 09:52:38 600
aslid        CLOSED   2001/03/01 09:52:38 600
fscab        CLOSED   2001/03/01 09:52:38 600
decaycab     CLOSED   2001/03/01 09:52:38 600
equipcab     CLOSED   2001/03/01 09:52:38 600
breakerbox   CLOSED   2001/03/01 09:52:38 600
```

METEOROLOGICAL DATA

Data messages of `DATA_TYPE MET` contain the meteorological data recorded at an IMS radionuclide station. The format for the MET data type is given in Table 89, and an example is provided in "MET" on page B26. There must be at least one record in a MET message.

TABLE 89: MET DATA FORMAT

Record	Position	Format	Description
1	1–5	a5	station code
2–*n*	1–10	i4,a1,i2,a1,i2	met start date (*yyyy*/*mm*/*dd*)
	12–21	i2,a1,i2,a1,f4.1	met start time (*hh*:*mm*:*ss*.*s*)
	23–32	i4,a1,i2,a1,i2	met end date (*yyyy*/*mm*/*dd*)
	34–43	i2,a1,i2,a1,f4.1	met end time (*hh*:*mm*:*ss*.*s*)
	45–49	f5.1	average outside temperature (°C)
	51–53	i3	average wind-direction (degrees from north)
	55–59	f5.1	average wind-speed (m/s)
	61–67	f7.2	average barometric reading (hPa)
	69–71	i3	average relative humidity (percent relative humidity)
	73–77	f5.1	rainfall (mm)[1]

1. optional parameter

ALERTS

Currently there are four types of ALERT messages.

- ALERT_FLOW

  This type of data message indicates that the sampler flow rate is above or below a specified threshold.

- ALERT_SYSTEM

  This type of data message indicates that the computer controlling the sampler and/or acquisition system is being rebooted or that the system is shutting down.

- ALERT_TEMP

  This type of data message indicates that the system temperature is outside the IMS required temperature range for that parameter.

- ALERT_UPS

  This type of data message indicates a problem with the UPS.

Table 90 describes the general format of an ALERT message. Examples of ALERT messages can be found in "Appendix B: Data Message Examples" on page B1.

TABLE 90: GENERAL ALERT MESSAGE FORMAT

Record	Position	Format	Description
1	1–5	a5	station code
	7–18	a12	alert type
	20–29	i4,a1,i2,a1,i2	date (*yyyy*/*mm*/*dd*)
	31–40	i2,a1,i2,a1,f4.1	time (*hh*:*mm*:*ss*.*s*)
2–*n*[1]	1–80	a80	free text describing alert

1. There must be at least one line of free text describing the problem.

Alert Type

The four acceptable alert types are: `ALERT_FLOW`, `ALERT_SYSTEM`, `ALERT_TEMP`, and `ALERT_UPS`.

RADIONUCLIDE LABORATORY REPORTS

Radionuclide Laboratory Reports (RLRs) contain sample analysis results from a certified radionuclide laboratory. (The names and locations of CTBT radionuclide certified laboratories are listed in Table A-3 on page A14 of this document.) The RLR is comprised of six block types. The required number of blocks in an RLR is described in Table 91.

TABLE 91: NUMBER OF DATA BLOCKS REQUIRED IN RADIONUCLIDE LABORATORY REPORT

Block Name	Number of Blocks Required in RLR
#Header	1
#Objective	1
#Test	≥1
#Results	≥1
#ResultsDescription	≥1
#Conclusion	1

Formats for the data blocks listed in Table 91 are described in Tables 92 through 97. If a required data block is shown as having an undetermined number of possible records (denoted by, for example, 4–*n*), the minimum number of records is one, unless specified otherwise. An example of an RLR is provided in "RLR" on page B30.

TABLE 92: #HEADER BLOCK FORMAT

Record	Position	Format	Description
1	1–7	a7	`#Header`

TABLE 92: #HEADER BLOCK FORMAT (CONTINUED)

Record	Position	Format	Description
2	1–5	a5	station code of the station at which the sample was collected
	7–15	a9	laboratory detector code
	17–32	a16	sample reference identification
3	1–10	i4,a1,i2,a1,i2	collection start date (*yyyy*/*mm*/*dd*)
	12–21	i2,a1,i2,a1,f4.1	collection start time (*hh*:*mm*:*ss*.*s*)
	23–32	i4,a1,i2,a1,i2	collection stop date (*yyyy*/*mm*/*dd*)
	34–43	i2,a1,i2,a1,f4.1	collection stop time (*hh*:*mm*:*ss*.*s*)
4	1–10	i4,a1,i2,a1,i2	sample arrival date at lab (*yyyy*/*mm*/*dd*)
	12–16	i4,a1,i2	sample arrival time at lab (*hh*:*mm*)
5	1–10	i4,a1,i2,a1,i2	test completion date at lab (*yyyy*/*mm*/*dd*)
	12–16	i4,a1,i2	test completion time at lab (*hh*:*mm*)
6	1–10	i4,a1,i2,a1,i2	transmit date (*yyyy*/*mm*/*dd*)
	12–16	i4,a1,i2	transmit time (*hh*:*mm*)

TABLE 93: #OBJECTIVE BLOCK FORMAT

Record	Position	Format	Description
1	1–10	a10	`#Objective`
2–*m*	1–80	a80	general free text comment describing purpose of testing – what is being investigated and why
m+1	1	a1	blank line to separate free text
m+2 – *n*	1–80	a80	general free text comment describing sample condition or special laboratory handling and storage procedures

TABLE 94: #TEST BLOCK FORMAT

Record	Position	Format	Description
1	1–5	a5	`#Test`
2	1–30	a30	test description or name
3–*m*	1–80	a80	test purpose
m+1	1	a1	blank line to separate free text
m+2 – *n*	1–80	a80	test procedures (including sample preparation, calibration, recording of data, mitigation of environmental factors)

TABLE 95: #RESULTS BLOCK FORMAT

Record	Position	Format	Description
1	1–8	a8	`#Results`
2	1–30	a30	test description or name
3	1–15	a15	units for concentration data
4–*n*	1–10	a10	nuclide name
	12–24	f13	nuclide concentration
	26–38	f13	concentration uncertainty
	40–52	f13	minimum detectable concentration (MDC)
	54–66	f13	activity ratio

TABLE 96: #RESULTSDESCRIPTION BLOCK FORMAT

Record	Position	Format	Description
1	1–19	a8	`#ResultsDescription`
2	1–30	a30	test description or name
3–*m*	1–80	a80	description of uncertainty and MDC calculations, description of activity ratios reported
m+1	1	a1	blank line to separate free text
m+2 – *n*	1–80	a80	interpretation of results (including rejection or approval of results and any anomalous findings)

TABLE 97: #CONCLUSIONS BLOCK FORMAT

Record	Position	Format	Description
1	1–12	a12	`#Conclusions`
2–*k*	1–80	a80	summary of IDC findings
k+1	1	a1	blank line to separate free text
k+2 – *m*	1–80	a80	summary of lab findings and conclusions
m+1	1	a1	blank line to separate free text
m+2 – *n*	1–80	a80	discussion of discrepancies between IDC and laboratory results

DATA PRODUCTS

The following data products are generated by the IDC and are made available to subscribers:

- ARR (Automated Radionuclide Report)

  The ARR contains results from the automated analysis of a particulate or gas sample.

- RRR (Reviewed Radionuclide Report)

  The RRR is a revised version of the ARR and is generated after the manual analysis of a particulate or gas sample is complete.

- SSREB (Standard Screened Radionuclide Event Bulletin)

  The SSREB is produced only for samples categorized as level 4 or level 5. This report contains the RRRs from stations contributing to the event, information on fission or activation products identified, and an enhanced field of regard. The SSREBs may be updated as new relevant data arrives

- RNPS (Radionuclide Network Product Summary)

  The RNPS contains a summary of all the data received from the IMS stations during a 3-day period.

The `DATA_TYPE` of these reports is `ARR`, `RRR`, `SSREB`, or `RNPS`, respectively.

ARR

An ARR contains the following sections as noted:

- Sample Information

  This section includes information on the sample collection and data acquisition.

- Activity Summary

  This section includes the concentration and relative uncertainties of the radionuclides detected in the sample.

- Minimum Detectable Concentration (MDC) for Key Nuclides

  This section lists the half-lives and MDCs of the radionuclides specified in [WG195].

- Peak Search Results

  This section includes information on the peaks identified during automated analysis of high-resolution γ-spectrometry data (particulate data only).

- ROI Results

  This section contains information on the ROIs used during the analysis process for β-γ coincidence data (noble gas data only).

- ROI Boundaries

  This section contains the ROI boundaries in energy units as specified in the PHD file (noble gas data only).

- Processing Parameters

  This section includes the settings used by the *rms_analyze* software unit to identify peaks and quantify peak characteristics (particulate data only). (See [IDC7.1.10Rev1] for a description of the *rms_analyze* software unit.)

- Update Parameters

  This section lists the settings used by the *rms_analyze* software unit to update the energy and resolution calibration curves.

- Data Quality Flags

  This section lists values for SOH and data quality parameters, acceptable values for these parameters, and test results (`PASS/FAIL`) (particulate data only).

- Event Screening Flags

  This section lists the anthropogenic radionuclides detected, as well as the station-dependent frequency of detection for each nuclide.

- Calibration Equations

  This section includes the energy, resolution, and efficiency calibration equations generated during automated analysis.

- Field of Regard

  This section includes a hypertext link that can be accessed to display atmospheric modeling results for the surrounding region (particulate data only).

An example of an Automated Radionuclide Report is provided in "ARR – Noble Gas Version" on page B3 and "ARR – Particulate Version" on page B4. Some of the data fields are described in the following sections. More information on processing parameters, update parameters, data quality flags, event screening flags, and calibration equations can be found in [IDC5.2.2Rev1].

%Eff

This parameter is the detector efficiency relative to a standard 3-inch by 3-inch cylindrical NaI(Tl) crystal with a source-to-detector distance of 25 cm. The `%Eff` is given in percent.

%b-gEff

This parameter is the β-γ coincidence detection efficiency for the specified ROI. The `%b-gEff` is given in percent.

%Uncer

This parameter is the 1σ uncertainty of the net area, reported in percentage of net area.

Allow Multiplets

This parameter can have one of two values: `Off` or `On`. When `Allow Multiplets` is `On`, the *rms_analyze* software unit allows multiplets to be used in update matching. When `Allow Multiplets` is `Off`, multiplets are not allowed.

Avg Flow Rate

This field contains the average blower flow rate in scm/h for IMS particulate stations. The average flow rate for noble gas stations is not available in reports at this time. For particulate IMS stations, the average flow rate is equivalent to the `Sample Quantity` divided by the `Sampling Time`. For IMS noble gas stations, this quantity cannot be derived from the sample quantity.

Baseline Channels

This parameter gives the number of channels to the left and right of an ROI that are used in estimating the background contribution under a peak.

Baseline Type

This parameter describes the type of equation used for estimating the shape of the background under a peak. The `Baseline Type` can be either `STEP`, indicating a step-function, or `LINEAR`.

Centroid

Photopeak and ROI centroids are reported in units of channels.

Collection Station Comments

This field contains any comments made by station personnel.

Confidence Threshold

This parameter is a confidence factor used in the nuclide identification process. The lower the `Confidence Threshold`, the more likely a possible peak will be accepted.

Critical Level Test

This parameter can have one of two values: `Off` or `On`. When `Critical Level Test` is `On`, the *rms_analyze* software unit tests whether the gross peak area exceeds 1.64 times the background standard deviation. Peaks that exceed this limit have less than a 10 percent probability of originating from a fluctuation in background radiation.

Detector Type

This field describes the kind of detector used in the acquisition process. Possible detector types include the following:

- `2D b–g`

  This detector type describes a β-γ coincidence detector system that reports only γ-spectra (β-gated, non coincident, and/or total).
- `3D b–g`

  This detector type describes a β-γ coincidence detector system that reports β-γ coincidence histograms. Such systems may also report γ and β-spectra (gated, non coincident, or total).
- `HPGe n`

  This detector type describes an n-type HPGe detector, that is, one with a germanium crystal doped with acceptor atoms at impurity concentration levels.
- `HPGe p`

  This detector type describes a p-type detector, that is, one with a germanium crystal doped with acceptor atoms at impurity concentration levels.
- `InHPGe`

  This detector type describes an intrinsic HPGe detector, that is, one with a germanium crystal of extremely high purity.
- `HPGe`

  This detector type describes an HPGe detector of unknown carrier type.
- `LEGe`

  This detector type describes a low-energy high-purity germanium detector.

Energy Tolerance

The *rms_analyze* software unit will associate a photopeak with a certain nuclide when the peak centroid falls within the `Energy Tolerance` of the photon energy listed in the nuclide library.

Estimate Peak Widths

This parameter can have one of two values: `Off` or `On.` When `Estimate Peak Widths` is `Off`, the *rms_analyze* software unit calculates peak widths with a peak fitting equation. Otherwise, the *rms_analyze* unit uses resolution calibration data to determine peak widths.

Fit Singles

This parameter can have one of two values: `Off` or `On`. When `Fit Singles` is `On`, the *rms_analyze* software unit determines ROI areas using a Gaussian fitting function. When `Fit Singles` is `Off`, the *rms_analyze* software unit determines ROI areas using a simple summation. ROI areas for multiplets are always determined using a Gaussian fit.

Force Linear

This parameter can have one of two values: `Off` or `On`. When `Force Linear` is `On`, the *rms_analyze* software unit uses a linear fit for energy vs. channel regression (ECR). When `Force Linear` is `Off`, the *rms_analyze* software unit uses the type of polynomial that best fits the data for the ECR. The maximum polynomial order is three, that is, a cubic polynomial.

FWHM

This parameter gives the full width at half-max (FWHM) of a photopeak or ROI, that is, the peak width at half the maximum peak height. The `FWHM` is reported in keV.

FWHM Limits

The `Left FWHM limit`, the `Right FWHM limit`, and the `Multiplet FWHM limit` confine the width of an ROI. These parameters are given in units of FWHMs.

Gain Shift

This parameter is the shift in gain used in the iterative process of locating reference (ref) lines during update processing. The `Gain Shift` is given in percent and is used with the `Zero Shift` below in determining the energy step interval used in finding the ref lines from an original estimated value.

K40_LocationDifference

This parameter is the distance between a sample's K-40 photopeak centroid and that of the MRP, which is reported in units of channels. If `Use MRP` is `Off`, then this data quality test is not performed.

Lookup Tol Floor

This parameter is the minimum energy tolerance for matching peaks with nuclides during the update processing.

Minimum Area

Ref lines with net peak areas less than the `Minimum Area` are not used in the update process.

Most Recent Prior Sample

This parameter is the sample ID (SID) of the most recent prior (MRP).

Net Area

The `Net Area` is the total number of counts in an ROI that is not associated with background radiation levels.

NormalizedGainDifference

The gain is determined by dividing the difference in peak energies for the highest and lowest ref lines by the difference in centroid channels for the highest and lowest ref lines. The normalized gain is determined by dividing the gain by the total spectrum gain, that is, the result from dividing the difference in the highest and lowest spectrum energies by the total spectrum channels. The `NormalizedGainDifference` is then the difference between a sample's normalized gain and the normalized gain of the MRP. A small value for the `NormalizedGainDifference` is indicative of a detector system with stable electronics.

Nts

This parameter is a number assigned to an explanatory footnote that is located at the end of the Peak Search results section.

Perform Subtraction

This parameter can have one of two values: `Off` or `On`. When `Perform Subtraction` is `On`, the *rms_analyze* software performs an ROI-by-ROI blank subtraction.

Sample ID

This is a unique number assigned to a PHD message by the IDC. This number is referenced in all data products resulting from the PHD set with that SID.

Sample Quantity

This field describes the total atmospheric air volume sampled (in scm).

Sampling Time

This field is the sample collection duration and is equal to the difference in the `Collection Stop` and `Collection Start` times.

Station Type

This field contains a descriptor of the monitoring station. Some possible station types include:

- `ARIX`

  Noble gas monitoring unit developed at V. G. Khlopin Radium Institute, St. Petersburg, Russia.
- `ARSA`

  Automated Radioxenon Sample/Analyzer unit developed by Pacific Northwest National Laboratory, Richland, Washington, U.S.A. and produced by DME Corp., Orlando, Florida, U.S.A.
- `CINDERELLA`

  Radionuclide aerosol sampler/analyzer unit developed by SENYA, Finland.
- `ISAR`

  International Surveillance of Atmospheric Radionuclides station developed and produced by Pacific-Sierra Research Corp., Arlington, Virginia, U.S.A. in conjunction with the Defense Research Establishment (FOA), Stockholm, Sweden.
- `RASA`

  Radionuclide Aerosol sampler/Analyzer unit developed by Pacific Northwest Laboratory, Richland Washington, U.S.A. and produced by DME Corp., Orlando Florida, U.S.A.
- `SAUNA`

  Noble gas monitoring unit developed and produced by FOA, Stockholm, Sweden.
- `SPALAX`

  Noble gas monitoring unit developed by the Département Analyse et Surveillance de l'Environment (DASE) at the Commissariat à l'Ènergie Atomique (CEA) in France.

More station types will likely be added in the future.

Threshold

When the width of a possible photopeak is greater than the `Threshold` multiplied by the peak centroid standard deviation, the possible peak is accepted and analyzed as a true spectrum line. The `Threshold` can have any value between zero and three, including three.

Use MRP

This parameter can have one of two values: `Yes` or `No`. When `Use MPR` is `Yes`, the *rms_analyze* software unit uses the energy and resolution data from the MRP sample in the update process. The MRP is the sample counted most recently on the detector, originating from the same station as the sample of interest. When `Use MRP` is `No`, the *rms_analyze* software unit uses the energy and resolution pair data of the present sample.

Use Weights

This parameter can have one of two values: `Off` or `On`. When `Use Weights` is `On`, the *rms_analyze* software unit determines calibration regression lines by weighting peaks according to their size and area uncertainty. When `Use Weights` is `Off`, all peaks are weighted equally.

Width

This field contains the total number of channels in which the photopeak or ROI is observed.

Zero Shift

This parameter is the channel shift in the zero point energy point by *rms_analyze* in the iterative process of locating ref lines during update processing. The `Zero Shift` is given in channels and is used with the `Gain Shift` above in determining the energy step interval used in finding the ref lines from an original estimated energy value.

RRR

All sections in the ARR are also found in the RRR, including two additional sections for high-resolution γ-spectrometry data: Spectral-Region-of-Interest Editing and Peak Search Notes. The RRR is a product of the manual review of the automated results by an IDC analyst. The Spectral-Region-Interest Editing section summarizes the number of peaks added, deleted, and modified by the analyst in a high-resolution γ-spectrum. The Peak Search Notes section includes notes written during the automated analysis process.

Examples of RRR are provided in "RRR – Noble Gas Version" on page B33 and "RRR – Particulate Version" on page B35.

SSREB

The Standard Screened Radionuclide Event Bulletin (SSREB) is designated as `DATA_TYPE SSREB`. The SSREB is comprised of the following sections:

- Event Window

  This section summarizes information about the event.
- Regional Source Location

  This section includes a description and map of the event location.
- Event Detection Summary

  This section summarizes the sample characteristics that resulted in the creation of the SSREB.
- Isotopic Ratios

  This section includes any isotopic ratios (for example, $^{134}Cs/^{137}Cs$) from the sample analysis.
- Certified Laboratory Results

  This section includes any sample analysis results performed at a certified radionuclide laboratory.

- Revision

  This section contains information about revisions made, including the user, date, and time

An example of an SSREB is provided in “SSREB” on page B46.

RNPS

The Radionuclide Network Product Summary provides a summary of all the radionuclide network activity over a period of 3 days. This report is produced daily and includes a listing of all of the radionuclide products received at the IDC – ARRs, RRRs, and SSREBs. An example of a RNPS is provided in “RNPS” on page B33.

Chapter 6: Summary Messages

This chapter describes the request message formats and includes the following topics:

- Introduction
- Executive Summary

Chapter 6: Summary Messages

INTRODUCTION

AutoDRM data formats provide a common format for data and data product exchange. The data messages described in this chapter are for summary data products such as the Executive Summary.

Each data message contains the required information for all *AutoDRM* messages. All data messages must contain the BEGIN line and be followed by a MSG_TYPE line and a MSG_ID line using the proper formats for the arguments. The MSG_TYPE for data messages is data. Because a data message may be a response to a request, a REF_ID line may also appear. If the data message is a response to a subscription, then a PROD_ID line will be included. Sections of data-specific information follow the identification line(s).

The data format for summary messages is IMS1.0. The type of data that is included in a data section and the format of the data are designated with a DATA_TYPE line.

DATA_TYPE

Data sections must begin with a DATA_TYPE line. The arguments to DATA_TYPE are the type of data that follows (for example, EXECSUM) and the format (IMS1.0).

Syntax

`data_type` *data_type format*

data_type	type of data that follows; typical examples are EXECSUM, BULLETIN, and RESPONSE
format	general format of the data (IMS1.0)

Example

```
data_type execsum ims1.0
```

The end of a data section is implied by another DATA_TYPE line or a STOP line.

The following sections give the formats for data messages. Examples of these data formats are provided in "Appendix B: Data Message Examples" on page B1.

EXECUTIVE SUMMARY

The Executive Summary contains summary statistics of the number of events in the SEB and those in the various event-screening categories, the number of radionuclide detections and those categorized as Level 4 or Level 5, and the number of events with cross-referenced radionuclide and seismic-acoustic data. It also contains status metrics regarding the IMS network, GCI communications, IDC processing, and Radionuclide Laboratories. It includes the time interval for which the results were requested, the time at which it was generated, and the times at which the latest seismic-acoustic and radionuclide processing were performed. The format is defined in Table 98, and an example is provided in "Execsum" on page B22.

TABLE 98: EXECUTIVE SUMMARY FORMAT

Record	Position	Format	Description
1 (title)	2–22	a21	`Executive Summary for`
	24–33	i4,a1,i2,a1,i2	start date of requested interval (*yyyy*/*mm*/*dd*)
	35–42	i2,a1,i2,a1,i2	start time of requested interval (*hh*:*mm*:*ss*)
	44–45	a2	`to`
	47–56	i4,a1,i2,a1,i2	end date of requested interval (*yyyy*/*mm*/*dd*)
	58–65	i2,a1,i2,a1,i2	end time of requested interval (*hh*:*mm*:*ss*)
2 (time stamp)	2–13	a12	`generated at`
	15–24	i4,a1,i2,a1,i2	date generated (*yyyy*/*mm*/*dd*)
	26–33	i2,a1,i2,a1,i2	time generated (*hh*:*mm*:*ss*)
3	(blank line)		
4 (header)	1–48	a48	`LATEST PROCESSING TIME (for requested interval)`
5 (header)	4–19	a16	`Seismic-Acoustic`
	31–42	a12	`Radionuclide`
6 (time stamps)	1–10	i4,a1,i2,a1,i2	date of latest SHI processing (*yyyy*/*mm*/*dd*)
	12–19	i2,a1,i2,a1,i2	time of latest SHI processing (*hh*:*mm*:*ss*)
	24–33	i4,a1,i2,a1,i2	date of latest RN processing (*yyyy*/*mm*/*dd*)
	35–42	i2,a1,i2,a1,i2	time of latest RN processing (*hh*:*mm*:*ss*)
7	(blank line)		
8 (header)	1–24	a24	`SEISMIC-ACOUSTIC SUMMARY`

TABLE 98: EXECUTIVE SUMMARY FORMAT (CONTINUED)

Record	Position	Format	Description
9 (header)	1–11	a11	`TotalEvents`
	13–22	a10	`Considered`
	24–34	a11	`InsufftData`
	36–46	a11	`NotScreened`
	48–60	a13	`ConflEvidence`
	62–72	a11	`ScreenedOut`
10 (data)	6–11	i6	total number of events in time block
	17–22	i6	number of events in time block that were considered for screening
	29–34	i6	number of events in time block that had insufficient data for screening
	41–46	i6	number of events in time block that were not screened
	55–60	i6	number of events in time block that had conflicting evidence
	67–72	i6	number of events in time block that were screened out
11	(blank line)		
12 (header)	1–20	a20	`RADIONUCLIDE SUMMARY`
13 (header)	1–10	a10	`Detections`
	13–18	a6	`Level4`
	21–26	a6	`Level5`
14 (data)	6–10	i5	total number of radionuclide detections
	14–18	i5	number of Level 4 radionuclide detections
	22–26	i5	number of Level 5 radionuclide detections
15	(blank line)		

TABLE 98: EXECUTIVE SUMMARY FORMAT (CONTINUED)

Record	Position	Format	Description
16 (header)	1–22	a22	`SYSTEMS STATUS SUMMARY`
17 (header)	2–4	a3	`IMS`
	7–9	a3	`GCI`
	12–14	a3	`IDC`
	16–20	a5	`RNLab`
18 (data)	1–4	i4	station capability summary of the IMS
	6–9	i4	network availability of the GCI
	11–14	i4	IDC system performance
	17–20	i4	radionuclide laboratory capability summary
19	(blank line)		
20 (header)	1–24	a24	`IMS STATUS BY TECHNOLOGY`
21 (header)	4–5	a2	`PS`
	9–10	a2	`AS`
	15	a1	`H`
	20	a1	`I`
	24–25	a2	`RN`
22 (data)	2–5	i5	primary seismic (PS) network capability
	7–10	i4	auxiliary seismic (AS) network capability
	12–15	i4	hydroacoustic (H) network capability
	17–20	i4	infrasound (I) network capability
	22–25	i4	radionuclide network capability

Chapter 7: Station AutoDRM Basics

This chapter describes the basic *AutoDRM* capabilities that are needed for auxiliary seismic stations and includes the following topics:

- Introduction
- Basic Message Support
- Environment Lines
- Request Lines
- Data Types
- AutoDRM Implementation Safeguards
- Help Recommendations

Chapter 7: Station AutoDRM Basics

INTRODUCTION

Stations and NDCs providing station data must have a minimum capability to provide data to the IDC through the message system. Clearly, all of the functionality of the request and data messages cannot be supported by these stations to the full extent, and a minimal *AutoDRM* capability is all that is necessary. This chapter describes the minimal *AutoDRM* configuration necessary to fulfill the duties of an auxiliary station supplying data in IMS1.0 format.

BASIC MESSAGE SUPPORT

A station/NDC providing segmented data must adhere to all of the basic message conventions on size, line length, date-time formats, station and channel naming, and use of units. The following sections describe the basic message formats that must be supported.

BEGIN Line

All messages must contain the BEGIN line and must support IMS1.0 format.

MSG_TYPE

The `request` message type must be supported for receiving requests; the `data` message type must be supported for sending data messages.

MSG_ID

The message identification string and optional source in the MSG_ID line must be recognized in request messages, and a unique message identification string must be generated for data messages.

REF_ID

The message identification of the request message must be used as the reference identifier of the returned data message.

E-MAIL Line

Email must be supported as a data return mechanism. FTP is not required.

ENVIRONMENT LINES

Many of the environment lines described in the chapter on Request Messages are not applicable to a limited station capability for *AutoDRM*s. The only variable that must be explicitly specified is TIME. If STA_LIST and CHAN_LIST are not explicitly specified, the default values of all stations and all channels are assumed. The AUX_LIST environment is required only if necessary to distinguish between two different data streams. Using these environments, simple requests can be made that obtain data from a particular station and channel within a specified time interval.

REQUEST LINES

The request lines specify the data that can be obtained from the *AutoDRM*. A simple station *AutoDRM* should be able to provide WAVEFORM, STATION, CHANNEL, RESPONSE, and OUTAGE data.

Request lines may have one or more arguments that specify subtype, formats, and subformats. A simple *AutoDRM* must support the IMS1.0 format as the main format for all requests as well as one of the ASCII subformats (INT, CM6, or AU6) for waveforms.

DATA TYPES

Data messages are sent in response to requests sent to the *AutoDRM*. Thus, WAVEFORM, STATION, CHANNEL, RESPONSE, and radionuclide data types must be supported by a simple *AutoDRM* in the IMS1.0 format.

AUTODRM IMPLEMENTATION SAFEGUARDS

Responding to requests in an automatic system requires safeguards against repeated requests, excessive numbers of requests, excessively large requests, and failures of the email system (for example, returned mail). Although each installation of the *AutoDRM* will be different, some general guidelines are suggested to avoid major problems.

Message Size

Messages returned by email will have a maximum size of 1 MB. Each *AutoDRM* site may set their own limit for the maximum size of an FTP message and may give priority to trusted users as they see fit.

Request Echo

The original request message should be echoed in the returned data message as a LOG data type.

Repeat Requests

Repeated requests for the same data by the same requestor within 10 minutes of the original request may be ignored by an *AutoDRM*.

Returned Messages

An error in the address for a data message sent out by an *AutoDRM* will result in an email returned to the *AutoDRM* by the email system. The sender's name (before the @ character in the mail address) for such an email will be either mailer-daemon or postmaster (with any combination of upper- and lowercase letters). The *AutoDRM* will forward these messages to the local *AutoDRM*-operator; no other action is taken and no response is sent. The *AutoDRM* may also recognize returned messages by the MSG_TYPE, which will be `data`, or by the presence of a REF_ID line, which is not used in request messages.

Syntax Errors

If any syntax error is detected while processing a request message, a ERROR_LOG data message is returned. Also, if a request is made with a keyword that has not been implemented, a ERROR_LOG data message is sent.

A serious syntax error anywhere in a message should abort the entire message, but local policy can override this suggestion.

AutoDRM Internal Problem Logging

Any problem other than a syntax error revealed during processing of a request message should be reported to the *AutoDRM* operator, who should take appropriate action. All request messages must be answered; an ERROR_LOG data message is sent as response for these types of errors.

AutoDRM Operation Logs

All local *AutoDRM* installations should keep logs of incoming and outgoing messages, parameters of MSG_ID lines, volume of data transferred, and Universal Coordinated Times (UTC) of message receipt and dispatch.

HELP RECOMMENDATIONS

The HELP mechanism can be used to convey a variety of information. The following topics can be included in an *AutoDRM* HELP message. At a minimum, every HELP message contains the items shown in **bold**.

Introduction

- information about the local data center
- **email address of local contact** (in case of problems)
- recently added features
- date that the HELP message was last updated

Description of message formats and protocols

- basic message format
- sending and receiving email through *AutoDRM*

Description of commands understood by this *AutoDRM*

- **supported environments**
- **supported data types**
  - **supported subtypes, default subtype**
  - **supported subformats, default subformats**
- local extensions

Local limits

- maximum size of email message
- maximum size of FTP message
- types of requests that will be rejected (for example, sent by root or mailer-daemon)
- repeated identical requests from the same user over a short interval

Local data

- description of what data types are available from what stations/channels
- description of local data archives
  - segmented versus continuous
  - delay in data collection (how soon after real time is data available)
  - time period during which data are available

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[WG195] Working Group 1, *Radionuclide Monitoring*, Ad Hoc Committee on a Nuclear Test Ban, WG1/NTB/224, 1995.

[WGB00] Working Group B, *Updated Draft of the Operational Manual for the International Data Centre (February 2000 Update)*, Preparatory Commission of the Comprehensive Nuclear Test-Ban Treaty Organization, CTBT/WGB/TL-2/45, 2000.

Appendix A: Codes

This appendix contains codes used in *AutoDRM* messages and includes the following topics:

- Country Codes
- Radionuclide Site Codes
- Seismometer Instrument Codes

Appendix A: Codes

COUNTRY CODES

TABLE A-1: COUNTRY CODES[1]

Country	Three-letter Code	Two-letter Code
Afghanistan	AFG	AF
Albania	ALB	AL
Algeria	DZA	DZ
Andorra	AND	AD
Angola	AGO	AO
Antigua and Barbuda	ATG	AG
Argentina	ARG	AR
Armenia	ARM	AM
Australia	AUS	AU
Austria	AUT	AT
Azerbaijan	AZE	AZ
Bahamas	BHS	BS
Bahrain	BHR	BH
Bangladesh	BGD	BD
Barbados	BRB	BB
Belarus	BLR	BY
Belgium	BEL	BE
Belize	BLZ	BZ
Benin	BEN	BJ

TABLE A-1: COUNTRY CODES[1] (CONTINUED)

Country	Three-letter Code	Two-letter Code
Bhutan	BTN	BT
Bolivia	BOL	BO
Bosnia and Herzegovina	BIH	BA
Botswana	BWA	BW
Brazil	BRA	BR
Brunei Darussalam	BRN	BN
Bulgaria	BGR	BG
Burkina Faso	BFA	BF
Burundi	BDI	BI
Cambodia	KHM	KH
Cameroon	CMR	CM
Canada	CAN	CA
Cape Verde	CPV	CV
Central African Republic	CAF	CF
Chad	TCD	TD
Chile	CHL	CL
China	CHN	CN
Columbia	COL	CO
Comoros	COM	KM
Congo	COG	CG
Congo, The Democratic Republic of the	COD	CD
Cook Islands	COK	CK
Costa Rica	CRI	CR
Cote d'Ivoire	CIV	CI
Croatia	HRV	HR

Table A-1: Country Codes[1] (continued)

Country	Three-letter Code	Two-letter Code
Cuba	CUB	CU
Cyprus	CYP	CY
Czech Republic	CZE	CZ
Denmark	DNK	DK
Djibouti	DJI	DJ
Dominica	DMA	DM
Dominican Republic	DOM	DO
Ecuador	ECU	EC
Egypt	EGY	EG
El Salvador	SLV	SV
Equatorial Guinea	GNQ	GQ
Eritrea	ERI	ER
Estonia	EST	EE
Ethiopia	ETH	ET
Fiji	FJI	FJ
Finland	FIN	FI
France	FRA	FR
Gabon	GAB	GA
Gambia	GMB	GM
Georgia	GEO	GE
Germany	DEU	DE
Ghana	GHA	GH
Greece	GRC	GR
Grenada	GRD	GD
Guatemala	GTM	GT

Table A-1: Country Codes[1] (continued)

Country	Three-letter Code	Two-letter Code
Guinea	GIN	GN
Guinea-Bissau	GNB	GW
Guyana	GUY	GY
Haiti	HTI	HT
Holy See	VAT	VA
Honduras	HND	HN
Hungary	HUN	HU
Iceland	ISL	IS
India	IND	IN
Indonesia	IDN	ID
Iran, Islamic Republic of	IRN	IR
Iraq	IRQ	IQ
Ireland	IRL	IE
Israel	ISR	IL
Italy	ITA	IT
Jamaica	JAM	JM
Japan	JPN	JP
Jordan	JOR	JO
Kazakhstan	KAZ	KZ
Kenya	KEN	KE
Kiribati	KIR	KI
Korea, Democratic People's Republic of	PRK	KP
Korea, Republic of	KOR	KR
Kuwait	KWT	KW
Kyrgyzstan	KGZ	KG

Table A-1: Country Codes[1] (continued)

Country	Three-letter Code	Two-letter Code
Lao People's Democratic Republic	LAQ	LA
Latvia	LVA	LV
Lebanon	LBN	LB
Lesotho	LSO	LS
Liberia	LBR	LR
Libyan Arab Jamahiriya	LBY	LY
Liechtenstein	LIE	LI
Lithuania	LTU	LT
Luxembourg	LUX	LU
Macedonia, The Former Yugoslav Republic of	MKD	MK
Madagascar	MDG	MG
Malawi	MWI	MW
Malaysia	MYS	MY
Maldives	MDV	MV
Mali	MLI	ML
Malta	MLT	MT
Marshall Islands	MHL	MH
Mauritania	MRT	MR
Mauritius	MUS	MU
Mexico	MEX	MX
Micronesia, Federated States of	FSM	FM
Moldova	MDA	MD
Monaco	MCO	MC
Mongolia	MNG	MN
Morocco	MAR	MA

TABLE A-1: COUNTRY CODES[1] (CONTINUED)

Country	Three-letter Code	Two-letter Code
Mozambique	MOZ	MZ
Myanmar	MMR	MM
Namibia	NAM	NA
Nauru	NRU	NR
Nepal	NPL	NP
Netherlands	NLD	NL
New Zealand	NZL	NZ
Nicaragua	NIC	NI
Niger	NER	NE
Nigeria	NGA	NG
Niue	NIU	NU
Norway	NOR	NO
Oman	OMN	OM
Pakistan	PAK	PK
Palau	PLW	PW
Panama	PAN	PA
Papua New Guinea	PNG	PG
Paraguay	PRY	PY
Peru	PER	PE
Philippines	PHL	PH
Poland	POL	PL
Portugal	PRT	PT
Qatar	QAT	QA
Romania	ROM	RO
Russian Federation	RUS	RU

TABLE A-1: COUNTRY CODES[1] (CONTINUED)

Country	Three-letter Code	Two-letter Code
Rwanda	RWA	RW
Saint Kitts and Nevis	KNA	KN
Saint Lucia	LCA	LC
Saint Vincent and the Grenadines	VCT	VC
Samoa	WSM	WS
San Marino	SMR	SM
Sao Tome & Principe	STP	ST
Saudi Arabia	SAU	SA
Senegal	SEN	SN
Seychelles	SYC	SC
Sierra Leone	SLE	SL
Singapore	SGP	SG
Slovakia	SVK	SK
Slovenia	SVN	SI
Solomon Islands	SLB	SB
Somalia	SOM	SO
South Africa	ZAF	ZA
Spain	ESP	ES
Sri Lanka	LKA	LK
Sudan	SDN	SD
Suriname	SUR	SR
Swaziland	SWZ	SZ
Sweden	SWE	SE
Switzerland	CHE	CH
Syrian Arab Republic	SYR	SY

TABLE A-1: COUNTRY CODES[1] (CONTINUED)

Country	Three-letter Code	Two-letter Code
Tajikistan	TWN	TJ
Tanzania, United Republic of	TZA	TZ
Thailand	THA	TH
Togo	TGO	TG
Tonga	TON	TO
Trinidad and Tobago	TTO	TT
Tunisia	TUN	TN
Turkey	TUR	TR
Turkmenistan	TKM	TM
Tuvalu	TUV	TV
Uganda	UGA	UG
Ukraine	UKR	UA
United Arab Emirates	ARE	AE
United Kingdom of Great Britain and Northern Ireland	GBR	GB
United States of America	USA	US
Uruguay	URY	UY
Uzbekistan	UZB	UZ
Vanuatu	VUT	VU
Venezuela	VEN	VE
Viet Nam	VNM	VN
Yemen	YEM	YE
Yugoslavia	YUG	YU
Zambia	ZMB	ZM
Zimbabwe	ZWE	ZW

1. [ISO97]

RADIONUCLIDE SITE CODES

Table A-2, Table A-3, and Table A-4 provide the site codes for all particulate stations, tentative noble gas stations, and certified labs, respectively.

TABLE A-2: RADIONUCLIDE PARTICULATE STATION CODES

Station Code	Country	Location
ARP01	Argentina	Buenos Aires
ARP02	Argentina	Salta
ARP03	Argentina	Bariloche
AUP04	Australia	Melbourne, VIC
AUP05	Australia	Mawson, Antarctica
AUP06	Australia	Townsville, QLD
AUP07	Australia	Macquarie Island
AUP08	Australia	Cocos Islands
AUP09	Australia	Darwin, NT
AUP10	Australia	Perth, WA
BRP11	Brazil	Rio de Janeiro
BRP12	Brazil	Recife
CMP13	Cameroon	Douala
CAP14	Canada	Vancouver, B.C.
CAP15	Canada	Resolute, N.W.T.
CAP16	Canada	Yellowknife, N.W.T.
CAP17	Canada	St. John's, N.L.
CLP18	Chile	Punta Arenas
CLP19	Chile	Hanga Roa, Easter Island
CNP20	China	Beijing
CNP21	China	Lanzhou

TABLE A-2: RADIONUCLIDE PARTICULATE STATION CODES (CONTINUED)

Station Code	Country	Location
CNP22	China	Guangzhou
CKP23	Cook Islands	Rarotonga
ECP24	Ecuador	Isla San Cristóbal, Galápagos Islands
ETP25	Ethiopia	Filtu
FJP26	Fiji	Nadi
FRP27	France	Papeete, Tahiti
FRP28	France	Pointe-á-Pitre, Guadeloupe
FRP29	France	Reunion
FRP30	France	Port-aux-Français, Kerguelen
FRP31	France	Cayanne, French Guiana
FRP32	France	Dumont d'Urville, Antarctica
DEP33	Germany	Schauinsland/Freiburg
ISP34	Iceland	Reykjavik
IRP36	Iran, Islamic Republic of	Tehran
JPP37	Japan	Okinawa
JPP38	Japan	Takasaki, Gunma
KIP39	Kiribati	Kiritimati
KWP40	Kuwait	Kuwait City
LYP41	Libya	Misratah
MYP42	Malaysia	Kuala Lumpur
MRP43	Mauritania	Nouakchott
MXP44	Mexico	Baja California
MNP45	Mongolia	Ulaanbaatar
NZP46	New Zealand	Chatham Island
NZP47	New Zealand	Kaitaia

TABLE A-2: RADIONUCLIDE PARTICULATE STATION CODES (CONTINUED)

Station Code	Country	Location
NEP48	Niger	Bilma
NOP49	Norway	Spitsbergen
PAP50	Panama	Panama City
PGP51	Papua New Guinea	New Hanover
PHP52	Philippines	Quezon City
PTP53	Portugal	Ponta Delgada, São Miguel, Azores
RUP54	Russian Federation	Kirov
RUP55	Russian Federation	Norilsk
RUP56	Russian Federation	Peleduy
RUP57	Russian Federation	Bilibino
RUP58	Russian Federation	Ussuriysk
RUP59	Russian Federation	Zalesovo
RUP60	Russian Federation	Petropavlovsk-Kamchatskiy
RUP61	Russian Federation	Dubna
ZAP62	South Africa	Marion Island
SEP63	Sweden	Stockholm
TZP64	Tanzania, United Republic of	Dar es Salaam
THP65	Thailand	Bangkok
GBP66	United Kingdom of Great Britain and Northern Ireland	BIOT/Chagos Archipelago
GBP67	United Kingdom of Great Britain and Northern Ireland	St. Helena
GBP68	United Kingdom of Great Britain and Northern Ireland	Tristan de Cunha
GBP69	United Kingdom of Great Britain and Northern Ireland	Halley, Antarctica

TABLE A-2: RADIONUCLIDE PARTICULATE STATION CODES (CONTINUED)

Station Code	Country	Location
USP70	United States of America	Sacramento, California
USP71	United States of America	Sand Point, Alaska
USP72	United States of America	Melbourne, Florida
USP73	United States of America	Palmer Station, Antarctica
USP74	United States of America	Ashland, Kansas
USP75	United States of America	Charlottesville, Virginia
USP76	United States of America	Salchacket, Alaska
USP77	United States of America	Wake Island
USP78	United States of America	Midway Islands
USP79	United States of America	Oahu, Hawaii
USP80	United States of America	Upi, Guam

TABLE A-3: RADIONUCLIDE CERTIFIED LABORATORY CODES

Laboratory Code	Country or State responsible for Laboratory	Name and Location of Laboratory
ARL01	Argentina	National Board of Nuclear Regulation, Buenos Aires
AUL02	Australia	Australian Radiation Laboratory, Melbourne, VIC
ATL03	Austria	Austrian Research Center, Seibersdorf
BRL04	Brazil	Institute of Radiation Protection and Dosimetry, Rio de Janeiro
CAL05	Canada	Health Canada, Ottawa, Ontario
CNL06	China	Beijing
FIL07	Finland	Centre for Radiation and Nuclear Safety, Helsinki
FRL08	France	Atomic Energy Commission, Montlhéry
ILL09	Israel	Soreq Nuclear Research Centre, Yavne
ITL10	Italy	Laboratory of the National Agency for the Protection of the Environment, Rome
JPP11	Japan	Japan Atomic Energy Research Institute, Tokai, Ibaraki
NZL12	New Zealand	National Radiation Laboratory, Christchurch
RUL13	Russian Federation	Central Radiation Control Laboratory, Ministry of Defense Special Verification Service, Moscow
ZAL14	South Africa	Atomic Energy Corporation, Pelindaba
GBL15	United Kingdom of Great Britain and Northern Ireland	AWE Blacknest, Chilton
USL16	United States of America	McClellan Central Laboratories, Sacramento, California

Table A-4: Radionuclide Noble Gas Station Codes (tentative)[1]

Station Code	Country	Location
ARG01	Argentina	Buenos Aires
AUG04	Australia	Melbourne, VIC
AUG09	Australia	Darwin, NT
BRG11	Brazil	Rio de Janeiro
BRG12	Brazil	Recife
CMG13	Cameroon	Douala
CAG17	Canada	St. John's, N.L.
CLG19	Chile	Hanga Roa, Easter Island
CNG20	China	Beijing
CNG21	China	Lanzhou
CNG22	China	Guangzhou
ETG25	Ethiopia	Filtu
FRG27	France	Papeete, Tahiti
FRG29	France	Réunion
FRG30	France	Port-aux-Français, Kerguelen
FRG32	France	Dumont d'Urville, Antarctica
DEG33	Germany	Freiburg
IRG36	Iran, Islamic Republic of	Tehran
JPG38	Japan	Takasaki, Gunma
KIG39	Kiribati	Kiritimati
KWG40	Kuwait	Kuwait City
MRG43	Mauritania	Nouakchott
MNG45	Mongolia	Ulaanbaatar
NEG48	Niger	Bilma

TABLE A-4: RADIONUCLIDE NOBLE GAS STATION CODES (TENTATIVE)[1] (CONTINUED)

Station Code	Country	Location
NOG49	Norway	Spitsbergen
PAG50	Panama	Panama City
RUG55	Russian Federation	Norilsk
RUG60	Russian Federation	Petropavlovsk-Kamchatskiy
RUG61	Russian Federation	Dubna
ZAG62	South Africa	Marion Island
SEG63	Sweden	Stockholm
THG65	Thailand	Bangkok
GBG66	United Kingdom of Great Britain and Northern Ireland	BIOT/Chagos Archipelago
GBG68	United Kingdom of Great Britain and Northern Ireland	Tristan de Cuhna
USG72	United States of America	Melbourne, Florida
USG73	United States of America	Palmer Station, Antarctica
USG74	United States of America	Ashland, Kansas
USG75	United States of America	Charlottesville, Virginia
USG77	United States of America	Wake Island
USG79	United States of America	Oahu, Hawaii

1. “Tentative 40 Noble Gas Stations Network,” CTBT/PC/V/WGB/TL/95, 1998.

SEISMOMETER INSTRUMENT CODES

Table A-5 lists the instrument codes used for seismometers.

TABLE A-5: IMS S/H/I INSTRUMENT TYPES

Instrument Type	Description
Akashi	Akashi
20171A	Geotech 20171A
23900	Geotech 23900
7505A	Geotech 7505A
8700C	Geotech 8700C
BB-13V	Geotech BB-13V
CMG-3	Guralp CMG-3
CMG-3N	Guralp CMG-3NSN
CMG-3T	Guralp CMG-3T
CMG-3E	Guralp CMG3-ESP
FBA-23	Kinemetrics FBA-23
GS-13	Geotech GS-13
GS-21	Geotech GS-21
HM-500	HM-500
KS3600	Geotech KS-36000
KS360i	Geotech KS-36000-I
KS5400	Geotech KS-54000
LE-3D	LE-3D
Mk II	Willmore Mk II
MP-L4C	Mark Products L4C
Oki	Oki
Parus2	Parus-2

TABLE A-5: IMS S/H/I INSTRUMENT TYPES (CONTINUED)

Instrument Type	Description
Podrst	Podrost
S-13	Geotech S-13
S-500	Geotech S-500
S-750	Geotech S-750
STS-1	Streckeisen STS-1
STS-2	Streckeisen STS-2
SDSE-1	SDSE-1
SOSUS	SOSUS
TSJ-1e	TSJ-1e

Appendix B: Data Message Examples

This appendix contains examples of formatted data messages. Some of the examples wrap onto the next line and appear as they would on a computer screen.

Appendix B: Data Message Examples

ALERT_FLOW

```
DATA_TYPE ALERT_FLOW
KWP40 ALERT_FLOW   2001/12/17 11:01:05.15
^G Air flow alarm! Flow = 0.000189 Low limit = 0.100000 Hi limit = 0.320000
```

ALERT_SYSTEM

```
DATA_TYPE ALERT_SYSTEM
JPG38 ALERT_SYSTEM 2000/05/31 21:45:11.23
THE SYSTEM HAS REBOOTED!
```

ALERT_TEMP

```
DATA_TYPE ALERT_TEMP
AUP04 ALERT_TEMP   2001/06/05 00:01:23.54
Temp alarm: Interior Temp: 29 Upper limit: 28 Lower limit: 15
```

ALERT_UPS

```
DATA_TYPE ALERT_UPS
MXP44 ALERT_UPS    2001/12/19 20:36:11.16
UPS AC line power restored!
```

ARR – NOBLE GAS VERSION

```
                    PIDC GENERATED REPORT
                AUTOMATED RADIONUCLIDE REPORT
                     Noble Gas Version

SAMPLE INFORMATION ===========================================================

Station ID:       USG79       Detector ID:      USX99-XY4
Station Type:     ARSA        Detector Type:    3D b-g
Authenticated:    Yes

Station Location: Washington, US
Detector Description: ARSA Detector, Cell 4

Sample ID:        58497       Sample Geometry:  M44
Sample Volume:    10.0 m3     Sample Type:      S

Collect. Start:   02/24/2000 03:00 GMT    Sampling Time:    8 hours
Collect. Stop:    02/24/2000 11:00 GMT    Decay Time:       5.47 hours
Acquisition Start:02/24/2000 04:28 GMT    Acquisition Time: 23.99 hours
Acquisition Stop: 02/25/2000 04:28 GMT    Avg. Flow Rate:   1.25 m3/hour

Comments
--------


MINIMNUM DETECTABLE CONCENTRATION FOR KEY NUCLIDES ===========================

Nuclide     Half-Life   MDA(uBq/m3)
----------  ----------  ----------
PB-214      3.8235 D    0.0
XE-135      9.09 H      1.685022
XE-133      5.245 D     0.486555
None        5.245 D     0.0
XE-131M     11.9 D      0.237127
XE-133M     2.19 D      0.149563


ACTIVITY SUMMARY =============================================================


Nuclide           Half-Life         Activity(uBq/m3)  Activity Error(uBq/m3)
----------------  ----------------  ----------------  --------------------
XE-133            5.245 D           0.606             0.172



ROI RESULTS ==================================================================

ROI NetCounts      %NetError  Efficiency  Nuclide     Critical Lim.
--- ------------   ---------- ----------  ----------  ------------
1   178.97         0.49       0.29        PB-214      111.10
```

```
2   -333.36        -0.31      0.35        XE-135      115.19
3   141.16         0.28       0.36        XE-133      55.29
4   295.36         0.17       0.52        None        0.00
5   -2.25          -16.46     0.52        XE-131M     58.99
6   -2.06          -9.40      0.52        XE-133M     30.18


ROI BOUNDARIES ===============================================================


ROI GammaLow(keV) GammaHigh(keV)    BetaLow(keV) BetaHigh(keV)
--- ------------  ---------------   -----------  ----------------
1   319.00        384.90            8.17         450.00
2   220.00        280.00            8.17         910.00
3   65.00         95.20             8.17         200.00
4   12.00         40.00             8.17         400.00
5   12.00         40.00             90.50        170.20
6   12.00         40.00             171.00       238.40


EVENT SCREENING FLAGS ========================================================
(This section under development.)


CALIBRATION EQUATIONS ========================================================

Energy vs. Channel
------------------
Gamma Energy(channel)= -0.932 + 1.594 * channel
Beta Energy(channel) = -0.932 + 1.594 * channel
```

ARR – PARTICULATE VERSION

```
                           PIDC GENERATED REPORT
                        AUTOMATED RADIONUCLIDE REPORT
                           Particulate Version


SAMPLE INFORMATION ======================================================

Station ID:       DEP33       Detector ID:      DEP33IAR3
Station Type:     RASA        Detector Type:    HPGe p
Authenticated:    NO

Station Location: Schauinsland, Germany
Detector Description: Germany

Sample ID:        0055238           Sample Geometry:  FILTER_PEL
Sample Quantity:  74893.30 m3       Sample Type:      Particulate

Collection Start:       2000/06/23 19:09        Sampling Time:    24.00 hours
Collection Stop:        2000/06/24 19:09        Decay Time:       24.00 hours
```

```
Acquisition Start:      2000/06/25 19:09        Acquisition Time: 23.85 hours
Acquisition Stop:       2000/06/25 19:00        Avg Flow Rate:    445.93 m3/hr

Collection Station Comments:


IDC Analysis General Comments:
Analysis 2000/07/19 09:10:54


ACTIVITY SUMMARY ========================================================

NATURAL RADIOACTIVITY:
Nuclides Identified and not Quantified:

GE-71M, PB-206, BE-7, K-40, NA-22, PB-210, PB-212, TL-208

Nuclides Quantified:

Nuclide   Half-Life     Conc(uBq/m3)     %RelErr Notes
None Found

ACTIVATION-PRODUCT RADIOACTIVITY:

None Found

FISSION-PRODUCT RADIOACTIVITY:

CS-137     30.1206 Y    0.34       12.61


MINIMUM DETECTABLE CONCENTRATION FOR KEY NUCLIDES =======================


Nuclide           Half-Life         MDC(uBq/m3)
CS-134            2.06341 Y         0.17
BA-140            12.752 D          0.96
CE-143            1.37662 D         28.20
CS-136            13.16 D           0.28
CS-137            30.1206 Y         0.21
I-131             8.04 D            0.57
I-133             20.8 H            35.70
MO-99             2.7475 D          10.51
NB-95             34.97 D           0.21
RU-103            39.26 D           0.19
TE-132            3.204 D           1.39
ZR-95             64.02 D           0.35
ZR-97             16.9 H            101.47


PEAK SEARCH RESULTS =====================================================


27 peaks found in spectrum by automated peak search.
```

```
14 peaks associated with nuclides by automated processing.
13 peaks not associated with nuclides by automated processing.
52 percent of peaks were associated with nuclides.

Note: "*" indicates that a peak was a component of a multiplet.

Energy   Centroid   Width  FWHM   %Eff   Net Area   %RelErr  Nuclide  Nts
46.35    88.91      9      1.50   1.44   10067.14   1.63     PB-210
72.66    140.37 *   14     1.49   7.34   2015.30    5.83     TL-208
74.79    144.55 *   14     1.50   7.80   4559.14    3.17     PB-212
74.79    144.55 *   14     1.50   7.80   4559.14    3.17     TL-208
84.60    163.73 *   15     1.65   9.61   3481.14    3.84     TL-208
87.20    168.80 *   15     1.66   10.01  1658.86    6.90     PB-212
87.20    168.80 *   15     1.66   10.01  1658.86    6.90     TL-208
198.26   386.01     12     1.41   10.97  660.50     20.55    GE-71M
238.63   464.98     12     1.68   9.74   3346.55    4.53     PB-212
477.63   932.41     14     1.73   5.94   610066.44  0.13     BE-7
511.00   997.68     14     2.88   5.68   11398.34   1.10     NA-22
511.00   997.68     14     2.88   5.68   11398.34   1.10     TL-208
583.31   1139.10    15     1.97   5.21   1134.37    5.13     TL-208
661.60   1292.22    15     1.67   4.81   367.58     12.61    CS-137
802.96   1568.69    16     2.40   4.27   463.09     10.48    PB-206
911.23   1780.44    13     0.83   3.93   98.17      29.37
1120.11  2188.96    10     1.74   3.41   375.49     10.16
1237.99  2419.51    16     2.25   3.15   232.36     16.61
1274.23  2490.39    19     2.76   3.08   392.08     10.65    NA-22
1377.64  2692.63    16     1.62   2.88   166.97     17.62
1407.96  2751.93    14     3.32   2.82   180.72     20.33
1460.66  2855.00    20     2.35   2.72   3834.15    1.80     K-40
1495.87  2923.86    8      1.29   2.66   49.33      35.48
1508.70  2948.96    13     3.02   2.64   206.32     15.67
1621.26  3169.10    16     1.21   2.45   61.06      31.76
1729.52  3380.82    18     2.19   2.28   235.46     11.73
1764.32  3448.89    18     2.43   2.23   1575.78    2.98
1847.53  3611.64    17     3.04   2.11   316.64     9.12
1929.36  3771.67 *  29     1.35   2.00   54.25      28.84
1936.63  3785.90 *  29     1.35   1.99   51.73      30.40


PROCESSING PARAMETERS ==================================================

Threshold:              3
Peak Start (keV):       42
Peak End (keV):         1990
Left FWHM limit:        2
Right FWHM limit:       2
Multiplet FWHM limit:   4
Fit Singlets:           On
Critical-level Test:    On
Estimate Peak Widths:   On
Baseline Type:          STEP
Baseline Channels:      3
Perform Subtraction:    Off
Energy Tolerance:       0.65
```

```
Confidence Threshold:   0.25


UPDATE PARAMETERS =====================================================


Use MRP:                       Yes
Most Recent Prior sample:      Used
Gain Shift (%):                0.1
Zero Shift (Channels):         0.5
Minimum Area:                  100
Use Weights:                   On
Allow Multiplets:              On
Force Linear:                  Off
Lookup Tol Floor (keV):        0.2
Default RER Intercept:         0.7
Default RER Slope:             0.04
Default ECR Slope:             0
Do RER Update:                 Yes


DATA QUALITY FLAGS ====================================================


Name                      Pass/Fail        Value            Test
FlowRate                  FAIL             445.926          >500
Ba140_MDC                 PASS             0.958            <30
Be7_FWHM                  FAIL             1.7296           <1.7
K40_LocationDifference    FAIL             1.21875          <3*std deviation
NormalizedGainDifference FAIL              0.000492454      <0.0001


CALIBRATION EQUATIONS =================================================


Energy vs. Channel

E(c) = 0.8855 + 0.5113*c

E = energy (keV)
c = channel number

Resolution vs. Energy

FWHM(E) = 0.72 + 0.04356*SQRT(E)

FWHM = Full Width Half Max (keV)
E = energy (keV)

Efficiency vs. Energy

L(E) = ln(1515.0/E)

e(E) = exp { -3.639 + 0.9934*L - 0.5397*L^2
```

```
+ 0.2973*L^3 - 0.02491*L^4 - 0.01246*L^5 }

e = efficiency (counts/gamma)
E = energy (keV)


FIELD OF REGARD ======================================================


Field of Regard images not available for this sample.
This sample does not follow the required 24 hour cycle
```

ARRIVAL:ASSOCIATED

```
DATA_TYPE ARRIVAL:ASSOCIATED IMS1.0
Net       Sta      Dist  EvAz Phase        Date       Time        TRes  Azim AzRes  Slow  SRes Def   SNR       Amp   Per Qual Magni
tude   OrigID Author       ArrID
IDC_SEIS  BBB      1.61  57.1 Pg        1996/08/16 03:41:40.523  -1.1 256.3  17.5  16.2  -2.4 T__  13.4     228.6  0.33 a__ ML
 4.1   769476 IDC_REB   11618399
IDC_SEIS  BBB      1.61  57.1 Lg        1996/08/16 03:42:04.531   1.1 334.7  95.9  18.6 -12.5 T__   8.2     338.6  0.33 a__
       769476 IDC_REB   11618393
IDC_SEIS  DLBC     7.12   1.2 Pn        1996/08/16 03:42:58.584   0.5 166.7 -14.8  16.5   2.8 T__  16.5       1.5  0.33 a__ ML
 4.2   769476 IDC_REB   11618396
IDC_SEIS  DLBC     7.12   1.2 Lg        1996/08/16 03:44:59.808   1.1                         T__                       a__
       769476 IDC_REB   11621022
IDC_SEIS  NEW      9.07 104.6 Pn        1996/08/16 03:43:23.394  -1.3 308.2  13.5   6.6  -7.2 T__   4.2       0.3  0.33 a__ ML
 3.5   769476 IDC_REB   11614783
IDC_SEIS  NEW      9.07 104.6 Lg        1996/08/16 03:46:03.321   2.8 337.6  42.9  12.2 -
19.6 ___    4.1       0.2  0.33 a__              769476 IDC_REB   11614787
IDC_SEIS  YKA     14.05  31.2 Pn        1996/08/16 03:44:30.887  -1.7 222.6  -1.8  12.4  -1.2 T__  11.9       0.5  0.33 a__ ML
 4.5   769476 IDC_REB   11614280
IDC_SEIS  WAKE    58.41 261.4 T         1996/08/16 04:52:31.503 -94.3                         ___   3.1                     m__
       769476 IDC_REB   11614764
IDC_SEIS  HFS     65.16  18.9 P         1996/08/16 03:51:55.581   0.9 343.9   7.9   3.5  -3.0 T__   5.0       1.2  0.55 a__ mb
 4.1   769476 IDC_REB   11614380
                                                                                                                        mbmle
 4.4   769476 IDC_REB   11614380
```

ARRIVAL:AUTOMATIC

```
DATA TYPE ARRIVAL:AUTOMATIC IMS1.0
Net        Sta   BeamID          Date       Time      Phase     Azim  Slow   SNR       Amp   Per   STA   Dur Author      DetID
IDC_SEIS   BBB   BP0.5_4.0    1996/08/16 03:41:40.523 P        256.3  16.2  13.4     228.6  0.33   4.5   0.2 IDC_REB   11618391
IDC_SEIS   BBB   BP0.2_1.0    1996/08/16 03:42:04.531 S        334.7  18.6   8.2     338.6  0.33   9.1   1.2 IDC_REB   11618393
IDC_SEIS   DLBC  BP0.2_2.0    1996/08/16 03:42:58.584 P        166.7  16.5  16.5       1.5  0.33   2.0   0.4 IDC_REB   11618396
IDC_SEIS   DLBC  BP0.4_6.0    1996/08/16 03:44:59.808                                                        IDC_REB   11621022
```

ARRIVAL:GROUPED[1]

```
DATA_TYPE ARRIVAL:GROUPED IMS1.0
Net        Sta  Chan Aux     Date       Time        Phase     Azim  Slow   SNR       Amp   Per Qual   Group C Author       ArrID
IDC_SEIS   BBB   bhz      1996/08/16 03:41:40.523 P        256.3  16.2  13.4     228.6  0.33 a__     5636   IDC_REB   11618395
IDC_SEIS   BBB   bhz      1996/08/16 03:42:04.531 S        334.7  18.6   8.2     338.6  0.33 a__     5636   IDC_REB   11618393
IDC_SEIS   DLBC  bhz      1996/08/16 03:42:58.584 P        166.7  16.5  16.5       1.5  0.33 a__     5636   IDC_REB   11618396
IDC_SEIS   DLBC  bhz      1996/08/16 03:44:59.808 S                                          m__     5636   IDC_REB   11621022
IDC_SEIS   NEW   bhz      1996/08/16 03:43:23.394 P        308.2   6.6   4.2       0.3  0.33 a__     5636   IDC_REB   11614783
IDC_SEIS   NEW   bhz      1996/08/16 03:46:03.321 S        337.6  12.2   4.1       0.2  0.33 a__     5636   IDC_REB   11614787
```

ARRIVAL:REVIEWED[2]

```
DATA_TYPE ARRIVAL:REVIEWED IMS1.0
Net        Sta  Chan  Aux     Date       Time        Phase     Azim  Slow   SNR       Amp   Per Qual Author      ArrID
IDC_SEIS   BBB   bhz     _  1996/08/16 03:41:40.523 P        256.3  16.2  13.4     228.6  0.33 a__ IDC_REB   11618391
IDC_SEIS   BBB   bhz        1996/08/16 03:42:04.531 S        334.7  18.6   8.2     338.6  0.33 a__ IDC_REB   11618393
IDC_SEIS   DLBC  bhz        1996/08/16 03:42:58.584 P        166.7  16.5  16.5       1.5  0.33 a__ IDC_REB   11618396
IDC_SEIS   DLBC  bhz        1996/08/16 03:44:59.808 S                                          m__ IDC_REB   11621022
IDC_SEIS   NEW   bhz        1996/08/16 03:43:23.394 P        308.2   6.6   4.2       0.3  0.33 a__ IDC_REB   11614783
IDC_SEIS   NEW   bhz        1996/08/16 03:46:03.321 S        337.6  12.2   4.1       0.2  0.33 a__ IDC_REB   11614787
```

ARRIVAL:UNASSOCIATED[3]

```
DATA TYPE ARRIVAL:UNASSOCIATED IMS1.0
Net        Sta   BeamID          Date       Time       Phase     Azim  Slow   SNR       Amp   Per    STA   Dur Author    DetID
IDC_SEIS   BBB   BP0.5_4.0    1996/08/16 03:41:40.523 P        256.3  16.2  13.4     228.6  0.33    4.5   0.2 IDC_REB   11618391
IDC_SEIS   BBB   BP0.2_1.0    1996/08/16 03:42:04.531 S        334.7  18.6   8.2     338.6  0.33    9.1   1.2 IDC_REB   11618393
IDC_SEIS   DLBC  BP0.2_2.0    1996/08/16 03:42:58.584 P        166.7  16.5  16.5       1.5  0.33    2.0   0.4 IDC_REB   11618396
IDC_SEIS   DLBC  BP0.4_6.0    1996/08/16 03:44:59.808                                                         IDC_REB   11621022
```

1. ARRIVAL:GROUPED is not supported at the IDC.
2. ARRIVAL:REVIEWED is not supported at the IDC.
3. ARRIVAL:UNASSOCIATED is not supported at the IDC.

AUTH_STATUS[4]

```
DATA_TYPE AUTH_STATUS IMS1.0
Report period from 1994/12/03 00:00:00.0 to 1994/12/04 00:00:00.0
Net       Sta  Chan Aux   Packets_Tested  Packets_Failed
IDC_SEIS  ABC   shz                 8640               3
IDC_SEIS  DEF   bhz                 8640               0
 Failed Packet Intervals
Net       Sta  Chan Aux      Start_Time           End_Time         Comment
IDC_SEIS  ABC   shz      1994/12/03 14:28:40  1994/12/03 14:29:10  Unknown cause
```

BLANKPHD

```
DATA_TYPE BLANKPHD
#Header 3
CAP15 CAP15D007 P SF                FULL
15000000000002
CAP15D007-2000/05/05-14:15:51.0                0                        0
2000/05/07 16:30:25.5
#Comment
This filter is manufactured by ACME Inc., model IL4690, batch 09-51-2330.
#Acquisition
2000/05/05 14:15:51.0 300010.0       300000.0
#g_Energy
4.654E+001       1.870E+002       3.330E-003
8.803E+001       3.532E+002       5.998E-004
1.221E+002       4.892E+002       6.106E-004
1.365E+002       5.469E+002       2.515E-003
1.590E+002       6.370E+002       8.392E-004
3.201E+002       1.282E+003       1.009E-003
3.917E+002       1.568E+003       7.921E-004
5.140E+002       2.057E+003       8.154E-004
6.617E+002       2.647E+003       9.894E-004
8.980E+002       3.592E+003       1.024E-003
1.173E+003       4.693E+003       1.505E-003
1.332E+003       5.330E+003       1.654E-003
1.836E+003       7.343E+003       2.083E-003
#g_Resolution
4.654E+001       4.101E+000       1.930E-003
8.803E+001       4.194E+000       2.966E-004
1.221E+002       4.337E+000       3.136E-004
1.365E+002       4.375E+000       1.397E-003
1.590E+002       4.478E+000       4.393E-004
3.201E+002       5.063E+000       5.462E-004
3.917E+002       5.301E+000       4.140E-004
5.140E+002       5.669E+000       4.233E-004
6.617E+002       6.147E+000       5.225E-004
8.980E+002       6.811E+000       5.229E-004
```

4. AUTH_STATUS is not supported at the IDC.

```
1.173E+003       7.534E+000       7.521E-004
1.332E+003       7.933E+000       8.183E-004
1.836E+003       9.103E+000       9.587E-004
#g_Efficiency
5.954E+001       6.355E-002       3.177E-003
8.803E+001       6.848E-002       3.428E-003
1.221E+002       6.620E-002       3.315E-003
1.659E+002       5.809E-002       3.061E-003
3.917E+002       2.667E-002       1.503E-003
6.617E+002       1.701E-002       8.508E-004
8.980E+002       1.155E-002       6.435E-004
1.173E+003       9.470E-003       4.735E-004
1.333E+003       8.442E-003       4.221E-004
1.836E+003       6.210E-003       3.181E-004
#g_Spectrum
8192  2047
0     0          0          0          0          0
5     0          0          751        968        7712
10    12182      15479      15757      14011      10300
15    7166       4777       3306       2567       2248
...
8170  120        119        115        108        107
8175  138        125        109        108        112
8180  114        121        116        131        109
8185  113        113        100        110        106
8190  129        103        0          0          0
STOP
```

BULLETIN (IMS1.0:SHORT FORMAT)

```
DATA_TYPE BULLETIN IMS1.0:short
Reviewed Event Bulletin (REB) of the CTBO_IDC for August 16, 1996
EVENT 768958  QUEEN CHARLOTTE ISLANDS REGION
    Date       Time       Err   RMS Latitude Longitude  Smaj  Smin  Az  Depth  Err Ndef Nsta Gap  mdist  Mdist Qual   Author
  OrigID
1996/08/16 03:41:12.45   0.88  0.92  51.3300 -
130.3100  16.6   7.7  63   0.0f        23   18 192   1.61  77.98 m i uk IDC_REB     769476

Magnitude  Err Nsta  Author    OrigID
ML     3.8 0.5    7  IDC_REB   769476
mb     4.0 0.2    6  IDC_REB   769476

Sta     Dist  EvAz Phase        Time      TRes  Azim AzRes   Slow   SRes Def   SNR       Amp   Per Qual Magnitude    ArrID
BBB     1.61  57.1 Pg       03:41:40.523  -1.1 256.3  17.5   16.2   -2.4 T__  13.4     228.6  0.33 a__ ML     4.1 11618391
NEW     9.07 104.6 Pn       03:43:23.394  -1.3 308.2  13.5    6.6   -7.2 T__   4.2       0.3  0.33 a__ ML     3.5 11614783
YKA    14.05  31.2 Pn       03:44:30.887  -1.7 222.6  -1.8   12.4   -1.2 T__  11.9       0.5  0.33 a__ ML     4.5 11614280
WAKE   58.41 261.4 T        04:52:31.503 -94.3                           ___   3.1                  m__           11614764
HFS    65.16  18.9 P        03:51:55.581   0.9 343.9   7.9    3.5   -3.0 T__   5.0       1.2  0.55 a__ mb     4.1 11614380
                                                                                                        mbmle  4.4 11614380
```

BULLETIN (IMS1.0:LONG FORMAT)

```
DATA_TYPE BULLETIN IMS1.0:LONG
Standard Event Bulletin of the PIDC from 2000/01/27 00:00:00 to 2000/01/28 00:00:00,  generated 2000/10/18 22:40:39
EVENT 20671795 TIMOR REGION, INDONESIA
   Date       Time        Err   RMS Latitude Longitude  Smaj  Smin  Az Depth   Err Ndef Nsta Gap  mdist Mdist Qual   Author
  OrigID
2000/01/27 18:40:01.63   1.30  0.72  -9.8256  124.3652  45.8  19.9  62   0.0f         8    8 147   8.32 58.98 m i uk PIDC_SEB
20672711

Magnitude  Err Nsta Author      OrigID
ML     4.1 0.3    2 PIDC_SEB  20672711
mb     4.2 0.1    5 PIDC_SEB  20672711
mbmle  4.1 0.1   12 PIDC_SEB  20672711
Ms     3.3 0.0    1 PIDC_SEB  20672711
msmle  3.0 0.1   11 PIDC_SEB  20672711
```

```
Sta     Dist  EvAz Phase         Time      TRes  Azim AzRes   Slow   SRes Def   SNR       Amp   Per Qual Magnitude    ArrID
FITZ    8.32 171.6 Pn       18:42:05.000   1.4   6.4  15.1   10.1   -3.6 T__  36.6       2.8  0.33 a__ ML     4.3 27240961
ASAR   16.51 147.7 Pn       18:43:54.150  -0.6 322.2  -2.7   11.5   -1.3 T__  98.2       0.8  0.33 a__ ML     3.8 27239856
CTA    23.45 118.3 P        18:45:12.314  -0.6  65.6 133.0   13.4    3.3 T__                       m__            27250064
CMAR   37.67 318.2 P        18:47:18.500  -0.3 145.6  -3.1    6.7   -0.3 T__  14.7       4.4  1.11 a__ mb     4.2 27239946
CMAR   37.67 318.2 LR       19:06:20.277  65.3 245.7 109.5   41.9    1.7 ___            35.7 18.13 a__ Ms     3.3 27250623
KSAR   47.13   3.8 P        18:48:36.190   0.6 185.8   2.7    8.7   -0.0 T__   4.2       1.2  0.98 a__ mb     3.7 27239951
MJAR   47.92  15.0 P        18:48:42.204   0.4 194.2   7.9    7.3   -0.1 T__   7.6       3.8  0.59 a__ mb     4.5 27239842
BJT    50.17 351.8 P        18:48:58.040  -0.9  48.3 -121.   11.9    4.3 T__   4.7       1.6  0.38 a__ mb     4.3 27239831
HIA    58.98 356.5 P        18:50:03.123   0.3 163.8 -10.8    6.6   -0.4 T__  13.4       2.2  0.50 a__ mb     4.4 27239832

EVENT SCREENING
Category  Score Dscore Mscore Rscore Hscore Smaj_sc Smin_sc Depth  Sdep  mbms Smbms       Foffsh MinWD Clr
NS/Onsh   -0.72         -0.72   1.26           45.8    19.9   0.0        2.01  0.67         0.00     0   0

HYDROACOUSTIC SCREENING
Sta    Clr   CPS8   SNR7   Noi7   Sta_score
PSUR     n
WK30     n
WK31     n

REGIONAL SCREENING
Sta    PNSMX5 PNSMX7
ASAR
FITZ           -0.57
Net            -0.57

SHORT-PERIOD/LONG-PERIOD ENERGY RATIO
Sta         Ratio
FITZ   1.22281140

FREQUENCY-DEPENDENT PHASE AMPLITUDE BLOCK    1 of   1
Sta   Phase      Amp       SNR       Amp       SNR       Amp       SNR       Amp       SNR
                   2.0 to 4.0          4.0 to 6.0          6.0 to 8.0
FITZ  Pn         6.5      32.9       6.5      63.0       2.9      58.6
FITZ  Pg!        7.7       0.9       4.3       0.7       3.3       1.0
FITZ  Sn!       31.8       0.7      27.3       1.0      19.2       1.5
FITZ  Lg
ASAR  Pn         1.7      34.6       0.6      23.4       0.3       9.7
ASAR  Pg!        1.4       1.0       0.5       1.0       0.3       1.1
ASAR  Sn!        3.1       1.3       1.3       1.0       0.7       1.1
ASAR  Lg!        1.6       0.9       0.4       0.9       0.1       0.8
```

```
SPECTRAL VARIANCE OF THE DETRENDED LOG SPECTRUM
Sta   Phase MinFreq MaxFreq       SpecVar
FITZ  Pn       1.88    9.69      0.057315
ASAR  Pn       1.88    9.69      0.169021

COMPLEXITY
Sta   Phase  Complexity        SNR
CMAR  P          2.6634     8.8246
KSAR  P          3.5322     1.4226
MJAR  P          0.5285     4.6020
BJT   P          1.6471     1.9762
HIA   P          1.1688     5.4644

THIRD MOMENT of FREQUENCY
Sta        TMF
HIA        2.6

TIME FREQUENCY PARAMETERS
Sta     zavpct     zavcep     zavcor
FITZ    0.1296      401.3     401.2

STOP
```

CALIBPHD

```
DATA_TYPE CALIBPHD
#Header 3
CAP16 CAP16D007 P SF FULL
16999999990003
CAP16D007-2001/03/05-11:47:41.0 CAP16D007-2001/01/05-13:29:00.0 0
2001/03/05 14:02:11.0
#Comment
STYPE EFFICIENCY Calibrate
DetectorName N45007
GEOMETRY 57MM_FLTR_ON_DET
#Acquisition
2001/03/05 11:47:41.0 7640.9 7200.0
#g_Energy
4.654E+001       1.870E+002       3.330E-003
8.803E+001       3.532E+002       5.998E-004
1.221E+002       4.892E+002       6.106E-004
1.365E+002       5.469E+002       2.515E-003
1.590E+002       6.370E+002       8.392E-004
3.201E+002       1.282E+003       1.009E-003
3.917E+002       1.568E+003       7.921E-004
5.140E+002       2.057E+003       8.154E-004
6.617E+002       2.647E+003       9.894E-004
8.980E+002       3.592E+003       1.024E-003
1.173E+003       4.693E+003       1.505E-003
1.332E+003       5.330E+003       1.654E-003
1.836E+003       7.343E+003       2.083E-003
#g_Resolution
4.654E+001       4.101E+000       1.930E-003
8.803E+001       4.194E+000       2.966E-004
1.221E+002       4.337E+000       3.136E-004
1.365E+002       4.375E+000       1.397E-003
1.590E+002       4.478E+000       4.393E-004
3.201E+002       5.063E+000       5.462E-004
3.917E+002       5.301E+000       4.140E-004
5.140E+002       5.669E+000       4.233E-004
6.617E+002       6.147E+000       5.225E-004
8.980E+002       6.811E+000       5.229E-004
1.173E+003       7.534E+000       7.521E-004
1.332E+003       7.933E+000       8.183E-004
1.836E+003       9.103E+000       9.587E-004
#g_Efficiency
4.650E+001       2.010E-001       6.038E-003
8.803E+001       1.883E-001       5.667E-003
1.221E+002       1.629E-001       4.896E-003
1.659E+002       1.156E-001       3.475E-003
2.792E+002       8.232E-002       2.477E-003
3.917E+002       5.686E-002       1.708E-003
5.140E+002       3.977E-002       1.195E-003
6.617E+002       3.434E-002       1.031E-003
8.980E+002       2.061E-002       6.214E-004
1.173E+003       1.740E-002       5.227E-004
```

```
1.333E+003       1.569E-002       4.737E-004
1.836E+003       1.023E-002       3.076E-004
#Certificate
9133.4000  2000/07/01 12:30:00.0
Pb-210   22.3000 Y     606.8    5.0     46.520   4.5     0 -9999999 -999999
Cd-109   1.2665 Y      620.8    4.3     88.030   3.72    0 -9999999 -999999
Co-57    271.7700 D    371.8    4.6     122.060  85.5195 0 -9999999 -999999
Ce-139   137.6600 D    466.9    4.2     165.850  79.884  0 -9999999 -999999
Hg-203   46.6000 D     1038.0   4.1     279.190  81.4    0 -9999999 -999999
Sn-113   115.0900 D    649.4    4.0     391.690  64      0 -9999999 -999999
Cs-137   30.3000 Y     408.5    4.4     661.660  89.92   0 -9999999 -999999
Y-88     106.6100 D    1636.0   4.1     898.060  94      0 -9999999 -999999
Co-60    5.2710 Y      807.3    4.1     1173.240 99.9    0 -9999999 -999999
Co-60    5.2710 Y      812.9    4.4     1332.500 99.98   0 -9999999 -999999
Y-88     106.6100 D    1715.0   4.1     1836.080 99.36   0 -9999999 -999999
#Calibration
2001/02/05 09:26:58.0
#g_Spectrum
8192  2047
0     0          1          0          1          1
5     2          1          3          27         257
10    2454       9861       22500      38315      49372
15    55879      59168      56474      46757      34302
20    25650      22271      23184      24552      25434
...
8170  120        119        115        108        107
8175  138        125        109        108        112
8180  114        121        116        131        109
8185  113        113        100        110        106
8190  129        103
STOP
```

CHANNEL

```
DATA_TYPE CHANNEL IMS1.0
Net       Sta  Chan Aux   Latitude  Longitude Coord Sys     Elev Depth   Hang  Vang Sample Rate Inst      On Date    Off Date
IDC_SEIS  ARA0  she       69.53490   25.50580 WGS-84       0.403 0.010   90.0  90.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARA0  shn       69.53490   25.50580 WGS-84       0.403 0.011    0.0  90.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARA0  shz       69.53490   25.50580 WGS-84       0.403 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARA1  shz       69.53630   25.50710 WGS-84       0.411 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARA2  shz       69.53380   25.50780 WGS-84       0.392 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARA3  shz       69.53460   25.50190 WGS-84       0.402 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARB1  shz       69.53790   25.50790 WGS-84       0.414 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARB2  shz       69.53570   25.51340 WGS-84       0.397 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARB3  shz       69.53240   25.51060 WGS-84       0.376 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARB4  shz       69.53280   25.49980 WGS-84       0.378 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARB5  shz       69.53630   25.49850 WGS-84       0.405 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
```

CHAN_STATUS

```
DATA_TYPE CHAN_STATUS IMS1.0
Report period from 1994/12/03 00:00:00.0 to 1994/12/04 00:00:00.0
Data Availability Statistics
Net       Sta   Chan Aux    Max_Exp_Time     %_Avail  Gaps     Median        Min          Max
IDC_SEIS  OBN    bhz      000 00:05:00.0     100.000     0  000:00:00.0  000:00:00.0  000:00:00.0
IDC_SEIS  OBN    bhn      000 00:05:00.0      99.034     6  000:00:10.0  000:00:00.0  000:00:24.0
IDC_SEIS  OBN    bhe      000 00:05:00.0     100.000     0  000:00:00.0  000:00:00.0  000:00:00.0
IDC_SEIS  ARU    bhz      000 01:23:14.0      99.843     8  000:00:07.0  000:00:00.0  000:00:12.0
IDC_SEIS  ARU    bhn      000 01:23:14.0      99.843    12  000:00:10.0  000:00:00.0  000:00:12.0
IDC_SEIS  ARU    bhe      000 01:23:14.0      99.843    12  000:00:10.0  000:00:00.0  000:00:12.0

Data Timeliness Statistics
Net       Sta   Chan Aux    Max_Exp_Time   Delay_Med       Mean       Std_Dev        Min          Max
IDC_SEIS  OBN    bhz      000 00:05:00.0 000:00:00.0 000:00:00.0 000:00:00.0 000:00:00.0 000:00:00.0
IDC_SEIS  OBN    bhn      000 00:05:00.0 000:00:00.0 000:00:00.0 000:00:00.0 000:00:00.0 000:00:00.0
IDC_SEIS  OBN    bhe      000 00:05:00.0 000:00:00.0 000:00:00.0 000:00:00.0 000:00:00.0 000:00:00.0

IDC_SEIS  ARU    bhz      000 01:23:14.0 000:46:22.0 000:50:17.0 000:25:50.0 000:44:14.0 000:58:01.0
IDC_SEIS  ARU    bhn      000 01:23:14.0 000:46:27.0 000:50:21.0 000:25:55.0 000:44:16.0 000:58:05.0
IDC_SEIS  ARU    bhe      000 01:23:14.0 000:45:53.0 000:49:39.0 000:26:28.0 000:43:45.0 000:57:39.0
```

COMMENT[5]

```
DATA_TYPE COMMENT IMS1.0

  Almost anything may be typed into the space between the
  DATA_TYPE line and the STOP line.  No association was
  desired for this comment, so the association line was
  left blank.  Note that this comment is indented so that
  the DATA_TYPE in the second line of this paragraph is
  not interpreted as a command line.
DATA_TYPE COMMENT IMS1.0
Event      7687234
  The referenced event was felt over a wide area (300 square
  kilometers) near the epicenter.
```

COMM_STATUS[6]

```
DATA_TYPE COMM_STATUS IMS1.0
Report period from 1994/12/03 00:00:00.0 to 1994/12/04 00:00:00.0
Link               Nom_kbps  Mode  %_Up   From    Util   From    Util
AUS_NDC  - CTBO_IDC     56.0  full  88.4  AUS_NDC  0.50  CTBO_IDC  0.08
NOR_NDC  - CTBO_IDC    128.0  full  99.2  NOR_NDC  0.77  CTBO_IDC  0.10
USA_NDC  - CTBO_IDC   1000.0  full 100.0  USA_NDC  0.25  CTBO_IDC  0.25

AUS_NDC  - CTBO_IDC  link outages
         From                Through             Duration
1994/12/02 20:23:14.0  1994/12/03 00:48:28.0  000 00:25:14.0
1994/12/03 02:34:31.0  1994/12/03 02:49:39.0  000 00:15:08.0
1994/12/03 19:02:27.0  1994/12/03 19:12:29.0  000 00:10:02.0

NOR_NDC  - CTBO_IDC  link outages
         From                Through             Duration
1994/12/03 04:34:31.0  1994/12/03 06:35:39.0  000 00:45:13.0
```

DETBKPHD

```
DATA_TYPE DETBKPHD
#Header  3
USP70 USP70USC1 P   ontop           FULL
0
USP70USC1-2000/11/14-14:30:00.0        0                        0
2000/11/15 23:45:21.1
#Comment
B. Hosticka - Det E Covered
#Acquisition
```

5. COMMENT is not supported at the IDC.
6. COMM_STATUS is not suported at the IDC.

```
2000/11/14 14:30.00.0 86505.9        86400.0
#g_Energy
88.031998         182.146408       0.000587
122.063004        251.662811       0.000956
159.000000        326.842712       0.001123
391.687988        803.116638       0.002128
513.989990        1053.270996      0.002370
661.648987        1355.394165      0.002442
898.020996        1838.968018      0.003699
1173.215942       2402.180908      0.003237
1332.485962       2728.213623      0.003440
1836.010010       3759.856934      0.005185
#g_Resolution
88.031998         1.093642         0.000421
122.063004        1.025736         0.000643
159.000000        1.207469         0.000915
391.687988        1.174246         0.001481
513.989990        1.421895         0.001503
661.648987        1.397918         0.001675
898.020996        1.495379         0.002426
1173.215942       1.696683         0.002198
1332.485962       1.653738         0.002209
1836.010010       1.830409         0.004532
#g_Efficiency
88.031998         0.051083         0.002145
122.063004        0.057258         0.002024
159.000000        0.053273         0.002327
391.687988        0.021048         0.000887
513.989990        0.015954         0.000941
661.648987        0.012693         0.000449
898.020996        0.008559         0.000321
1173.215942       0.006468         0.000231
1332.485962       0.005683         0.000204
1836.010010       0.004116         0.000144
#g_Spectrum
4096  2000
0     0          4          67         55         5
5     11         2          2          436        569
10    512        524        516        464        464
15    459        486        438        430        434
20    403        441        404        404        384
...
4075  2          1          4          4          7
4080  4          1          3          7          2
4085  1          4          3          5          2
4090  6          3          4          2          2
4095  2          0          0          0          0
STOP
```

ERROR_LOG

The following example shows how the `error log` section is used to identify that the request message line in a request failed.

```
data_type error_log IMS1.0
 An error was detected in the
 following request  message:
   begin IMS1.0
   msg_type request
   msg_id 1040 any_ndc
   time 94/03/01 to 94/03/02
   *** unrecognized time format ***
   sta_list ARA0
   waveform
   stop
```

EVENT

```
DATA_TYPE EVENT IMS1.0:short
Reviewed Event Bulletin (REB) of the CTBO_IDC for August 16, 1996
Event 768958   QUEEN CHARLOTTE ISLANDS REGION
   Date       Time        Err   RMS Latitude Longitude  Smaj  Smin  Az  Depth   Err Ndef Nsta Gap  mdist  Mdist Qual   Author
  OrigID
1996/08/16 03:41:12.45   0.88  0.92  51.3310 -130.3125  16.6   7.7  63   0.0f        23   18 192   1.61  77.98 m i uk IDC_REB
  769476

Magnitude  Err Nsta Author      OrigID
ML     3.8 0.5    7 IDC_REB     769476
mb     4.0 0.2    6 IDC_REB     769476
```

EXECSUM

```
DATA_TYPE EXECSUM IMS1.0
 Executive Summary for 2000/05/21 00:00:00 to 2000/05/22 00:00:00
 generated at 2000/07/07 19:48:36

LATEST PROCESSING TIME (for requested interval)
   Seismic-Acoustic           Radionuclide
2000/05/25 23:47:50

SEISMIC-ACOUSTIC SUMMARY
TotalEvents Considered InsufftData NotScreened ConflEvidence ScreenedOut
         50         39          39           0              0           0

RADIONUCLIDE SUMMARY
Detections  Level4  Level5
         1       0       0

FUSION SUMMARY
FusedEvents

SYSTEM STATUS SUMMARY
 IMS  GCI  IDC RNLab

IMS STATUS BY TECHNOLOGY
   PS   AS    H    I   RN
```

FTP_LOG

The following example is a data message sent to a requestor of data. It indicates that the data are on machine `pidc.org` in directory `/pub/data` in file `1994001.gz`. The requestor must log into `pidc.org` as a user to obtain the data.

```
data_type ftp_log IMS1.0
ftp_file pidc.org user /pub/data any_ndc 1994001.gz
 The original request could not be satisfied using
 email due to the size of the requested
 information; ftp was used instead. Please
 log into your user account to retrieve the
 data. Data will be removed by 1996/10/23.
```

GASBKPHD

```
DATA_TYPE GASBKPHD
#Header 3
USG72 USG72-BG1 B     M44           FULL
0
USG72-BG1-2001/01/16-23:57:11       0                           0
2001/01/17 07:22:11
#Comment
%Cell: 1
#Acquisition
2001/01/16 23:57:11   26698          26694.00
#g_Energy
11.00            7.50             0.50
31.60            20.40            0.90
81.00            51.40            2.30
241.90           152.40           6.80
295.10           185.70           8.30
351.90           221.40           9.90
#b_Energy
129.00           C 30.90          6.4000
199.00           C 48.10          9.8000
346.00           B 84.40          17.1000
481.00           C 117.80         23.8000
910.00           B 223.70         44.9000
975.00           C 239.70         48.1000
#g_Resolution
31.60            11.9000          0.600000
81.00            12.0000          0.600000
241.90           22.6000          1.100000
250.00           23.5000          0.200000
295.10           29.5000          1.500000
351.90           38.7000          1.900000
#b_Resolution
129.00           26.0000          6.500000
199.00           40.0000          10.000000
```

```
346.00          69.0000         17.100000
481.00          96.0000         24.100000
910.00          182.0000        45.500000
975.00          95.0000         48.800000
#g_Efficiency
31.60           0.570           0.0350
76.30           0.590           0.0380
81.00           0.601           0.0390
241.90          0.450           0.0240
250.00          0.440           0.0240
295.10          0.401           0.0160
351.90          0.371           0.0150
#ROI_Limits
1  8.1700     450.0000   319.0000   384.9000
2  8.1700     910.0000   220.0000   280.0000
3  8.1700     200.0000   65.0000    95.2000
4  8.1700     400.0000   12.0000    40.0000
5  90.5000    170.2000   12.0000    40.0000
6  171.0000   238.4000   12.0000    40.0000
#b-gEfficiency
1        PB-214     0.2880     0.013000
2        XE-135     0.3550     0.024000
3        XE-133     0.3610     0.024000
4        XE-133     0.5230     0.034000
5        XE-131m    0.5230     0.034000
6        XE-133m    0.5230     0.034000
#Ratios
PB214_352:242   1  2  0.514      0.026
PB214_352:80    1  3  0.095      0.005
XE133-1_81:30   3  4  1.994      0.054
XE133-2_81:30   3  5  0.809      0.027
XE133-3_81:30   3  6  0.323      0.014
#g_Spectrum
256   400
0     0          0          7          1417       4749
5     3377       2406       1930       1625       1521
10    1399       1353       1213       1195       1157
15    1237       1344       1249       1334       1335
20    1263       1276       1280       1333       1372
...
230   983        901        885        864        799
235   894        838        728        802        753
240   732        776        743        718        716
245   735        719        648        717        688
250   641        647        716        649        625
255   10623
#b_Spectrum
250   900
0     0          0          0          0          0
5     0          0          0          0          0
10    4          16         9          10         21
15    16         2          32         28         25
20    24         2          23         16         17
...
```

```
225   5          4          3          12         3
230   0          5          0          4          0
235   5          3          3          3          5
240   2          5          4          2          4
245   2          3          1          2          11
#Histogram
255   249   420  1000
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
...
0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
STOP
```

HELP

The following examples use the correct protocols for requesting an *AutoDRM User's Guide* from the message subsystem.

`to:` *[AutoDRM email address]*
`from:` *[your email address]*
`subject:` *[any subject]*
`cc:`
`bcc:`
`Attached:`
[Text as follows: `help`*]*

`to:` *[AutoDRM email address]*
`from:` *[your email address]*
`subject: help`
`cc:`
`bcc:`
`Attached:`

LOG

The following example is a section of a message that is sent to a data requestor or subscriber after *AutoDRM* processes a subscription or request message. The log section precedes the message data section and is used to state that the request command was processed.

```
data_type log IMS1.0
 command waveform processed.
data_type waveform IMS1.0:cm6
...
```

MET

```
DATA_TYPE MET
AUP10
2000/07/18 00:30:08   2000/07/18 00:40:08   12.0  226 3.1   1014.60 88  0.0
2000/07/18 00:40:08   2000/07/18 00:50:08   12.6  242 2.6   1014.90 86  0.0
2000/07/18 00:50:08   2000/07/18 01:00:08   12.6  219 6.7   1015.20 84  0.0
2000/07/18 01:00:08   2000/07/18 01:10:08   13.0  242 5.7   1015.20 77  0.0
2000/07/18 01:10:08   2000/07/18 01:20:08   13.5  242 4.1   1015.30 76  0.0
2000/07/18 01:20:08   2000/07/18 01:30:08   13.6  217 7.7   1015.40 78  0.0
2000/07/18 01:30:08   2000/07/18 01:40:08   13.8  210 4.1   1015.40 72  0.0
2000/07/18 01:40:08   2000/07/18 01:50:08   14.4  219 6.2   1015.40 69  0.0
2000/07/18 01:50:08   2000/07/18 02:00:08   14.7  215 5.1   1015.50 66  0.0
2000/07/18 02:00:08   2000/07/18 02:10:08   13.9  193 8.7   1015.90 71  0.0
2000/07/18 02:10:08   2000/07/18 02:20:08   13.0  211 6.7   1016.10 83  0.0
2000/07/18 02:20:08   2000/07/18 02:30:08   13.3  245 5.1   1016.10 78  0.0
```

NETWORK[7]

```
data_type network IMS1.0
Net       Description
IDC_SEIS  International Data Center Seismic Network
IDC_HYDR  International Data Center Hydroacoustic Network
```

7. NETWORK is not supported at the IDC.

ORIGIN

```
DATA_TYPE ORIGIN IMS1.0

   Date       Time        Err   RMS Latitude Longitude  Smaj  Smin  Az  Depth  Err Ndef Nsta Gap  mdist  Mdist Qual   Author
  OrigID
1996/08/16 03:41:12.45   0.88  0.92  51.3300 -130.3100  16.6   7.7  63   0.0f        23   18 192   1.61  77.98 m i uk IDC_REB
  769476

Magnitude  Err Nsta Author      OrigID
ML     3.8 0.5    7 IDC_REB     769476
mb     4.0 0.2    6 IDC_REB     769476


   Date       Time        Err   RMS Latitude Longitude  Smaj  Smin  Az  Depth  Err Ndef Nsta Gap  mdist  Mdist Qual   Author
  OrigID
1996/08/16 04:35:17.66   2.72  0.29   2.1300  127.8800  55.1  44.2  71   0.0f         9    9 150  22.84  92.33 m i uk IDC_REB
  769435

Magnitude  Err Nsta Author      OrigID
mb     4.1 0.4    7 IDC_REB     769435
```

OUTAGE

```
DATA_TYPE OUTAGE IMS1.0
Report period from 1994/12/24 00:00:00.000 to 1994/12/25 12:00:00.000
NET       Sta  Chan Aux      Start Date Time          End Date Time        Duration Comment
IDC_SEIS  APL  shz       1994/12/24 08:13:05.000 1994/12/24 08:14:10.000     65.000
IDC_SEIS  APL  shn       1994/12/25 10:00:00.000 1994/12/25 10:00:00.030      0.030
```

QCPHD

```
DATA_TYPE QCPHD
#Header 3
NZP46 NZP46_001 P DISC70MMX5MM FULL
46888888880001
NZP46_001-2001/05/31-01:06:48.0 NZP46_001-2001/04/06-01:23:39.0   0
2001/05/31 05:26:12.8
#Comment
FilterMngr.exe Version 2.5.0.0
#g_Energy
46.520      141.409729003906 0.00048424798297
88.030      266.746612548828 0.00059806811623
122.060     369.615020751953 0.00093211198691
165.850     501.975372314453 0.00145047961269
279.190     844.725219726563 0.00383619614877
391.690     1185.25781250000 0.00223208894022
661.660     2002.27099609375 0.00230602500960
898.060     2717.83911132813 0.00369989895262
1173.240    3551.11376953125 0.00316781084985
1332.500    4033.88500976563 0.00347075401805
1836.080    5559.54052734375 0.00719164405018
#g_Resolution
46.520      0.89444857700000 0.00030762100000
88.030      0.95483799600000 0.00040331500000
122.060     0.98785063000000 0.00061278800000
165.850     1.03811930800000 0.00099187100000
279.190     1.15998167300000 0.00268931800000
391.690     1.28633042600000 0.00148149000000
661.660     1.57167277300000 0.00150380400000
898.060     1.79637543800000 0.00252420300000
1173.240    2.09648041100000 0.00205275400000
1332.500    2.22931631900000 0.00212554200000
1836.080    2.78796804500000 0.00461843600000
#g_Efficiency
46.520      0.28057128190994 0.01402896828949
88.030      0.27281355857849 0.01173159107566
122.060     0.24432533979416 0.01124015916139
165.850     0.16471120715141 0.00692037958652
279.190     0.12935109436512 0.00531985564157
391.690     0.09095052629709 0.00364042934962
661.660     0.05444441363215 0.00239639542997
898.060     0.03058835677803 0.00125483574811
1173.240    0.02700990997255 0.00110784615390
1332.500    0.02375824004412 0.00104570167605
1836.080    0.01574143953621 0.00064617028693
#Certificate
9133.4000  2000/07/01 12:30:00.0
Pb-210   22.3000 Y     606.8    5.0     46.520    4.5     0 -9999999 -999999
Cd-109   1.2665 Y      620.8    4.3     88.030    3.72    0 -9999999 -999999
Co-57    271.7700 D    371.8    4.6     122.060   85.5195 0 -9999999 -999999
Ce-139   137.6600 D    466.9    4.2     165.850   79.884  0 -9999999 -999999
Hg-203   46.6000 D     1038.0   4.1     279.190   81.4    0 -9999999 -999999
```

```
Sn-113   115.0900 D    649.4    4.0     391.690  64      0 -9999999 -999999
Cs-137   30.3000 Y     408.5    4.4     661.660  89.92   0 -9999999 -999999
Y-88     106.6100 D    1636.0   4.1     898.060  94      0 -9999999 -999999
Co-60    5.2710 Y      807.3    4.1     1173.240 99.9    0 -9999999 -999999
Co-60    5.2710 Y      812.9    4.4     1332.500 99.98   0 -9999999 -999999
Y-88     106.6100 D    1715.0   4.1     1836.080 99.36   0 -9999999 -999999
#Calibration
2001/01/30 05:04:48.0
#Acquisition
2001/05/31 01:06:48.0 952 941
#g_Spectrum
8192    2700
0       1       1       0       0       2
5       2       0       0       1       1126
10      5448    5981    5240    3611    2709
15      2137    2050    2820    3098    2597
...
8170    0       0       0       0       0
8175    0       0       0       0       0
8180    0       0       0       0       0
8185    0       0       0       1       0
8190    0       0
STOP
```

RESPONSE

```
DATA_TYPE RESPONSE
CAL2 MIAR  BHZ      CMG-3N  4.11000000E+00  16.000   40.00000 1992/09/23 20:00
 (USNSN station at Mount Ida, Arkansas, USA)
PAZ2  1 V  7.29000000E+04   1.000         4   2       CMG-3 (NSN) Acc-Vel (Std)
 -3.14000000E-02  3.14000000E-04
 -1.97000000E-01  1.97000000E-03
 -2.01000000E+02  2.01000000E+00
 -6.97000000E+02  6.97000000E+00
  0.00000000E+00  0.00000000E+00
  0.00000000E+00  0.00000000E+00
 (Theoretical response provided by Guralp Systems, Ltd.)
DIG2  2  4.18000000E+05  5120.00000                  Quanterra QX80
FIR2  3   1.00E+00   16    0.006 C   30          QDP380/900616 stage 1
 -1.11328112e-03 -1.00800209e-03 -1.35286082e-03 -1.73045369e-03 -2.08418001e-03
 -2.38537718e-03 -2.60955630e-03 -2.73352256e-03 -2.73316190e-03 -2.58472445e-03
 -2.26411712e-03 -1.74846814e-03 -1.01403310e-03 -3.51681737e-05  1.23782025e-03
  3.15983174e-03  6.99944980e-03  9.09959897e-03  1.25423642e-02  1.63123012e-02
  2.02632397e-02  2.43172608e-02  2.84051094e-02  3.24604138e-02  3.64142842e-02
  4.01987396e-02  4.37450483e-02  4.69873249e-02  4.98572923e-02  5.22795729e-02
FIR2  4   1.00E+00    2    0.379 C   22          QDP380/900616 stage 2,3,4
  2.88049545e-04  1.55313976e-03  2.98230513e-03  2.51714466e-03 -5.02926821e-04
 -2.81205843e-03 -8.08708369e-04  3.21542984e-03  2.71266000e-03 -2.91550322e-03
 -5.09429071e-03  1.33933034e-03  7.40034366e-03  1.82796526e-03 -8.81958286e-03
 -6.56719319e-03  8.38608573e-03  1.24268681e-02 -5.12978853e-03 -1.84868593e-02
 -1.79236766e-03  2.33604181e-02
(Theoretical response provided by Quanterra, Inc.)
```

RLR

```
DATA_TYPE RLR
#Header
KWP40 FIL07-001 63199709150611
1997/09/29 06:00:00.0 1997/09/30 06:00:00.0
1997/10/29 08:30
1997/11/09 12:00
1997/11/09 16:00
#Objective
The PIDC network detected airborne 137Cs in Kuwait on 21-23 September 1996 at
concentrations that were beyond normal variability.  No 134Cs was found.  The
laboratory studies should give further data to deduce whether the finding is
resuspension of Chernobyl fallout or some other debris.

Before shipment, the filters were cut into four pieces.  The samples were sent
to different laboratories for a more detailed analysis; the Finnish Centre for
Radiation and Nuclear Safety (STUK) received two samples.  As indicated above,
this is the first of these two sections.
#Test
Gamma Spectrometry
Gamma spectrometry was performed to determine the activities and minimum
detectable concentrations (MDCs) of the 137Cs and 134Cs isotopes.  With these
values, the ratios of the isotopes can be compared to ratios expected from the
Chernobyl fallout.

The samples from Kuwait were prepared for gamma spectrometry by compressing
them with a hydraulic press to a cylindrical form of 42 mm in diameter and 4-5
mm in height.  The samples were counted with HPGe detectors of 99.8 % and 40.0
% relative efficiencies.  The blank filter was treated similarly enabling
background peak subtraction.  To reduce MDC of 134Cs for obtaining a low
minimum detectable activity ratio of 134Cs/137Cs, the two compressed samples were
wrapped in thin plastics and placed one on top of the other without a beaker
for a counting period of 3.7 d (99.8 % HPGe).
#Results
Gamma Spectrometry
uBq/m3
Be-7       5800        3             0.0           0.0
K-40       930         8             0.0           0.0
Cs-134     0           0             2.2           0.015
Cs-137     62          5             0.0           0.0
#ResultsDescription
Gamma Spectrometry
The above results show the MDC of different nuclides in Kuwait in September
1996.  The confidence level for the MDCs is approximately 95 % (estimated from
3 times background standard deviation) and the uncertainties are stated as a
percent (1 ().  The ratio shown is that of the MDC of 134Cs to the activity of
137Cs.  Sample self-absorption and true coincidence correction were taken into
account in the analyses of the spectra.

134Cs was not observed when counting on the 100 % detector; however, the MDC
allowed for an estimate of the 134Cs/137Cs ratio.  This ratio corresponds to fuel
burn-up of 6,000 MWd/tUO2. The average burn-up of Chernobyl fuel was 10,000
MWd/tUO2.  Thus, these samples may contain 137Cs that is not explained by the
Chernobyl fallout.  Further conclusions may be drawn through purification of
Cs utilizing methods of radiochemistry.
#Test
Cesium Chemistry
```

```
Detection limit of 134Cs can be improved by radiochemistry.  Separation of Cs
from the compressed filter matrix improves counting geometry and reduces the
amount of disturbing natural nuclides.  The original plan was to separate
137+134Cs with Cs carrier from the sample matrix with AMP precipitation, and, if
necessary, to consider an additional separation of Cs from K using Bi iodide
and hexachloroplatinate precipitations. Separation of radiocesium with AMP was
tested.

Cs carrier (20 mg) was added to the Kuwait sample KW0349B.  The filter was wet
ashed with nitric and hydrochloric acids.  A small undissolved residue was
separated from the solution.  Cs was coprecipitated by adding 1 g of
ammoniummolybdophosphate (AMP) to the solution.  The AMP precipitation was
separated and measured by gamma spectrometer.  The remaining solution was
completely evaporated and the dry residue was also measured.
#Results
Cesium Chemistry
uBq
Be-7       17.7          3             0.0           0
K-40       7.5           7             0.0           0
Cs-134     0.0           0             0.014         0
Cs-137     0.24          5             0.0           0
Be-7       0.0           0             0.0           0
K-40       0.0           0             0.0           0
Cs-134     0.0           0             0.0           0
Cs-137     0.03          13            0.0           0
Be-7       5.7           4             0.0           0
K-40       3.5           7             0.0           0
Cs-134     0.0           0             0.0           0
Cs-137     0.21          7             0.0           0
#ResultsDescription
Cesium Chemistry
The above results show the activity concentration (or MDC) of different
nuclides in Kuwait in September 1996.  The first set are the values for the
original compressed filter, the second set for the AMP, and the third for the
filtrate residue. The AMP was measured in a geometry with diameter 21 mm while
the filtrate was measured as dried evaporation residue in a geometry with
diameter 73 mm, height 22 mm and volume 92 cm3.  The confidence level for the
MDCs is approximately 95 % and the uncertainties are expressed as a percent
(1 s).

Decomposing the filter with an oxidizing mineral acid HNO3 resulted in a clear
liquid.  However, it contained some organic compound which complicated further
separations of Cs.  Only a small fraction of Cs (13 %) was coprecipitated with
AMP (Table 4).  The evaporation residue of the filtrate contained most of the
cesium.  Thus, the detection limit of 134Cs was not improved as compared with
the original result.
#Conclusions
137Cs was detected at the IDC with an activity estimated at 65 mBq/m3. The ratio
of the 134Cs MDC to this activity was approximately 0.15.  No Cs-134 was
observed in the IDC analysis.

137Cs was detected in the gamma spectrometry and cesium separations performed
at the Finnish Centre for Radiation and Nuclear Safety.  The 137Cs activity was
estimated to be 62 ?Bq/m3.  The ratio of the 134Cs MDC to the 137Cs activity was
0.015.  With the extra sensitivity of the gamma spectrometry, it was determined
that the 137Cs existed in a proportion greater than that expected from
Chernobyl fallout.
```

```
Gamma spectrometry in laboratory, using counting times of several days,
improved detection limits considerably as compared to routine procedures in
the CTBT network. Particular emphasis was placed on analysis method and on
nuclide library used by the software.  Coincidence correction and self-
absorption correction were performed to get reliable activity ratios.
Essential reduction of the detection limits in the gamma spectrometry was
possible by purifying the sample.  Separation of Cs from the filter matrix was
applied in the present study to the sample from Kuwait.  The filter material
contained some unknown compound that interfered with the purification
processes.  The separation method has worked well for glass fibre filters used
by STUK (yield 90 %).  The filter matrix should not contain organic or
inorganic compounds that make the laboratory analyses more complicated and the
chemical procedure itself must be well tested in advance for the filter
material used by the sampling station.  The use of autoradiography was not
easy or fruitful in the analyses of the samples.  The Kuwait filters were
compressed, i.e., they consist of bulk material that is difficult to handle.
Glass fibre filters routinely used in the air sampling programme of STUK do
not induce extra blackening.  The filter material must be carefully chosen not
only for particle collection but also for later laboratory analyses.
```

RMSSOH

This is an example of an RMSSOH message from a particulate station equipped only with an air sampler. Sampled air is not heated at the inlet. All sample filters are shipped to a certified lab for analysis.

```
DATA_TYPE RMSSOH
#Header 3
NZP47 NA
2001/05/03 18:36:18.0 2001/05/03 20:36:18.0 2001/05/03 20:45:23.8
#AirSamplerFlow
897.0000   5.00        2000/05/03 18:36:18.0 600
897.0000   5.00        2000/05/03 18:46:18.0 600
891.0000   5.50        2000/05/03 18:56:18.0 600
891.0000   5.00        2000/05/03 19:06:18.0 600
891.0000   5.50        2000/05/03 19:16:18.0 600
897.0000   5.50        2000/05/03 19:26:18.0 600
897.0000   5.50        2000/05/03 19:36:18.0 600
897.0000   5.00        2000/05/03 19:46:18.0 600
892.0000   5.00        2000/05/03 19:56:18.0 600
897.0000   5.00        2000/05/03 20:06:18.0 600
896.0000   5.50        2000/05/03 20:16:18.0 600
891.0000   5.00        2000/05/03 20:26:18.0 600
#EquipStatus
C: 47200005020011   P: 0               A:  0          2000/05/03 18:36:18.0 600
C: 47200005020011   P: 0               A:  0          2000/05/03 18:46:18.0 600
C: 47200005020011   P: 0               A:  0          2000/05/03 18:56:18.0 600
C: 47200005020011   P: 0               A:  0          2000/05/03 19:06:18.0 600
C: 47200005020011   P: 0               A:  0          2000/05/03 19:16:18.0 600
C: 47200005020011   P: 0               A:  0          2000/05/03 19:26:18.0 600
C: 47200005020011   P: 0               A:  0          2000/05/03 19:36:18.0 600
C: 47200005020011   P: 0               A:  0          2000/05/03 19:46:18.0 600
C: 47200005020011   P: 0               A:  0          2000/05/03 19:56:18.0 600
C: 47200005020011   P: 0               A:  0          2000/05/03 20:06:18.0 600
```

```
C: 47200005020011   P: 0               A:  0          2000/05/03 20:16:18.0 600
C: 47200005020011   P: 0               A:  0          2000/05/03 20:26:18.0 600
#PowerSupply
MAIN ON  AUX OFF UPS ON  2000/05/03 18:36:18.0 600
MAIN ON  AUX OFF UPS ON  2000/05/03 18:46:18.0 600
MAIN ON  AUX OFF UPS ON  2000/05/03 18:56:18.0 600
MAIN ON  AUX OFF UPS ON  2000/05/03 19:06:18.0 600
MAIN ON  AUX OFF UPS ON  2000/05/03 19:16:18.0 600
MAIN ON  AUX OFF UPS ON  2000/05/03 19:26:18.0 600
MAIN ON  AUX OFF UPS ON  2000/05/03 19:36:18.0 600
MAIN ON  AUX OFF UPS ON  2000/05/03 19:46:18.0 600
MAIN ON  AUX OFF UPS ON  2000/05/03 19:56:18.0 600
MAIN ON  AUX OFF UPS ON  2000/05/03 20:06:18.0 600
MAIN ON  AUX OFF UPS ON 2000/05/03 20:16:18.0 600
MAIN ON  AUX OFF UPS ON 2000/05/03 20:26:18.0 600
```

RNPS

Product created on Fri May 12 17:18:28 2000 GMT. This product shows the radionuclide products received at the PIDC between 2000/05/08 00:00:00 and 2000/05/10 23:59:59.

```
Station  SID  P/G Cstart(GMT)     Cstop(GMT)      Status   PRODUCTS CTBT Relevant
--------------------------------------------------------------------------------
CA002  53559  P   05/09/00 00:46  05/10/00 02:27  Level 1  A R
CA002  53549  P   05/08/00 01:53  05/09/00 00:44  Level 1  A R
CA002  53535  P   05/07/00 02:06  05/08/00 01:51  Level 1  A R
--------------------------------------------------------------------------------
UK002  53572  P   05/02/00 08:20  05/08/00 08:00           A
--------------------------------------------------------------------------------
US001  53557  P   05/08/00 22:43  05/09/00 21:37  Level 1  A R
US001  53545  P   05/07/00 22:45  05/08/00 22:41  Level 1  A R
--------------------------------------------------------------------------------
USP72 53570   P   05/09/00 12:10  05/10/00 12:10  Level 1  A R
USP72 53556   P   05/08/00 12:10  05/09/00 12:10  Level 1  A R
USP72 53543   P   05/07/00 12:10  05/08/00 12:10  Level 1  A R
--------------------------------------------------------------------------------
Products Legend:
A: ARR
R: RRR
S: SSREB
```

RRR – NOBLE GAS VERSION

```
                              PIDC GENERATED REPORT
                           REVIEWED RADIONUCLIDE REPORT
                              Noble Gas Version

SAMPLE INFORMATION ===========================================================
```

```
Station ID:       USG79       Detector ID:      USG79-XY4
Station Type:     ARSA        Detector Type:    3D b-g
Authenticated:    Yes

Station Location: Washington, US
Detector Description: ARSA Detector, Cell 4

Sample ID:        58497       Sample Geometry:  M44
Sample Volume:    10.0 m3     Sample Type:      S

Collect. Start:   02/24/2000 03:00 GMT    Sampling Time:    8 hours
Collect. Stop:    02/24/2000 11:00 GMT    Decay Time:       5.47 hours
Acquisition Start:02/24/2000 04:28 GMT    Acquisition Time: 23.99 hours
Acquisition Stop: 02/25/2000 04:28 GMT    Avg. Flow Rate:   1.25 m3/hour

Comments
--------


MEASUREMENT CATEGORIZATION ===================================================

Categorization Legend
---------------------
Level 1 Typical Background Rad. Meas.
Level 2 Anomalous Background Rad. Meas.
Level 3 Typical Anthropogenic Rad. Meas.
Level 4 Anomalous Anthropogenic Rad. Meas.
Level 5 Mult. Anomalous Anthropogenic Rad. Meas.

Categorization Summary
----------------------
Nuclide     Category    Categorization Comment
----------  ----------  ------------------------------------------------------
XE-133      4           Not Regularly Measured


MINIMNUM DETECTABLE CONCENTRATION FOR KEY NUCLIDES ===========================

Nuclide     Half-Life         MDA(uBq/m3)
----------  ---------------   ------------------
PB-214      3.8235 D          0.0
XE-135      9.09 H            1.685022
XE-133      5.245 D           0.486555
None        5.245 D           0.0
XE-131M     11.9 D            0.237127
XE-133M     2.19 D            0.149563


ACTIVITY SUMMARY =============================================================

Nuclide           Half-Life         Activity(uBq/m3)  Activity Error(uBq/m3)
----------------  ----------------  ----------------- ---------------------
XE-133            5.245 D           0.606             0.172
```

```
ROI RESULTS ==================================================================

ROI NetCounts      %NetError  Efficiency  Nuclide     Critical Lim.
--- ------------   ---------- ----------  ----------  ------------
1   178.97         0.49       0.29        PB-214      111.10
2   -333.36        -0.31      0.35        XE-135      115.19
3   141.16         0.28       0.36        XE-133      55.29
4   295.36         0.17       0.52        None        0.00
5   -2.25          -16.46     0.52        XE-131M     58.99
6   -2.06          -9.40      0.52        XE-133M     30.18


ROI BOUNDARIES ===============================================================


ROI GammaLow(keV) GammaHigh(keV)    BetaLow(keV) BetaHigh(keV)
--- ------------  ----------------  ----------   ---------------
1   319.00        384.90            8.17         450.00
2   220.00        280.00            8.17         910.00
3   65.00         95.20             8.17         200.00
4   12.00         40.00             8.17         400.00
5   12.00         40.00             90.50        170.20
6   12.00         40.00             171.00       238.40


EVENT SCREENING FLAGS ========================================================
(This section under development.)


CALIBRATION EQUATIONS ========================================================

Energy vs. Channel
------------------
Gamma Energy(channel)= -0.932 + 1.594 * channel
Beta Energy(channel) = -0.932 + 1.594 * channel
```

RRR – PARTICULATE VERSION

```
                           PIDC GENERATED REPORT
                       REVIEWED RADIONUCLIDE REPORT
                           Particulate Version


SAMPLE INFORMATION =======================================================

Station ID:       USP70       Detector ID:      USP70-CA1
Station Type:     RASA        Detector Type:    HPGe
Authenticated:    NO

Station Location: Sacramento, CA
```

```
Detector Description: RASA Detector at Sacramento, CA

Sample ID:         0054569            Sample Geometry:  M4
Sample Quantity:   22546.98 m3        Sample Type:      Particulate


Collection Start:        2000/06/23 19:09  Sampling Time:     24.00 hours
Collection Stop:         2000/06/24 19:09  Decay Time:        24.00 hours
Acquisition Start:       2000/06/25 19:09  Acquisition Time:  23.85 hours
Acquisition Stop:        2000/06/26 19:00  Avg Flow Rate:     939.46 m3/hr

Collection Station Comments:
0000101014 This is a comment.

IDC Analysis General Comments:
mpickeri 2000/07/07 14:58:08
A known feature of this system is that the QC source is not sufficiently
shielded from the detector during sample spectral acquisition.

Analysis 2000/06/27 00:52:22


MEASUREMENT CATEGORIZATION ==============================================

Categorization Legend
---------------------
Level 1 = Typical Background Rad. Meas.
Level 2 = Anomalous Background Rad. Meas.
Level 3 = Typical Anthropogenic Rad. Meas.
Level 4 = Anomalous Anthropogenic Rad. Meas.
Level 5 = Mult. Anomalous Anthropogenic Rad. Meas.

Spectrum Category (1) -- Typical Background Rad. Meas.


ACTIVITY SUMMARY ========================================================

NATURAL RADIOACTIVITY:

Nuclides Identified and not Quantified:

AC-228, BI-212, BI-214, K-40, PA-234M, PB-214, TH-234, TL-208, U-235


Nuclides Quantified:
Nuclide      Half-Life   Conc(uBq/m3)      %RelErr     Notes
BE-7         53.29 D     1.2E+03           6.87
PB-212       10.64 H     6.3E+04           4.80

ACTIVATION-PRODUCT RADIOACTIVITY:

None Found

FISSION-PRODUCT RADIOACTIVITY:
```

```
None Found


MINIMUM DETECTABLE CONCENTRATION FOR KEY NUCLIDES =======================

Nuclide     Half-Life   MDC(uBq/m3)
CS-134      2.06341 Y   4.58
BA-140      12.752 D    21.07
CE-143      1.37662 D   34.41
CS-136      13.16 D     4.78
CS-137      30.1206 Y   5.44
I-131       8.04 D      7.52
I-133       20.8 H      24.78
MO-99       2.7475 D    59.36
NB-95       34.97 D     5.55
RU-103      39.26 D     5.34
TE-132      3.204 D     10.84
ZR-95       64.02 D     8.18
ZR-97       16.9 H      30.11


PEAK SEARCH RESULTS =====================================================

60 peaks found in spectrum by automated peak search.
56 peaks associated with nuclides by automated processing.
4 peaks not associated with nuclides by automated processing.
93 percent of peaks were associated with nuclides.

Note: "*" indicates that a peak was a component of a multiplet.

Energy   Centroid   Width  FWHM   %Eff   Net Area   %RelErr  Nuclide   Nts
74.76    110.73 *   11     1.46   3.58   22914.54    0.86    PB-212
74.76    110.73 *   11     1.46   3.58   22914.54    0.86    PB-214
74.76    110.73 *   11     1.46   3.58   22914.54    0.86    TL-208
77.04    114.09 *   11     1.47   3.72   27881.09    0.75    BI-212
77.04    114.09 *   11     1.47   3.72   27881.09    0.75    BI-214
77.04    114.09 *   11     1.47   3.72   27881.09    0.75    PB-212
77.04    114.09 *   11     1.47   3.72   27881.09    0.75    PB-214
84.73    125.41 *   20     1.54   4.12   4405.66     2.85    TL-208
87.16    128.99 *   20     1.54   4.23   13200.24    1.25    PB-212
87.16    128.99 *   20     1.54   4.23   13200.24    1.25    PB-214
87.16    128.99 *   20     1.54   4.23   13200.24    1.25    TL-208
89.81    132.89 *   20     1.54   4.33   3798.74     3.18    AC-228
89.81    132.89 *   20     1.54   4.33   3798.74     3.18    BI-212
89.81    132.89 *   20     1.54   4.33   3798.74     3.18    PB-212
89.81    132.89 *   20     1.54   4.33   3798.74     3.18    PB-214
89.81    132.89 *   20     1.54   4.33   3798.74     3.18    U-235
92.60    137.00 *   20     1.55   4.43   2597.01     4.51    TH-234
115.12   170.16      9     1.61   4.87   1841.31     7.24    PB-212
185.73   274.15      9     1.47   4.67   2094.36     5.65    U-235
198.47   292.92      7     0.92   4.57   242.66      36.61               1
238.64   352.07     10     1.46   4.25   120895.13   0.30    PB-212
252.55   372.55      9     0.50   4.15   593.39      65.61   TL-208
```

```
277.36   409.10     10     1.49   3.97   5552.93     1.98    TL-208
288.25   425.13     10     1.39   3.90   928.35      8.71    BI-212
295.18   435.34 *   16     1.50   3.86   789.82      8.92    PB-214
300.13   442.63 *   16     1.50   3.83   7483.42     1.56      PB-212
328.04   483.74     10     1.52   3.66   338.90      22.28     AC-228
328.04   483.74     10     1.52   3.66   338.90      22.28     BI-212
351.89   518.85     10     1.62   3.53   1558.13     5.24      PB-214
452.79   667.45     11     1.67   3.08   766.68      8.56      BI-212
477.63   704.02     10     1.58   2.99   7247.73     1.42      BE-7
510.78   752.85     11     1.98   2.87   20687.56    0.76      TL-208
583.19   859.48     11     1.65   2.65   52132.51    0.45      TL-208
609.31   897.94     12     1.69   2.58   2730.32     2.58      BI-214
727.33   1071.75    12     1.69   2.31   11126.43    1.02      AC-228
727.33   1071.75    12     1.69   2.31   11126.43    1.02      BI-212
763.44   1124.93 *  19     1.87   2.23   915.30      5.47      TL-208
767.99   1131.64 *  19     1.87   2.22   359.56      11.13     BI-214
785.51   1157.44    11     1.80   2.19   1661.74     3.45      BI-212
785.51   1157.44    11     1.80   2.19   1661.74     3.45      PB-214
795.09   1171.53     9     2.06   2.17   240.45      17.51     AC-228
860.57   1267.97    12     1.76   2.06   6808.69     1.34      TL-208
893.35   1316.24    19     1.53   2.01   466.86      8.61      BI-212
911.27   1342.64    12     1.84   1.98   1050.00     4.62      AC-228
952.09   1402.75    12     1.78   1.92   241.27      15.76     BI-212
964.86   1421.55 *  17     2.10   1.90   174.72      19.73     AC-228
969.01   1427.67 *  17     2.10   1.85   291.36      13.60     PA-234M
1078.77  1589.31    13     1.72   1.76   663.21      6.22      BI-212
1093.90  1611.59    13     2.05   1.74   776.59      5.75      TL-208
1120.30  1650.47    13     1.97   1.71   996.86      4.65      BI-214
1155.45  1702.24     9     1.53   1.67   79.54       35.68     BI-214
1173.23  1728.42    13     1.93   1.66   2784.04     2.23      CO-60    2
1238.27  1824.20    13     1.97   1.59   405.41      8.99      BI-214
1332.46  1962.91    14     1.99   1.51   3782.85     1.79      CO-60    3
1377.74  2029.60    10     1.98   1.48   231.62      12.98     BI-214
1408.21  2074.46    10     1.22   1.46   138.96      17.41     BI-214
1460.85  2151.99    14     2.10   1.42   5344.84     1.45      K-40
1509.35  2223.41 *  20     2.04   1.39   130.56      17.72     BI-214
1512.90  2228.64 *  20     2.04   1.39   414.25      7.53      BI-212
1592.83  2346.36    11     1.96   1.34   843.69      4.58      TL-208
1620.75  2387.46    14     2.04   1.32   1632.88     2.91      BI-212
1661.10  2446.89    10     1.26   1.30   72.59       27.19     BI-214
1678.73  2472.86    14     0.97   1.30   46.88       35.98              4
1729.96  2548.30    11     2.38   1.27   203.12      13.78     BI-214
1745.05  2570.52     9     0.56   1.26   52.85       14.92              5
1764.54  2599.22    14     2.23   1.26   1184.72     3.54      BI-214
1836.55  2705.27    12     2.26   1.23   143.08      18.84              6
1847.42  2721.27    13     0.96   1.22   83.80       23.03     BI-214
2103.56  3098.49    15     3.39   1.14   2944.00     2.14      TL-208
2118.82  3120.97    15     6.68   1.14   216.70      17.17     BI-214
2204.12  3246.58    15     3.11   1.12   512.37      7.31      BI-214
2447.39  3604.83    12     1.60   1.08   87.74       26.06     BI-214
2614.53  3850.98    16     2.60   1.07   26742.94    0.61      TL-208

SPECTRAL-REGION-OF-INTEREST (SROI) EDITING =============================
```

```
SPECTRAL-REGION-OF-INTEREST (SROI) EDITING =============================

PEAKS ADDED: none

PEAKS DELETED: none

SROIs MODIFIED: none

Nuclide ID Changes:

Average Concentration Differences: none

Nuclides Entering: none

Nuclides Leaving: none


PEAK SEARCH NOTES =====================================================

NOTE 1:
Date Entered: 2000/07/07 14:52:53
Analyst: mpickeri
False peak detection; Type I error in peak processing.

====================================================================

NOTE 2:
Date Entered: 2000/07/07 14:55:18
Analyst: mpickeri
This radionuclide is present in the spectrum but it results from detector
contamination. Therefore, it has been removed from the atmospheric radionuclide
activity summary.

====================================================================

NOTE 3:
Date Entered: 2000/07/07 14:55:18
Analyst: mpickeri
This radionuclide is present in the spectrum but it results from detector
contamination. Therefore, it has been removed from the atmospheric radionuclide
activity summary.

====================================================================

NOTE 4:
Date Entered: 2000/07/07 14:55:53
Analyst: mpickeri
False peak detection; Type I error in peak processing.

====================================================================

NOTE 5:
Date Entered: 2000/07/07 14:56:04
Analyst: mpickeri
```

```
False peak detection; Type I error in peak processing.

====================================================================

NOTE 6:
Date Entered: 2000/07/07 14:57:31
Analyst: mpickeri
This peak may be associated with a known Y-88 line at 1836.06 keV. This
detector system is known to be contaminated with this radionuclide.

====================================================================


PROCESSING PARAMETERS ==================================================

Threshold:              3
Peak Start (keV):       69
Peak End (keV):         2700
Left FWHM limit:        2
Right FWHM limit:       2
Multiplet FWHM limit:   4
Fit Singlets:           On
Critical-level Test:    On
Estimate Peak Widths:   On
Baseline Type:          STEP
Baseline Channels:      3
Perform Subtraction:    Off
Energy Tolerance        0.6
Confidence Threshold    0.25


UPDATE PARAMETERS ======================================================

Use MRP:                        Yes
Most Recent Prior sample:       Used
Gain Shift (%):                 0.1
Zero Shift (Channels):          0.5
Minimum Area:                   100
Use Weights:                    On
Allow Multiplets:               On
Force Linear:                   Off
Lookup Tol Floor (keV):         0.2
Default RER Intercept:          1.5
Default RER Slope:              0.03
Default ECR Slope:              0
Do RER Update:                  Yes

DATA QUALITY FLAGS =====================================================

Name                       Pass/Fail      Value          Test
FlowRate                   PASS           939.458        >500
Ba140_MDC                  PASS           21.072         <30
Be7_FWHM                   PASS           1.57663        <1.7
K40_LocationDifference     PASS           0.0239258      <3*std deviation
```

```
NormalizedGainDifference   PASS           8.34465e-07     <0.0001


EVENT SCREENING FLAGS ===================================================

Activation Products present in this spectrum    No
Only one fission product in spectrum            No
2 or more fission products in spectrum          No
Cs-137 present in spectrum                      No


CALIBRATION EQUATIONS ===================================================

Energy vs. Channel

      E(c) = -0.4302 + 0.679*c

      E = energy (keV)
      c = channel number

Resolution vs. Energy

      FWHM(E) = 0.94 + 0.03138*SQRT(E)
      FWHM = Full Width Half Max (keV)

      E = energy (keV)

Efficiency vs. Energy

L(E) = ln(947.8/E)

      e(E) = exp { -3.95 + 0.7006*L - 0.06308*L^2
      - 0.07802*L^3 + 0.07596*L^4 - 0.02493*L^5 }

      e = efficiency (counts/gamma)
      E = energy (keV)


FIELD OF REGARD ======================================================

http://www.pidc.org/web-gards/FOR/USP70/2000/177
```

SAMPLEPHD – NOBLE GAS VERSION

This is an example of a SAMPLEPHD from a noble gas station that reports 3-D β-γ coincidence data.

```
DATA_TYPE SAMPLEPHD
#Header 3
USG79 USG79-XY3 B CELL3             FULL
792001011718G
USG79-XY3-2001/01/18-07:27:58   0                              USG79-XY3-2001/01/17-23:30:05
2001/01/19 07:30:14
#Comment
%Cell: 3
%TCD_Avg: 66.67
%Pressure_Avg: 186.41
%Trap: B
%GasBkPHD: /arsa/data/count/new/2000011807-G3-1294.pbg
#Collection
2001/01/17 18:00:11   2001/01/18 02:00:11   0.00
#Processing
1.92235  0.12954
-999999  -999999
4
#Acquisition
2001/01/18 07:27:58   86403          86399.00
#Calibration
2000/10/15 12:56:04
#g_Energy
11.00           6.70            0.50
31.60           19.30           0.90
81.00           49.40           2.30
241.90          147.50          6.80
295.10          179.90          8.30
351.90          214.60          9.90
#b_Energy
129.00          C 30.90         0.64000
199.00          C 48.10         0.98000
346.00          B 84.40         1.71000
481.00          C 117.80        2.38000
910.00          B 223.70        4.49000
975.00          C 239.70        4.81000
#g_Resolution
31.60           11.9000         0.600000
81.00           12.0000         0.600000
241.90          22.6000         1.100000
250.00          23.5000         1.200000
295.10          29.5000         1.500000
351.90          38.7000         1.900000
#b_Resolution
129.00          26.0000         0.6500000
199.00          40.0000         1.0000000
```

```
346.00          69.0000         1.7100000
481.00          96.0000         2.4100000
910.00          182.0000        4.5500000
975.00          195.0000        4.8800000
#g_Efficiency
31.60           0.5700          0.0350
76.30           0.5900          0.0380
81.00           0.6010          0.0390
241.90          0.4500          0.0240
250.00          0.4400          0.0240
295.10          0.4010          0.0160
351.90          0.3710          0.0150
#ROI_Limits
 1 8.1700     450.0000   319.0000   384.9000
 2 8.1700     910.0000   220.0000   280.0000
 3 8.1700     200.0000   65.0000    95.2000
 4 8.1700     400.0000   12.0000    40.0000
 5 90.5000    170.2000   12.0000    40.0000
 6 171.0000   238.4000   12.0000    40.0000
#b-gEfficiency
1        PB-214     0.2880     0.013000
2        XE-135     0.3550     0.024000
3        XE-133     0.3610     0.024000
4        XE-133     0.5230     0.034000
5        XE-131m    0.5230     0.034000
6        XE-133m    0.5230     0.034000
#Ratios
PB214_352:242   1  2  0.514      0.026
PB214_352:80    1  3  0.095      0.005
XE133-1_81:30   3  4  2.076      0.203
XE133-2_81:30   3  5  0.841      0.094
XE133-3_81:30   3  6  0.397      0.051
#g_Spectrum
256   400
0     0          2          10         3345       15559
5     10624      7935       6177       5419       4868
10    4621       4234       4283       3963       4287
15    4564       5083       5776       6115       6157
20    5644       5372       5101       4781       4819
...
230   3094       2891       2986       2955       2662
235   2699       2737       2620       2557       2508
240   2485       2468       2427       2304       2267
245   2261       2255       2254       2292       2185
250   2213       2148       2108       2124       2181
255   35594
#b_Spectrum
250   900
0     0          0          0          0          0
5     0          0          0          0          0
10    34         38         60         108        163
15    203        218        267        233        276
20    294        270        256        245        230
...
```

```
225   3          1          3          1          3
230   2          1          1          3          1
235   0          1          4          1          1
240   0          0          1          1          1
245   0          0          2          1          5
#Histogram
255   400   420  900
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
...
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 1 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

SAMPLEPHD – PARTICULATE VERSION

This is an example of a FULL SAMPLEPDH from a particulate station.

```
DATA_TYPE SAMPLEPHD
#Header 3
AUP04 AUP04AUA1 P DISK              FULL
04200102021211
AUP04AUA1-2001/02/04-10:30:45.0 AUP04AUA1-2001/01/05-12:20:00.0 0
2001/02/05 07:45:30.0
#Comment
lh - Detector 1 Ranger (5-JUN-2000)
#Collection
2001/02/02 12:00:45.0 2001/02/03 12:15:16.7 37874.00
#Acquisition
2001/02/04 10:30:45.0 70200.0        70148.9
#g_Energy
88.000000        181.771881       0.000564
122.099998       251.364624       0.000978
158.899994       327.192535       0.001213
```

```
391.700012       803.392273       0.002349
661.700012       1355.032471      0.002398
898.000000       1838.518799      0.003568
1173.199951      2402.143799      0.003347
1332.500000      2728.179688      0.003560
#g_Resolution
88.000000        1.143942         0.000439
122.099998       1.102523         0.000621
158.899994       1.117119         0.000920
391.700012       1.209898         0.001287
661.700012       1.605823         0.001654
898.000000       2.062315         0.002390
1173.199951      2.054602         0.002274
1332.500000      2.180160         0.002831
#g_Efficiency
88.000000        0.086331         0.003467
122.099998       0.097125         0.002967
158.899994       0.087520         0.003611
391.700012       0.048294         0.001698
661.700012       0.032207         0.001096
898.000000       0.022622         0.000752
1173.199951      0.017539         0.000597
1332.500000      0.015828         0.000539
1836.099976      0.012308         0.000351
#g_Spectrum
8192  2797
0     0          0          0          0          0
5     0          0          0          0          0
10    0          0          0          0          0
15    0          0          0          0          2137
20    2756       2782       2748       2692       2770
25    2605       2695       2746       2987       3357
30    3383       3157       2937       2842       3236
35    3747       4070       4125       3562       2826
40    2645       2785       2844       2998       2925
45    2625       2264       2024       1902       1875
...
8145  19         17         23         12         27
8150  18         17         18         12         20
8155  22         11         15         20         14
8160  14         18         14         23         21
8165  11         16         15         19         14
8170  14         12         15         15         18
8175  13        13          21         15         19
8180  21        15          13         25         16
8185  20        18          17         18         20
8190  10        0
```

SSREB

```
                          PIDC GENERATED REPORT
              STANDARD SCREENED RADIONUCLIDE EVENT BULLETIN


Fission Product ID: 358                 Authenticated: NO


EVENT WINDOW ===================================================================
This section is currently under development.


REGIONAL SOURCE LOCATION =======================================================
This section is currently under development.


EVENT DETECTION SUMMARY ========================================================

Station Collect     Stop        SampleID     Name        Categorization Comment
------- ----------  -------     --------     ------      -----------------------
FI001   2000/07/23  08:10:00    60942        CS-137      Not Regularly Measured
FI001   2000/07/23  08:10:00    60942        EU-155      Not Regularly Measured

Activation Products present in this spectrum: No

Only one fission product in spectrum: No

2 or more fission products in spectrum: Yes

Number of days since 2 or more fission products: Never Seen

Cs-137 present in spectrum: Yes

Number of times seen in last 30 days: 2


ISOTOPIC RATIOS ==============================================================
This section is currently under development.


CERTIFIED LABORATORY RESULTS ===================================================
This section is currently under development.


REVISION =======================================================================
Revised by janeman on Fri Aug 04 14:22:43 EDT 2000

This is a revision added to SSREB 358
```

STATION

```
DATA_TYPE STATION IMS1.0
Net       Sta   Type  Latitude  Longitude Coord Sys     Elev   On Date   Off Date
IDC_SEIS  ARCES hfa   69.53490  25.50580 WGS-84       0.403 1987/09/30
IDC_SEIS  ARA0  3C    69.53490  25.50580 WGS-84       0.403 1987/09/30
IDC_SEIS  ARA1  1C    69.53630  25.50710 WGS-84       0.411 1987/09/30
IDC_SEIS  ARA2  1C    69.53380  25.50780 WGS-84       0.392 1987/09/30
IDC_SEIS  ARA3  1C    69.53460  25.50190 WGS-84       0.402 1987/09/30
IDC_SEIS  ARB1  1C    69.53790  25.50790 WGS-84       0.414 1987/09/30
IDC_SEIS  ARB2  1C    69.53570  25.51340 WGS-84       0.397 1987/09/30
IDC_SEIS  ARB3  1C    69.53240  25.51060 WGS-84       0.376 1987/09/30
IDC_SEIS  ARB4  1C    69.53280  25.49980 WGS-84       0.378 1987/09/30
IDC_SEIS  ARB5  1C    69.53630  25.49850 WGS-84       0.400 1987/09/30
IDC_SEIS  ARC1  1C    69.54110  25.50790 WGS-84       0.381 1987/09/30
IDC_SEIS  ARC2  3C    69.53830  25.52290 WGS-84       0.395 1987/09/30
IDC_SEIS  ARC3  1C    69.53290  25.52310 WGS-84       0.376 1987/09/30
IDC_SEIS  ARC4  3C    69.52930  25.51170 WGS-84       0.377 1987/09/30
IDC_SEIS  ARC5  1C    69.53000  25.49820 WGS-84       0.374 1987/09/30
IDC_SEIS  ARC6  1C    69.53410  25.48820 WGS-84       0.395 1987/09/30
IDC_SEIS  ARC7  3C    69.53960  25.49360 WGS-84       0.362 1987/09/30
IDC_SEIS  ARD1  1C    69.54830  25.50930 WGS-84       0.395 1987/09/30
IDC_SEIS  ARD2  1C    69.54520  25.53080 WGS-84       0.366 1987/09/30
```

STA_STATUS

```
DATA_TYPE STA_STATUS IMS1.0
Report period from 1994/12/03 00:00:00.0 to 1994/12/04 00:00:00.0
                          Station Capability
Net       Sta   Ch  Full      Part     Low     Non   Max_Exp_Time   Avail      Med_Delay Att Suc Pnd
IDC_SEIS  ARCES 33 100.000   0.000   0.000   0.000 000 24:00:00.0  98.587 000 00:42:54.0
IDC_SEIS  ABC    3  90.056   5.944   0.000   4.000 000 00:23:35.0  90.089 000 00:55:42.0   3   3   0
IDC_SEIS  DEF    3  80.154  19.846   0.000   0.000 000 24:00:00.0  83.080 000 05:23:36.0
```

WAVEFORM (IMS1.0:CM6 FORMAT)

The following waveform has the channel code `scc`, which indicates that it is a short-period coherent beam. The `eid2` line shows that this waveform is associated with the IDC_REB event `54903285`. The `bea2` line reveals that the beam was formed with an azimuth of 127.6 degrees and slowness of 0.125 degrees/second. The *BeamID* `FICB.Pa` may be used to get more detailed beam information from the `beam` data type.

```
DATA_TYPE WAVEFORM IMS1.0:CM6
WID2 1996/10/15 09:54:00.000 ARCES  scc      CM6     1200   20.000000   2.70e-01  1.0000 S-13   -1.0  0.0
STA2 IDC_SEIS    69.53489   25.50580 WGS-84       0.402 0.009
EID2 54903285 IDC_REB
BEA2 FICB.Pa      127.6  0.125
DAT2
AFkFCUHTkHUHCkRMUK-F4N+2-M1UHkGT6UHkGRUG6kQDDkEPUI7kO0UKLMUFLP6-F2R+AKkFC3OGA+kG65kEABQR
8DQIAFS+BR5UFTkFUG5SFCNH70LF7HP5BkG-AMkG6U
...
CHK2 8439546
```

The following message would be sent if data were not available from station `KAF`, channel `shz` from 15 October 1996 9:56:00.000 through 15 October 1996 9:57:00.000.

```
DATA_TYPE WAVEFORM IMS1.0:CM6
WID2 1996/10/15 09:54:00.000 KAF   shz      CM6     2400   20.000000   2.70e-01  1.0000 S-13    -1.0  0.0
STA2 IDC_SEIS    62.11270   26.30621 WGS-84       0.195 0.014
DAT2
AFkFCUHTkHUHCkRMUK-F4N+2-M1UHkGT6UHkGRUG6kQDDkEPUI7kO0UKLMUFLP6-F2R+AKkFC3OGA+kG65kEABQR
8DQIAFS+BR5UFTkFUG5SFCNH70LF7HP5BkG-AMkG6U
...
CHK2 1439544
OUT2 1996/10/15 09:56:00.000 KAF   shz           60.000
STA2 IDC_SEIS    62.11270   26.30621 WGS-84       0.195 0.014
WID2 1996/10/15 09:57:00.000 KAF   shz      CM6     1200   20.000000   2.70e-01  1.0000 S-13    -1.0  0.0
STA2 IDC_SEIS    62.11270   26.30621 WGS-84       0.195 0.014
DAT2
AFkFCUHTkHUHCkRMUK-F4N+2-M1UHkGT6UHkGRUG6kQDDkEPUI7kO0UKLMUFLP6-FH62R+AKkFC3OGA+kG65kEABQR
8DQIAFS+BR5UFTkFUG5SFCNH70LF7HP5BkG-AMkG6U
...
CHK2 8648264
STOP
```

WAVEFORM (IMS1.0:INT FORMAT)

```
WID2 1994/03/10 12:13:14.800 BLA   shz      INT    32490   40.000000   1.30e-02   2.000 GS-13   -1.0  0.0
STA2 IDC_SEIS    37.21130  -80.42050 WGS-84       0.491 0.009
DAT2
1873 1734 1690 1200 873 340 -290 -478 -1300 -209 -1972 -24 13 25 64 81 102 76 53 23 -10 -80 -132
...
12 15 36 75 53 80 27 6 -17 -32 -95 -73 -43 -4 3 29 46 59 100 125 103 76 52 10 -30
CHK2  4968214
```

Appendix C: Authentication Example

This appendix contains an example of an authenticated request message.

Appendix C: Authentication Example

AUTHENTICATED REQUEST MESSAGE

The following example shows a message requesting data from the Standard Event List 1 (SEL1). The message would be authenticated between the 'BEGIN' and 'STOP' lines. The digital signature is in the section labeled 'Cryptographic Signature'.

```
Received: from oedipus.CSS.GOV (oedipus.CSS.GOV [140.162.3.93])
        by zydeco.CSS.GOV (8.8.8/8.8.8) with ESMTP id KAA10451;
        Fri, 2 Oct 1998 10:37:32 -0400 (EDT)
Received: from cmr.gov (localhost [127.0.0.1])
        by oedipus.CSS.GOV (8.8.8/8.8.8) with ESMTP id KAA20612;
        Fri, 2 Oct 1998 10:37:30 -0400 (EDT)
Sender: pmoore@cmr.gov
Message-ID: <3614E521.707893E2@cmr.gov>
Date: Fri, 02 Oct 1998 10:37:21 -0400
From: "Patrick G. Moore" <pmoore@cmr.gov>
Organization: Center for Monitoring Research
X-Mailer: Mozilla 4.05 [en] (X11; I; SunOS 5.6 sun4m)
MIME-Version: 1.0
To: salzberg@css.gov
Subject: signed request message
Content-Type: multipart/signed; protocol="application/x-pkcs7-signature";
micalg=sha1; boundary="------------msDC7ECA315AB748BC62A6C224"
Content-Length: 3772
X-Mozilla-Status: 8001

This is a cryptographically signed message in MIME format.

--------------msDC7ECA315AB748BC62A6C224
Content-Type: text/plain; charset=us-ascii
Content-Transfer-Encoding: 7bit
```

```
BEGIN IMS1.0
MSG_TYPE REQUEST
MSG_ID Auth_ex GSI_IDC
TIME 1998/01/01 to 1998/01/02
BULL_TYPE SEL1
BULLETIN IMS1.0
STOP
--------------msDC7ECA315AB748BC62A6C224
Content-Type: application/x-pkcs7-signature; name="smime.p7s"
Content-Transfer-Encoding: base64
Content-Disposition: attachment; filename="smime.p7s"
Content-Description: S/MIME Cryptographic Signature
```


```
MIIJMAYJKoZIhvcNAQcCoIIJITCCCR0CAQExCzAJBgUrDgMCGgUAMAsGCSqGSIb3DQEHAaCC
B6wwggQ3MIIDoKADAgECAgQ0YloEMA0GCSqGSIb3DQEBBAUAMGAxCzAJBgNVBAYTAkNBMR4w
HAYDVQQKExVObyBMaWFiaWxpdHkgQWNjZXB0ZWQxMTAvBgNVBAsTKEVudHJ1c3QgRGVtbyBX
ZWIgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkwHhcNOTgxMDAxMTgyMzA2WhcNOTkwNDAxMTgy
MzA2WjCBijELMAkGA1UEBhMCVVMxJzAlBgNVBAoTHkNlbnRlciBmb3IgTW9uaXRvcmluZyBS
ZXNlYXJjaDEdMBsGA1UECxMUU29mdHdhcmUgRGV2ZWxvcG1lbnQxMzAUBgNVBAMTDVBhdHJp
Y2sgTW9vcmUwGwYJKoZIhvcNAQkBFg5wbW9vcmVAY21yLmdvdjBcMA0GCSqGSIb3DQEBAQUA
A0sAMEgCQQDTgv4+uPOreqmgeL2T0VUbbsKqU6X7sJx2IRm68GI35c1+97f68DgWsS+T6IlZ
K4e1Ut7OQJ9JeDzbqhmpQq3NAgMBAAGjggIVMIICETA9BglghkgBhvhCAQMEMBYuY2dpLWNs
aS93ZWJjbGkuZXhlP3R5cGU9cmV2Y2hlY2s/Q1JMPTY/c2VyaWFsPTARBglghkgBhvhCAQEE
BAMCBSAwJQYJYIZIAYb4QgECBBgWFmh0dHA6Ly8yMDQuMTAxLjEyOC41MC8wIAYJYIZIAYb4
QgEHBBMWEWRvY2NsaS9pbmRleC5odG1sMCEGCWCGSAGG+EIBCAQUFhJkb2NjbGkvcG9saWN5
Lmh0bWwwNwYJYIZIAYb4QgENBCoWKFRoaXMgaXMgYSBTL01JTUUtT25seSBjbGllbnQgY2Vy
dGlmaWNhdGUwHwYDVR0jBBgwFoAUkxYpvqwKH9VS8o3Yym0flfhL9EcwHQYDVR0OBBYEFPYj
DVfe+8OlpNxYtK9daBITznPTMAsGA1UdDwQEAwIFoDAaBgNVHRAEEzARgQ8xOTk5MDIwNjAz
MjMwNlowCQYDVR0TBAIwADCBggYDVR0fBHsweTB3oHWgc6RxMG8xCzAJBgNVBAYTAkNBMR4w
HAYDVQQKExVObyBMaWFiaWxpdHkgQWNjZXB0ZWQxMTAvBgNVBAsTKEVudHJ1c3QgRGVtbyBX
ZWIgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkxDTALBgNVBAMTBENSTDYwHwYJKoZIhvZ9B0EA
BBIwEBsKV0VCQ0EgMS4wMQMCBsAwDQYJKoZIhvcNAQEEBQADgYEASgO6n8As0qlp4v7u99ia
A8JUNm9k2Fxp/mmcVaK91G2qNPFkP1dXqj0jJ1BkLQW2eWEcogzgF80odblVLqxoDUeOr4ek
QngYwC2LPtGopcA1c1+Faqtx39RjWd2rAZNpL4pdKeTQ+MrHY1WBAAtT8L6JJvFkDmiX8j55
Lu1DlkYwggNtMIIC1qADAgECAgQ0Yjf/MA0GCSqGSIb3DQEBBAUAMGAxCzAJBgNVBAYTAkNB
MR4wHAYDVQQKExVObyBMaWFiaWxpdHkgQWNjZXB0ZWQxMTAvBgNVBAsTKEVudHJ1c3QgRGVt
byBXZWIgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkwHhcNOTcxMTA2MjEzNDU0WhcNMDIxMTA2
MjEzNDU0WjBgMQswCQYDVQQGEwJDQTEeMBwGA1UEChMVTm8gTGlhYmlsaXR5IEFjY2VwdGVk
MTEwLwYDVQQLEyhFbnRydXN0IERlbW8gV2ViIENlcnRpZmljYXRpb24gQXV0aG9yaXR5MIGd
```

MA0GCSqGSIb3DQEBAQUAA4GLADCBhwKBgQCt0ateoxBrX9dRs59Layn0VVN/qDtqYOADZexB
qm514GkOV1wYj6chu74AjjvNHMMcikhR3cOLBw6edRlzo0FZOIGFtABXPfqcBwjLeMCx6VeI
TMTrVhUvh04M+P/RFkD6eR+T3aKfFH0pNem1aVd1zoywHQ7R0JA5rihShB/u9QIBA6OCATQw
ggEwMB8GA1UdIwQYMBaAFJMWKb6sCh/VUvKN2MptH5X4S/RHMB0GA1UdDgQWBBSTFim+rAof
1VLyjdjKbR+V+Ev0RzALBgNVHQ8EBAMCAQYwGgYDVR0QBBMwEYEPMjAwMjExMDYyMTM0NTRa
MAwGA1UdEwQFMAMBAf8wgYIGA1UdHwR7MHkwd6B1oHOkcTBvMQswCQYDVQQGEwJDQTEeMBwG
A1UEChMVTm8gTGlhYmlsaXR5IEFjY2VwdGVkMTEwLwYDVQQLEyhFbnRydXN0IERlbW8gV2Vi
IENlcnRpZmljYXRpb24gQXV0aG9yaXR5MQ0wCwYDVQQDEwRDUkwxMB8GCSqGSIb2fQdBAAQS
MBAbCldFQkNBIDEuMDEDAgbAMBEGCWCGSAGG+EIBAQQEAwIABzANBgkqhkiG9w0BAQQFAAOB
gQAJHffNpg4CAhG/61jQBkZGoxJRMPYj6jhkncbLztl/EcU96YtZ38FP/SO4V0jtYK21PRi1
LKw/MfOVH+IiehXg58NMKPqXHKO0YY1j4Jy4TTLncFaRh101tPXtegaykQp+FLxkDc9638d+
aG4fm0V3BRe8G1+pLx4mN9eobeexzjGCAUwwggFIAgEBMGgwYDELMAkGA1UEBhMCQ0ExHjAc
BgNVBAoTFU5vIExpYWJpbGl0eSBBY2NlcHRlZDExMC8GA1UECxMoRW50cnVzdCBEZW1vIFdl
YiBDZXJ0aWZpY2F0aW9uIEF1dGhvcml0eQIENGJaBDAJBgUrDgMCGgUAoH0wGAYJKoZIhvcN
AQkDMQsGCSqGSIb3DQEHATAcBgkqhkiG9w0BCQUxDxcNOTgxMDAyMTQzNzIxWjAeBgkqhkiG
9w0BCQ8xETAPMA0GCCqGSIb3DQMCAgEoMCMGCSqGSIb3DQEJBDEWBBT+v88ZXyzZ6HBAABDd
0z7ITN3LkjANBgkqhkiG9w0BAQEFAARAJWfm571r5R24d9jWsmZ8e/qB4yVC39zPHLvhkwoV
Nju0AxQw6eNt8Mp7GpO22vI7Vz/sIAlptsE2unNH1T5wwA==
--------------msDC7ECA315AB748BC62A6C224--

DECODED SIGNATURE BLOCK

This section shows the decoded contents of the signature block for the previous example. The signature block was first converted from its base 64 encoding to the ASN.1 binary representation. Next, the binary representation was parsed with a custom program to identify each ASN.1 field that is contained in the signature block. The X.509 specification determines the ASN.1 fields and their ordering within the certificates and signatures [ISO95].

This signature block in the example contains the signature of the body of the message using one PIDC staff member's secret RSA key, along with a public key in a certificate, which has been signed by the Entrust demo Certificate Authority. To verify this signature, the application must have the PIDC staff member's or the Certificate Authority's certificate in its list of trusted certificates. This block would be almost identical had DSA been used rather than RSA signatures.

```
  0 30 2352: SEQUENCE {
  4 06    9:   OBJECT IDENTIFIER signedData (1 2 840 113549 1 7 2)
 15 A0 2337:   [0] {
 19 30 2333:     SEQUENCE {
 23 02    1:       INTEGER 1
 26 31   11:       SET {
 28 30    9:         SEQUENCE {
 30 06    5:           OBJECT IDENTIFIER sha1 (1 3 14 3 2 26)
 37 05    0:           NULL
           :           }
           :         }
 39 30   11:       SEQUENCE {
 41 06    9:         OBJECT IDENTIFIER data (1 2 840 113549 1 7 1)
           :         }
 52 A0 1964:       [0] {
 56 30 1079:         SEQUENCE {
 60 30  928:           SEQUENCE {
 64 A0    3:             [0] {
 66 02    1:               INTEGER 2
           :               }
 69 02    4:             INTEGER 878860804
 75 30   13:             SEQUENCE {
 77 06    9:               OBJECT IDENTIFIER
           :                 md5withRSAEncryption (1 2 840 113549 1 1 4)
 88 05    0:               NULL
           :               }
 90 30   96:             SEQUENCE {
 92 31   11:               SET {
 94 30    9:                 SEQUENCE {
 96 06    3:                   OBJECT IDENTIFIER countryName (2 5 4 6)
101 13    2:                   PrintableString 'CA'
           :                   }
           :                 }
105 31   30:               SET {
107 30   28:                 SEQUENCE {
109 06    3:                   OBJECT IDENTIFIER organizationName (2 5 4 10)
114 13   21:                   PrintableString 'No Liability Accepted'
           :                   }
           :                 }
```

```
 137 31   49:              SET {
 139 30   47:                SEQUENCE {
 141 06    3:                  OBJECT IDENTIFIER
            :                    organizationalUnitName (2 5 4 11)
 146 13   40:                  PrintableString 'Entrust Demo Web Certification
Authority'
            :                  }
            :                }
            :              }
 188 30   30:            SEQUENCE {
 190 17   13:              UTCTime '981001182306Z'
 205 17   13:              UTCTime '990401182306Z'
            :              }
 220 30  138:            SEQUENCE {
 223 31   11:              SET {
 225 30    9:                SEQUENCE {
 227 06    3:                  OBJECT IDENTIFIER countryName (2 5 4 6)
 232 13    2:                  PrintableString 'US'
            :                  }
            :                }
 236 31   39:              SET {
 238 30   37:                SEQUENCE {
 240 06    3:                  OBJECT IDENTIFIER organizationName (2 5 4 10)
 245 13   30:                  PrintableString 'Center for Monitoring Research'
            :                  }
            :                }
 277 31   29:              SET {
 279 30   27:                SEQUENCE {
 281 06    3:                  OBJECT IDENTIFIER
            :                    organizationalUnitName (2 5 4 11)
 286 13   20:                  PrintableString 'Software Development'
            :                  }
            :                }
 308 31   51:              SET {
 310 30   20:                SEQUENCE {
 312 06    3:                  OBJECT IDENTIFIER commonName (2 5 4 3)
 317 13   13:                  PrintableString 'Patrick Moore'
            :                  }
 332 30   27:                SEQUENCE {
 334 06    9:                  OBJECT IDENTIFIER
```

```
            :                 emailAddress (1 2 840 113549 1 9 1)
345 16    14:               IA5String 'pmoore@cmr.gov'
            :               }
            :             }
            :           }
361 30    92:         SEQUENCE {
363 30    13:           SEQUENCE {
365 06     9:             OBJECT IDENTIFIER
            :               rsaEncryption (1 2 840 113549 1 1 1)
376 05     0:             NULL
            :             }
378 03    75:           BIT STRING 0 unused bits
            :             30 48 02 41 00 D3 82 FE 3E B8 F3 AB 7A A9 A0 78
            :             BD 93 D1 55 1B 6E C2 AA 53 A5 FB B0 9C 76 21 19
            :             BA F0 62 37 E5 CD 7E F7 B7 FA F0 38 16 B1 2F 93
            :             E8 89 59 2B 87 B5 52 DE CE 40 9F 49 78 3C DB AA
            :             19 A9 42 AD CD 02 03 01 00 01
            :           }
455 A3   533:         [3] {
459 30   529:           SEQUENCE {
463 30    61:             SEQUENCE {
465 06     9:               OBJECT IDENTIFIER
            :                 revocation-url (2 16 840 1 113730 1 3)
476 04    48:               OCTET STRING
            :               16 2E 63 67 69 2D 63 6C 69 2F 77 65 62 63 6C 69
            :               2E 65 78 65 3F 74 79 70 65 3D 72 65 76 63 68 65
            :               63 6B 3F 43 52 4C 3D 36 3F 73 65 72 69 61 6C 3D
            :               }
526 30    17:             SEQUENCE {
528 06     9:               OBJECT IDENTIFIER
            :                 cert-type (2 16 840 1 113730 1 1)
539 04     4:               OCTET STRING
            :               03 02 05 20
            :               }
545 30    37:             SEQUENCE {
547 06     9:               OBJECT IDENTIFIER
            :                 base-url (2 16 840 1 113730 1 2)
558 04    24:               OCTET STRING
            :               16 16 68 74 74 70 3A 2F 2F 32 30 34 2E 31 30 31
            :               2E 31 32 38 2E 35 30 2F
```

```
         :                    }
584 30   32:                 SEQUENCE {
586 06    9:                   OBJECT IDENTIFIER
         :                       renewal-url (2 16 840 1 113730 1 7)
597 04   19:                   OCTET STRING
         :                   16 11 64 6F 63 63 6C 69 2F 69 6E 64 65 78 2E 68
         :                   74 6D 6C
         :                   }
618 30   33:                 SEQUENCE {
620 06    9:                   OBJECT IDENTIFIER
         :                       ca-policy-url (2 16 840 1 113730 1 8)
631 04   20:                   OCTET STRING
         :                   16 12 64 6F 63 63 6C 69 2F 70 6F 6C 69 63 79 2E
         :                   68 74 6D 6C
         :                   }
653 30   55:                 SEQUENCE {
655 06    9:                   OBJECT IDENTIFIER
         :                       comment (2 16 840 1 113730 1 13)
666 04   42:                   OCTET STRING
         :                   16 28 54 68 69 73 20 69 73 20 61 20 53 2F 4D 49
         :                   4D 45 2D 4F 6E 6C 79 20 63 6C 69 65 6E 74 20 63
         :                   65 72 74 69 66 69 63 61 74 65
         :                   }
710 30   31:                 SEQUENCE {
712 06    3:                   OBJECT IDENTIFIER
         :                       authorityKeyIdentifier (2 5 29 35)
717 04   24:                   OCTET STRING
         :                   30 16 80 14 93 16 29 BE AC 0A 1F D5 52 F2 8D D8
         :                   CA 6D 1F 95 F8 4B F4 47
         :                   }
743 30   29:                 SEQUENCE {
745 06    3:                   OBJECT IDENTIFIER
         :                       subjectKeyIdentifier (2 5 29 14)
750 04   22:                   OCTET STRING
         :                   04 14 F6 23 0D 57 DE FB C3 A5 A4 DC 58 B4 AF 5D
         :                   68 12 13 CE 73 D3
         :                   }
774 30   11:                 SEQUENCE {
776 06    3:                   OBJECT IDENTIFIER keyUsage (2 5 29 15)
781 04    4:                   OCTET STRING
```

```
           :                03 02 05 A0
           :                }
 787 30   26:              SEQUENCE {
 789 06    3:                OBJECT IDENTIFIER
           :                  privateKeyUsagePeriod (2 5 29 16)
 794 04   19:                OCTET STRING
           :                30 11 81 0F 31 39 39 39 30 32 30 36 30 33 32 33
           :                30 36 5A
           :                }
 815 30    9:              SEQUENCE {
 817 06    3:                OBJECT IDENTIFIER basicConstraints (2 5 29 19)
 822 04    2:                OCTET STRING
           :                30 00
           :                }
 826 30  130:              SEQUENCE {
 829 06    3:                OBJECT IDENTIFIER cRLDistPoints (2 5 29 31)
 834 04  123:                OCTET STRING
           :                30 79 30 77 A0 75 A0 73 A4 71 30 6F 31 0B 30 09
           :                06 03 55 04 06 13 02 43 41 31 1E 30 1C 06 03 55
           :                04 0A 13 15 4E 6F 20 4C 69 61 62 69 6C 69 74 79
           :                20 41 63 63 65 70 74 65 64 31 31 30 2F 06 03 55
           :                04 0B 13 28 45 6E 74 72 75 73 74 20 44 65 6D 6F
           :                20 57 65 62 20 43 65 72 74 69 66 69 63 61 74 69
           :                6F 6E 20 41 75 74 68 6F 72 69 74 79 31 0D 30 0B
           :                06 03 55 04 03 13 04 43 52 4C 36
           :                }
 959 30   31:              SEQUENCE {
 961 06    9:                OBJECT IDENTIFIER nsn-ce (1 2 840 113533 7 65)
 972 04   18:                OCTET STRING
           :                30 10 1B 0A 57 45 42 43 41 20 31 2E 30 31 03 02
           :                06 C0
           :                }
           :              }
           :            }
           :          }
 992 30   13:        SEQUENCE {
 994 06    9:          OBJECT IDENTIFIER
           :            md5withRSAEncryption (1 2 840 113549 1 1 4)
1005 05    0:          NULL
           :          }
```

```
1007 03  129:           BIT STRING 0 unused bits
            :             4A 03 BA 9F C0 2C D2 A9 69 E2 FE EE F7 D8 9A 03
            :             C2 54 36 6F 64 D8 5C 69 FE 69 9C 55 A2 BD D4 6D
            :             AA 34 F1 64 3F 57 57 AA 3D 23 27 50 64 2D 05 B6
            :             79 61 1C A2 0C E0 17 CD 28 75 B9 55 2E AC 68 0D
            :             47 8E AF 87 A4 42 78 18 C0 2D 8B 3E D1 A8 A5 C0
            :             35 73 5F 85 6A AB 71 DF D4 63 59 DD AB 01 93 69
            :             2F 8A 5D 29 E4 D0 F8 CA C7 63 55 81 00 0B 53 F0
            :             BE 89 26 F1 64 0E 68 97 F2 3E 79 2E ED 43 96 46
            :           }
1139 30  877:         SEQUENCE {
1143 30  726:           SEQUENCE {
1147 A0    3:             [0] {
1149 02    1:               INTEGER 2
            :               }
1152 02    4:             INTEGER 878852095
1158 30   13:             SEQUENCE {
1160 06    9:               OBJECT IDENTIFIER
            :                 md5withRSAEncryption (1 2 840 113549 1 1 4)
1171 05    0:               NULL
            :               }
1173 30   96:             SEQUENCE {
1175 31   11:               SET {
1177 30    9:                 SEQUENCE {
1179 06    3:                   OBJECT IDENTIFIER countryName (2 5 4 6)
1184 13    2:                   PrintableString 'CA'
            :                   }
            :                 }
1188 31   30:               SET {
1190 30   28:                 SEQUENCE {
1192 06    3:                   OBJECT IDENTIFIER organizationName (2 5 4 10)
1197 13   21:                   PrintableString 'No Liability Accepted'
            :                   }
            :                 }
1220 31   49:               SET {
1222 30   47:                 SEQUENCE {
1224 06    3:                   OBJECT IDENTIFIER
            :                     organizationalUnitName (2 5 4 11)
1229 13   40:                   PrintableString 'Entrust Demo Web Certification
Authority'
```

```
            :                     }
            :                   }
            :                 }
1271 30   30:               SEQUENCE {
1273 17   13:                 UTCTime '971106213454Z'
1288 17   13:                 UTCTime '021106213454Z'
            :                 }
1303 30   96:               SEQUENCE {
1305 31   11:                 SET {
1307 30    9:                   SEQUENCE {
1309 06    3:                     OBJECT IDENTIFIER countryName (2 5 4 6)
1314 13    2:                     PrintableString 'CA'
            :                     }
            :                   }
1318 31   30:                 SET {
1320 30   28:                   SEQUENCE {
1322 06    3:                     OBJECT IDENTIFIER organizationName (2 5 4 10)
1327 13   21:                     PrintableString 'No Liability Accepted'
            :                     }
            :                   }
1350 31   49:                 SET {
1352 30   47:                   SEQUENCE {
1354 06    3:                     OBJECT IDENTIFIER
            :                       organizationalUnitName (2 5 4 11)
1359 13   40:                     PrintableString 'Entrust Demo Web Certification
Authority'
            :                     }
            :                   }
            :                 }
1401 30  157:               SEQUENCE {
1404 30   13:                 SEQUENCE {
1406 06    9:                   OBJECT IDENTIFIER
            :                     rsaEncryption (1 2 840 113549 1 1 1)
1417 05    0:                   NULL
            :                   }
1419 03  139:                 BIT STRING 0 unused bits
            :                   30 81 87 02 81 81 00 AD D1 AB 5E A3 10 6B 5F D7
            :                   51 B3 9F 4B 6B 29 F4 55 53 7F A8 3B 6A 60 E0 03
            :                   65 EC 41 AA 6E 75 E0 69 0E 57 5C 18 8F A7 21 BB
            :                   BE 00 8E 3B CD 1C C3 1C 8A 48 51 DD C3 8B 07 0E
```

```
           :                  9E 75 19 73 A3 41 59 38 81 85 B4 00 57 3D FA 9C
           :                  07 08 CB 78 C0 B1 E9 57 88 4C C4 EB 56 15 2F 87
           :                  4E 0C F8 FF D1 16 40 FA 79 1F 93 DD A2 9F 14 7D
           :                  29 35 E9 B5 69 57 75 CE 8C B0 1D 0E D1 D0 90 39
           :                          [ Another 10 bytes skipped ]
           :                }
1561 A3  308:             [3] {
1565 30  304:               SEQUENCE {
1569 30   31:                 SEQUENCE {
1571 06    3:                   OBJECT IDENTIFIER
           :                     authorityKeyIdentifier (2 5 29 35)
1576 04   24:                   OCTET STRING
           :                   30 16 80 14 93 16 29 BE AC 0A 1F D5 52 F2 8D D8
           :                   CA 6D 1F 95 F8 4B F4 47
           :                   }
1602 30   29:                 SEQUENCE {
1604 06    3:                   OBJECT IDENTIFIER
           :                     subjectKeyIdentifier (2 5 29 14)
1609 04   22:                   OCTET STRING
           :                   04 14 93 16 29 BE AC 0A 1F D5 52 F2 8D D8 CA 6D
           :                   1F 95 F8 4B F4 47
           :                   }
1633 30   11:                 SEQUENCE {
1635 06    3:                   OBJECT IDENTIFIER keyUsage (2 5 29 15)
1640 04    4:                   OCTET STRING
           :                   03 02 01 06
           :                   }
1646 30   26:                 SEQUENCE {
1648 06    3:                   OBJECT IDENTIFIER
           :                     privateKeyUsagePeriod (2 5 29 16)
1653 04   19:                   OCTET STRING
           :                   30 11 81 0F 32 30 30 32 31 31 30 36 32 31 33 34
           :                   35 34 5A
           :                   }
1674 30   12:                 SEQUENCE {
1676 06    3:                   OBJECT IDENTIFIER basicConstraints (2 5 29 19)
1681 04    5:                   OCTET STRING
           :                   30 03 01 01 FF
           :                   }
1688 30  130:                 SEQUENCE {
```

```
1691 06    3:                 OBJECT IDENTIFIER cRLDistPoints (2 5 29 31)
1696 04  123:                 OCTET STRING
            :                 30 79 30 77 A0 75 A0 73 A4 71 30 6F 31 0B 30 09
            :                 06 03 55 04 06 13 02 43 41 31 1E 30 1C 06 03 55
            :                 04 0A 13 15 4E 6F 20 4C 69 61 62 69 6C 69 74 79
            :                 20 41 63 63 65 70 74 65 64 31 31 30 2F 06 03 55
            :                 04 0B 13 28 45 6E 74 72 75 73 74 20 44 65 6D 6F
            :                 20 57 65 62 20 43 65 72 74 69 66 69 63 61 74 69
            :                 6F 6E 20 41 75 74 68 6F 72 69 74 79 31 0D 30 0B
            :                 06 03 55 04 03 13 04 43 52 4C 31
            :                 }
1821 30   31:               SEQUENCE {
1823 06    9:                 OBJECT IDENTIFIER nsn-ce (1 2 840 113533 7 65)
1834 04   18:                 OCTET STRING
            :                 30 10 1B 0A 57 45 42 43 41 20 31 2E 30 31 03 02
            :                 06 C0
            :                 }
1854 30   17:               SEQUENCE {
1856 06    9:                 OBJECT IDENTIFIER
            :                   cert-type (2 16 840 1 113730 1 1)
1867 04    4:                 OCTET STRING
            :                 03 02 00 07
            :                 }
            :               }
            :             }
            :           }
1873 30   13:         SEQUENCE {
1875 06    9:           OBJECT IDENTIFIER
            :             md5withRSAEncryption (1 2 840 113549 1 1 4)
1886 05    0:           NULL
            :           }
1888 03  129:         BIT STRING 0 unused bits
            :           09 1D F7 CD A6 0E 02 02 11 BF EB 58 D0 06 46 46
            :           A3 12 51 30 F6 23 EA 38 64 9D C6 CB CE D9 7F 11
            :           C5 3D E9 8B 59 DF C1 4F FD 23 B8 57 48 ED 60 AD
            :           B5 3D 18 B5 2C AC 3F 31 F3 95 1F E2 22 7A 15 E0
            :           E7 C3 4C 28 FA 97 1C A3 B4 61 8D 63 E0 9C B8 4D
            :           32 E7 70 56 91 87 5D 35 B4 F5 ED 7A 06 B2 91 0A
            :           7E 14 BC 64 0D CF 7A DF C7 7E 68 6E 1F 9B 45 77
            :           05 17 BC 1B 5F A9 2F 1E 26 37 D7 A8 6D E7 B1 CE
```

```
             :           }
             :         }
2020 31  332:       SET {
2024 30  328:         SEQUENCE {
2028 02    1:           INTEGER 1
2031 30  104:           SEQUENCE {
2033 30   96:             SEQUENCE {
2035 31   11:               SET {
2037 30    9:                 SEQUENCE {
2039 06    3:                   OBJECT IDENTIFIER countryName (2 5 4 6)
2044 13    2:                   PrintableString 'CA'
             :                   }
             :                 }
2048 31   30:               SET {
2050 30   28:                 SEQUENCE {
2052 06    3:                   OBJECT IDENTIFIER organizationName (2 5 4 10)
2057 13   21:                   PrintableString 'No Liability Accepted'
             :                   }
             :                 }
2080 31   49:               SET {
2082 30   47:                 SEQUENCE {
2084 06    3:                   OBJECT IDENTIFIER
             :                     organizationalUnitName (2 5 4 11)
2089 13   40:                   PrintableString 'Entrust Demo Web Certification
Authority'
             :                   }
             :                 }
             :               }
2131 02    4:             INTEGER 878860804
             :             }
2137 30    9:           SEQUENCE {
2139 06    5:             OBJECT IDENTIFIER sha1 (1 3 14 3 2 26)
2146 05    0:             NULL
             :             }
2148 A0  125:           [0] {
2150 30   24:             SEQUENCE {
2152 06    9:               OBJECT IDENTIFIER
             :                 contentType (1 2 840 113549 1 9 3)
2163 31   11:               SET {
2165 06    9:                 OBJECT IDENTIFIER data (1 2 840 113549 1 7 1)
```

```
            :              }
            :            }
2176 30   28:          SEQUENCE {
2178 06    9:            OBJECT IDENTIFIER
            :              signingTime (1 2 840 113549 1 9 5)
2189 31   15:            SET {
2191 17   13:              UTCTime '981002143721Z'
            :              }
            :            }
2206 30   30:          SEQUENCE {
2208 06    9:            OBJECT IDENTIFIER
            :              sMIMECapabilities (1 2 840 113549 1 9 15)
2219 31   17:            SET {
2221 30   15:              SEQUENCE {
2223 30   13:                SEQUENCE {
2225 06    8:                  OBJECT IDENTIFIER rc2CBC (1 2 840 113549 3 2)
2235 02    1:                  INTEGER 40
            :                  }
            :                }
            :              }
            :            }
2238 30   35:          SEQUENCE {
2240 06    9:            OBJECT IDENTIFIER
            :              messageDigest (1 2 840 113549 1 9 4)
2251 31   22:            SET {
2253 04   20:              OCTET STRING
            :                FE BF CF 19 5F 2C D9 E8 70 40 00 10 DD D3 3E C8
            :                4C DD CB 92
            :              }
            :            }
            :          }
2275 30   13:        SEQUENCE {
2277 06    9:          OBJECT IDENTIFIER
            :            rsaEncryption (1 2 840 113549 1 1 1)
2288 05    0:          NULL
            :          }
2290 04   64:        OCTET STRING
            :          25 67 E6 E7 BD 6B E5 1D B8 77 D8 D6 B2 66 7C 7B
            :          FA 81 E3 25 42 DF DC CF 1C BB E1 93 0A 15 36 3B
            :          B4 03 14 30 E9 E3 6D F0 CA 7B 1A 93 B6 DA F2 3B
```

```
          :              57 3F EC 20 09 69 B6 C1 36 BA 73 47 D5 3E 70 C0
          :            }
          :          }
          :        }
          :      }
          :    }

0 warnings, 0 errors.
```

Glossary

Selected definitions in this glossary include prefixes of either "R: " or "S/H/I: ." Definitions applicable only to the radionuclide technology include the "R: " prefix; definitions applicable only to seismic, hydroacoustic, or infrasonic technologies include the "S/H/I: " prefix.

Symbols

3-C

Three-component.

μBq

R: MicroBecquerels.

A

acquisition live time

R: Time multichannel analyzer (MCA) electronics is available for processing pulse amplitude signals; equivalent to acquisition real-time less detector dead-time, reported in seconds.

acquisition real time

R: Total elapsed clock time a sample is counted, reported in seconds.

acquisition start

R: When the detection system at a station commences sample acquisition.

acquisition time interval

R: Equivalent to live time, reported in seconds.

activation products

R: Nuclides produced from the absorption of a neutron by a nucleus.

activity

R: Decay rate of a radionuclide; usually expressed in Becquerels (disintegrations per second), Bq.

ALERT

R: Alert message; data type that includes ALERT_FLOW, ALERT_SYS, ALERT_TEMP, and ALERT_UPS.

ALERT_FLOW

R: Type of ALERT message used to notify the IDC/IMS that the sample flow rate is above or below a specified threshold.

ALERT_SYS

R: Type of ALERT message used to notify the IDC/IMS that the computer controlling the systems is being rebooted or that the system is shutting down.

ALERT_TEMP

R: Type of ALERT message used to notify the IDC/IMS that a system temperature is above or below a specified threshold.

ALERT_UPS

R: type of ALERT message used to notify the IDC/IMS that there is a problem with the UPS.

ARMR

R: Atmospheric Radionuclide Measurement Report; electronic file containing a spectrum summary, collection statistics, comments, nuclide results, MDC's peak search results, and calibration equations.

ARR

R: Automatic Radionuclide Report. This report is a product of the automatic data processing and includes sections describing the sample information, prioritization results (noble gas only), sample activity, MDCs for key nuclides, peak search results and notes, processing parameters, update parameters, data quality flags, event screening flags, calibration equations, and field of regard.

array

S/H/I: Collection of sensors distributed over a finite area (usually in a cross or concentric pattern) and referred to as a single station.

ARSA

R: Automated Radioxenon Sampler/Analyzer.

ASCII

American Standard Code for Information Interchange. Standard, unformatted 256-character set of letters and numbers.

assay date

R: Date of certificate source assay, format is *yyyy/mm/dd*.

assay time

R: Time of certificate source assay, format is *hh*:*mm*:*ss.s*.

AutoDRM

Automatic Data Request Manager.

AUX

R: Auxiliary Power Supply.
S/H/I: Abbreviation for an auxiliary station code.

avg

Average.

B

background

R: Contribution to a spectrum from naturally occurring radionuclides as well as interactions between radiation and materials in the vicinity of the detector.

background measurement ID

R: Unique alphanumeric string identifying the relevant background measurement for a specific sample; includes the detector code and the background acquisition initiation date and time.

barometric pressure

Outside air pressure, expressed in hPa.

baseline

R: Contribution to a spectrum from the partial energy deposition of a gamma-ray in a detector.

beam

S/H/I: Waveform created from array station elements that are sequentially summed in the direction of a specified azimuth and slowness.

Becquerel

R: Unit of activity equal to one disintegration per second; denoted by Bq.

BLANKPHD

R: Blank Pulse Height Data; ASCII data message containing the pulse height data of an unexposed air filter, as well as other information, in an IDC-approved format.

BMID

R: Background Measurement ID.

Bq

R: Becquerel.

C

°C

Degrees Celsius.

CALIBPHD

R: Calibration Pulse Height Data; ASCII data message containing the pulse height data of a certified standard source, as well as other information, in an IDC-approved format. The data in a CALIBPHD are used to determine the ECR, EER, and RER.

category

R: Number from 1 to 5 assigned to a radionuclide sample during interactive analysis indicating the presence of certain types of nuclides. Category 1 indicates a spectrum with normal natural nuclides while 5 indicates spectra with multiple man made nuclides.

centroid

R: Energy (in keV) or channel number at the center of a fitted peak.

centroid channel

R: Spectrum channel at the center of a photopeak.

certificate

R: Certified standard source of known activity used in the acquisition of radionuclide energy, resolution, and efficiency calibration data.

certified laboratory

R: Radionuclide laboratories listed in Annex 1 of the CTBT and including any laboratories that are certified by the IMS/IDC in the future.

channel

R: Energy window (in keV) representing a differential increment of pulse height.
S/H/I: Component of motion or distinct stream of data.

cm

Centimeter.

CNF

R: Canberra Nuclear Format.

collection start

R: When the air sample system at a station commences sample collection.

collection stop

R: When the air sample system at a station completes sample collection.

comments

Free text field containing comments made by a station operator or IDC analyst.

count(s)

R: Number of pulses observed within a spectrum channel.
S/H/I: Units of digital waveform data.

CTBT

Comprehensive Nuclear Test-Ban Treaty (the Treaty).

CTBTO

Comprehensive Nuclear Test-Ban Treaty Organization; Treaty User group that consists of the Conference of States Parties (CSP), the Executive Council, and the Technical Secretariat.

D

data block

Units of information that, when combined with other data blocks, comprise a data message.

data type

Kind of data in a data message. R: Radionuclide data types include: ALERT_FLOW, ALERT_SYS, ALERT_TEMP, ALERT_UPS, ARR, BLANKPHD, CALIBPHD, DETBKPHD, GASBKPHD, MET, QCPHD, RLR, RMSSOH, RNPS, RRR, SPHDF, SPHDP, and SSREB.
S/H/I: S/H/I data types include: ARRIVAL, BULLETIN, CHANNEL, CHAN_STATUS, COMMENT, COMM_STATUS, EVENT, EXECSUM, NETWORK ORIGIN, OUTAGE, RESPONSE STATION, STA_STATUS, and WAVEFORM

date of last calibration

R: Date of previous detector calibration, format is *yyyy/mm/dd*.

dB

Decibel.

decade

Factor of ten in frequency (Hz).

decay time

R: Time duration an exposed filter is allowed to decay before data acquisition.

deg.

Degrees (as a distance).

DETBKPHD

R: Detector Background Pulse Height Data; ASCII data message containing the pulse height data from a background count, as well as other information, in an IDC-approved format.

detector code (or ID)

R: Includes the radionuclide site code plus four unique characters identifying a specific detector unit.

detector type

R: Data field describing the type of radiation detector used in the data acquisition process.

E

E.

East.

ECR

R: Energy versus Channel Regression; an equation providing the initial detector-specific relationship between channel number and energy. The equation contains calibration coefficients and is estimated from a transmitted calibration dataset.

ECRU

R: Energy versus Channel Regression Update; an equation providing the final detector-specific relationship between channel number and energy.

efficiency

R: Ratio of counts detected under a photopeak to the amount of radiation quanta emitted by a sample; depends on detector configuration and geometry. See also beta-gamma coincidence efficiency and beta-gated gamma efficiency.

email

Electronic mail.

energy

R: Usually refers to the measured kinetic energy of radiation quanta deposited in a detector. The unit most appropriate for such measurements is keV.
S/H/I: Occurrence that displays characteristics indicative of a possible nuclear weapons test.

event

R: Occurrence that displays characteristics indicative of a possible nuclear weapons test.
S/H/I: Unique source of seismic, hydroacoustic, or infrasonic wave energy that is limited in both time and space.

Executive Council

Executive body of the CTBTO responsible for supervising the activities of the Technical Secretariat.

F

FDSN

S/H/I: Federation of Digital Seismic Networks.

FIR

Finite Impulse Response.

fission products

R: Radionuclides produced from fission.

flow rate

R: Air volume passing through an air filter per unit time; reported in scm (m^3)/hr.

FPEB

R: Renamed SSREB.

FTP

File Transfer Protocol; protocol for transferring files between computers.

FULL SPHD

R: Full Sample Pulse Height Data; ASCII data message containing the pulse height data of a sample acquired for a complete collection interval, as well as other information, in an IDC-approved format.

full width at half-maximum

R: Metric of detector resolution and equivalent to the width of a photopeak (in keV) taken at the peak height equal to half the maximum peak counts.

FWHM

R: Full Width at Half-Maximum; metric of detector resolution and equivalent to the width of a photopeak (in keV) taken at the peak height equal to half the maximum peak counts.

G

g

Gram.

gain

R: Amplification of the measured energy deposition in a radiation detector. This is achieved through the use of electronic amplifiers.
S/H/I: Amplification of waveform energy.

GSE

Group of Scientific Experts.

GSETT-3

S/H/I: Group of Scientific Experts Third Technical Test.

H

h

Hour.

HPGe

R: High-Purity Germanium Detector.

Hz

Hertz.

I

IASPEI

S/H/I: International Association of Seismology and Physics of the Earth's Interior.

IDC

International Data Centre.

IEEE

Institute for Electrical and Electronic Engineers.

IIR

Infinite Impulse Response.

IMS

International Monitoring System.

inHPGE

R: Intrinsic HPGe detector.

ISAR

R: International Surveillance of Atmospheric Radionuclides.

ISAR station

R: Radionuclide monitoring station set up by the PIDC and that meets CTBT requirements.

ISC

S/H/I: International Seismological Centre.

K

KB

Kilobyte. 1,024 bytes.

keV

R: Kiloelectron Volts; a metric of kinetic energy.

km

Kilometer.

L

LAR

R: Laboratory Analysis Results.

LEGe

R: Low-Energy Germanium; a type of germanium detector that is used for low-energy gamma spectroscopy.

LSB

Least significant bit.

M

m

(1) Meter(s). (2) Megabyte(s); 1,024 kilobytes. (3) Month(s). (4) Minute(s).

MB

Megabyte. 1,024 kilobytes.

m_b

S/H/I: Magnitude of a seismic body wave.

mbmle

S/H/I: Magnitude of an event based on maximum likelihood estimation using seismic body waves.

MDC

R: Minimum Detectable Concentration.

measurement ID

R: Unique alphanumeric string identifying a specific data acquisition; includes the detector code and the acquisition start date and time.

message type

Kind of message; possible message types include DATA, REQUEST, and SUBSCRIPTION.

message ID

Unique 20-character alphanumeric identification given to a message by the sender that facilitates message tracking for the sender.

met start

R: When meteorological data collection at a station commences.

met stop

R: When meteorological data collection at a station ends.

MID

R: Measurement ID.

minimum detectable concentration

R: Activity concentration of a given radionuclide that is indistinguishable from the measurement process noise level.

M_L

S/H/I: Magnitude based on waves measured near the source.

mm

Millimeter.

MRP

R: Most Recent Prior; the sample counted most recently on the same detector and originating from the same station as the sample presently being analyzed.

M_s

S/H/I: Magnitude of seismic surface waves.

MSB

Most significant bit.

msmle

S/H/I: Magnitude of an event based on maximum likelihood estimation using surface waves.

multiplet

R: Spectral region of interest comprised of more than one photopeak.

Mw

S/H/I: Magnitude of an event based on measurements of the moment tensor.

N

N.

North.

natural radioactivity

R: Radioactivity from cosmogenic and primordial nuclides that is always present on earth.

NDC

National Data Center.

NEB

National Event Bulletin. Bulletin of events that is a national product.

NEIC

S/H/I: National Earthquake Information Center.

net area

R: Equal to the integrated photopeak counts minus the baseline and background counts.

nm

Nanometer.

NSEB

National Screened Event Bulletin. Bulletin of events that is produced using a national event screen.

nuclide

R: One of many combinations of nucleons that may comprise an atomic nucleus. Because all nuclides of interest with respect to CTBT compliance verification are radioactive, this term is often used to refer specifically to radionuclides.

P

peak

R: Statistically significant increase in counts above a spectrum baseline at an energy associated with a gamma line of a particular radionuclide or other phenomenon.

PHD

R: Pulse Height Data; a format for spectral data messages. Possible PHD data message types include BLANKPHD, CALIBPHD, DETBKPHD, GASBKPHD, QCPHD, and SAMPLEPHD.

photon energy

R: Component of the data pairs comprising a radionuclide detector's energy, resolution, and efficiency calibration data (in KeV).

PIDC

Prototype International Data Centre.

PREL SPHD

R: Preliminary Sample Pulse Height Data; ASCII data message containing the pulse height data of a sample acquired for less than a complete collection interval, as well as other information.

Provisional Technical Secretariat

(PTS) body of the CTBTO that includes the IMS and the IDC; the PTS will assist the Executive Council and the States Parties to implement the Treaty. After entry into force of the Treaty, the PTS will be referred to as the Technical Secretariat.

Q

QCPHD

R: Quality Control Pulse Height Data; ASCII data message containing the pulse height data of a certified source as well as other information. Information in the QCPHD, along with other data, is used to check a detector's state of health.

quantity

R: Collected air volume in scm; same as sampled air volume.

R

radioactivity

R: See activity.

radionuclide

R: Nuclide that has an unstable nucleus, that is, a radioactive nuclide.

RASA

R: Radionuclide Aerosol Sampler/Analyzer.

REB

S/H/I: Reviewed Event Bulletin; the bulletin formed of all S/H/I events that have passed analyst inspection and quality assurance review.

reference ID

See sample reference ID.

RER

R: Resolution (versus) Energy Regression; an equation providing the initial detector-specific relationship between resolution and energy. This equation contains calibration coefficients and is interpolated from a transmitted calibration spectrum.

resolution

R: Metric of a detector's ability to detect photons at discrete energies and is equivalent to the FWHM.

RMS

R: Radionuclide Monitoring System; the part of the IMS that monitors the atmosphere for radionuclides.

ROI

R: Region of interest.

RSR

R: Radionuclide Summary Report; report containing lists of category measurements, collection times, and locations of anthropogenic radionuclides, MDC's, and spectra received by the IDC within a time period.

S

S.

South.

s

Second (time).

sample

Any physical entity counted on a detector.

sample geometry

R: Sample configuration, shape, and physical state in a detector chamber.

sample ID

R: Unique identification number assigned to a given spectrum or record by the IDC.

sample reference ID

R: Unique alphanumeric string identifying a sample; includes station code, data type, and sample collection commencement date and time.

SAMPLEPHD

R: Sample Pulse Height Data; ASCII data message containing pulse height data acquired by counting a gas or particulate sample with a detector system.

scm

R: Standard Cubic Meter(s).

SEB

S/H/I: Standard Event Bulletin; a list of analyst reviewed S/H/I events and event parameters (origin and associated arrival information). The SEB is similar to the REB, but also includes event characterization parameters and event screening results for each event.

second split

R: Fractionation of the first split.

SEL1

S/H/I: Standard Event List 1; S/H/I bulletin created by total automatic analysis of continuous timeseries data. Typically, the list runs one hour behind real time.

SEL2

S/H/I: Standard Event List 2; S/H/I bulletin created by totally automatic analysis of both continuous data and segments of data specifically downloaded from stations of the auxiliary seismic network. Typically, the list runs five hours behind real time.

SEL3

S/H/I: Standard Event List 3; S/H/I bulletin created by totally automatic analysis of both continuous data and segments of data specifically downloaded from stations of the auxiliary seismic network. Typically, the list runs 12 hours behind real time.

S/H/I

S/H/I: Seismic, hydroacoustic, and infrasonic.

SID

R: Sample ID; unique alphanumeric string assigned to a sample during the automated processing for identification and accounting purposes.

singlet

R: Spectrum photopeak consisting of counts from one mono-energetic gamma-ray; photopeak containing counts from multiple photons, but fit as if it is comprised of counts from only one because contributions from the individual radiations cannot be separated, as in a multiplet.

site code

R: Five character alphanumeric field identifying a particular RMS site: the first two characters are the county code, the next character identifies the site type (`P` for particulate radionuclide station, `G` for noble gas radionuclide station, and `L` for certified lab), and the last two characters are the numbers assigned to the station or lab in the text of the CTBT.

SLSD

S/H/I: Standard List of Signal Detections.

snr

Signal-to-noise ratio.

spectral qualifier

R: Code in a SAMPLEPHD that indicates whether the spectrum acquisition time is truncated (PREL) or full (FULL).

spectrum

R: Plot of the differential number of pulses (in counts) per differential pulse height (in channels or keV).
S/H/I: Plot of the energy contained in waveforms as a function of frequency.

SPHD

R: Sample Pulse Height Data; ASCII data message type containing the pulse height data of a sample, as well as other information. The two types of SPHDs are full and preliminary. See FULL SPHD and PREL SPHD.

SPHDF

R: Full SPHD.

SPHDP

R: Preliminary SPHD.

SRID

R: Sample reference ID.

SSEB

S/H/I: Standard Screened Event Bulletin; similar in content and format to the Standard Event Bulletin (SEB), but does not include events that were screened out by a standard set of event screening criteria.

SSREB

R: Standard Screened Radionuclide Event Bulletin; bulletin generated by the IDC when fission or activation products are detected at a radionuclide station above normal limits. A SSREB contains information on the possible event, source location, fission products, activation products detected, any isotopic ratios calculated, and any certified laboratory results. New event information can be added to the SSREB as it arrives, therefore, multiple revisions of an SSREB are possible.

standard cubic meter

R: Volume occupied by 1 m^3 of gas at 0 ^oC and 1013 hPa.

station code (or ID)

(1) Code used to identify distinct stations. (2) Site code.

system type

R: Phase of the RMS sample being collected; "P" indicates particulate and "G" gaseous.

T

TCP/IP

Transmission Control Protocol/Internet Protocol.

Technical Secretariat

Referred to as the Provisional Technical Secretariat prior to the Treaty's entry-into-force; body of the CTBTO that includes the IMS and the IDC.

time of last calibration

R: Time of previous detector calibration, format is *hh:mm:ss.s*.

total efficiency

R: Ratio of the total number of pulses in the entire energy spectrum due to a photon of a given energy, E, to the number of photons emitted by a source for a specified source-to-detector distance. "The total efficiency can be affected by the shield design due to photon scattering" [ANSI Standard 42.14]. This parameter is required for cascade summing corrections.

transmit date

R: Date a message was sent from a transmitter, format is *yyyy/mm/dd*.

transmit time

R: Time a message is sent from a transmitter, format is *hh:mm:ss.s*.

Treaty

Comprehensive Nuclear Test-Ban Treaty (CTBT).

U

UPS

Uninterruptable Power Supply.

UTC

Universal Coordinated Time.

V

V

Volts; a unit of electrical potential or electromotive force.

W

W.

West.

X

XPU

R: Xenon Processing Unit.

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