



Animal and Plant Health Inspection Service

National Animal Health Laboratory Network (NAHLN)

**NAHLN/LMS HL7 Implementation Guide
For Laboratory Order and Response Messaging**

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Document Change Record

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4	May 2020	End to end review in coordination with Result

Acknowledgments

Introduction

Background

The NAHLN has developed a series of messaging specifications to facilitate data transfer between approved laboratories and the NAHLN utilizing Health Level Seven (HL7) version 2.6 message structures. These basic message structures can also be used lab-to-lab or lab to/from state animal health authority or other field system. HL7 version 2.6 was approved American National Standards Institute on October 12, 2007. This implementation guide has been developed as a detailed reference manual to assist the laboratories in integrating HL7 messaging into their Laboratory Information Management System (LIMS). This guide provides users with background information as well as definitions and descriptions of how data segments and fields map to their laboratory data. NAHLN messaging also requires the use of a set of strictly controlled vocabularies that are maintained at a central terminology service and are available for downloading into local LIMS (<http://vtsl.vetmed.vt.edu/nahln/main.cfm>). Example data are provided along with the corresponding XML tags that encompass the data. A detailed XML example of a largely populated message is also provided. A companion overview document, the “Hitchhiker’s Guide to NAHLN Messaging” that provides implementers with a high-level overview of HL7 messaging in the context of the NAHLN is available from the NAHLN documentation site and provides an excellent introduction to this topic.

Scope

This guide specifically addresses the use of HL7 version 2.6 messages to transmit orders for accession testing from field systems to a laboratory and for the laboratory to respond with acceptance or errors.

This guide is not intended as a tutorial for the general use of HL7, SNOMED or LOINC, or computer system interfacing in general. The reader is expected to have or acquire a basic understanding of interface concepts, HL7, data extraction, terminology standards and electronic messaging. This guide describes a generalized data exchange protocol applicable for findings produced in a laboratory in support of animal health programs supported by the NAHLN. It is based on HL7 version 2.6, SNOMED-CT and LOINC.

This document is designed to facilitate coordination between submitting field systems (e.g. EMRS2, MIMS, USAHERDS) or other laboratories and fulfilling laboratories using the *Population/Location-Based Laboratory Order Message* (OPL_O37) and *Population/Location-Based Laboratory Order Acknowledgment Message* (OPR_O38). Acknowledgement may use either the Original Mode or Enhanced Mode responses. Enhanced Mode allows an immediate accept acknowledgement after which the laboratory system has time to evaluate the order further and respond with an application acknowledgement later.

All inter-system messaging will use Health Level Seven (HL7) version 2.6 messages formatted using the v2.xml¹ encoding system. This version of NAHLN is designed to be a forward-compatible implementation, allowing for the addition/subtraction/modification of data from the message as needs are identified without dramatically affected the local implementation. Program-specific constraints for each constrained component are made available in individual program messaging guides, available on the terminology services website.

This document will address only the application layer of the networking system. The larger system-level architecture is under the jurisdiction of the USDA APHIS Marketing and Regulatory Programs Information Technology (MRP IT) Services.

How to Read This Document

Typefaces are used to differentiate types of information in this document. Times New Roman 10pt (this text) is used for descriptive and informative general text. Information from the HL7 standards is in Courier New

¹¹ HL7 Version 2: XML encoding Syntax Release 1, 2003

regular and **bold 10pt**. Sample message content in its v2.xml format is in Lucida Console 8pt. Note that many examples are line-wrapped within tags to fit the page. Normally, the closing tag should immediately follow the value text. In some cases, extra white space will make some parsers complain about invalid values.

Example:

```
<xmltag>
  <data>somedata</data>
</xmltag>
```

Message Structure

Messages are defined in tables following the HL7 standard notation for sequence of segments with optionality noted by square brackets [] and repeatability noted by curly brackets { }. Segments are identified by their three letter names. These are defined in similar tables. Data types are defined in place where they are helpful to the general discussion. The tables for Message and Segment definitions have been reduced in complexity by removing Segments or Fields that are not used in the NAHLN Base Schema implementation. This profile is a proper constraint upon the full standard defined OPL_O37 and OPR_O38 messages. In other words, no required elements have been removed. For forward compatibility issues, consult the HL7 version 2.6 standard for full definitions.

Some fields are indicated as Required or Empty (RE) where they have been identified as containing potentially valuable data for the NAHLN. These fields may be omitted if no data are available. If developing a messaging system designed to be “fully NAHLN Messaging compliant” all Required and Required or Empty fields must be supported if data are present. Fields listed as Optional are included because they may be useful in specific situations but are not widely supported or needed.

This document examines the message structures working from the outside in. First it covers the overall data flow, then the overall message structure, and then each segment in detail. The detailed message structure and data type discussions are intended to function as reference material and therefore can be read in any order. They assume a general knowledge of the information included in the introductory material and data flow sections.

Terminology value sets are referenced in the text of the document. The values included in these tables are provided as a service from the NAHLN Terminology Services site located at:

<http://vtsl.vetmed.vt.edu/nahln/main.cfm>.

Segment Groups

A new concept introduced by the v2.xml standard is the named segment group. A segment group is similar in concept to an X12 Loop. They are used to wrap groups of related segments that may be optional, repeatable or both as a group. These groupings have existed in HL7 2.x all along but have now received names in support of the XML encoding. These groups can be identified in the message definition tables as names in ALL CAPS in the description column. The segment name column will contain [, { or both to indicate optionality, repeatability, or both respectively for the group. When comments are added to the NAHLN usage column of the message definition tables, if in the group name row, they apply to the group as a whole.

Segment groups are used to control the cardinality and association of individual segments. Because the specific contents of each group vary slightly from one message structure to another, they are defined individually in the specific message structure definitions (schemas) and are named as the message structure plus the group name.

Segments

A segment is a logical grouping of data fields (attributes). Segments within a defined message may be required or optional, may occur only once or be allowed to repeat. Each segment is named and is identified by a unique 3-character code called a segment ID².

Fields

In HL7 version 2.x messaging, all field content is treated as a string of characters. The interpretation of how to treat these strings is defined by the data type format of the field. Each field is identified by the segment it is in and the position within the segment; e.g., PID.5 is the fifth field of the PID segment. For the purpose of NAHLN messaging, only fields that are supported in the message have detailed information. Whether a field is required, optional, or conditional in a segment is specified in the segment attribute tables.³ The profile described in this document has constrained all supported fields to be either Required, Required or Empty, Conditional, Optional or Not Supported.

Data Type Components

Some fields consist of a data type with just a single value represented as text. These fields appear in the XML as a pair of tags with the field name containing the value as what is known in XML as "PCDATA."

```
<single_value_field>value</single_value_field>
```

Other fields are made up of multiple components, each of which has its own pair of tags in the XML formatted message. These components may in turn be made up of subcomponents. When a field is made up of multiple components each of which is used in the NAHLN, the guide includes a table showing the components and their length, usage, etc.

```
<multi_component_field>
  <component1>value1</component1>
  <component2>value2</component2>
</multi_component_field>
```

In some cases a field can have many components in the standard but only one is used in the NAHLN profile. By design, HL7 has put the most commonly used components first. In these cases there will still be a pair of tags defining the single component.

```
<multi_component_field_only_one_used_by_nahln>
  <component1>value</component1>
</multi_component_field_only_one_used_by_nahln>
```

Note that if the field had been designed in XML from scratch, the example above could have been coded the same as the example for single value fields. It contains the additional "component1" tags to be explicit about which of the components allowed by the HL7 data type is actually being provided in our message. This keeps the XML consistent with the schema for the full HL7 standard and allows automated transformation between the XML format and the more widely used ER7 format.

For both singly used components and simple value fields, no component table is included as this essentially duplicates the table showing the field as a whole. The logic is the same for components and subcomponents.

Component details will be discussed when a data type is included in a location where it is commonly used or when the component usage differs from other elements of the same type. In other locations in this guide, you will find only the component table.

² HL7 Version 2.6, Appendix A.4.

³ HL7 Version 2.6. See Chapter referred to in abstract message definition

Value Set Tables

Where values within a given message element are restricted to a specified set, the value set is provided in the form of a “table.” Tables may be predefined by HL7 (“HL7 Tables”) or may be left to definition by the user (“User-Defined Tables”). In some cases, suggested values are provided by the standard for User-Defined Tables. In other cases the User-Defined Table value set shall be defined by the NAHLN Information Technology Committee. Tables may be as simple as a few lines or as complex as the list of all SNOMED codes for species or breeds. Hyperlinks to the NAHLN Terminology Services are provided for each NAHLN utilized value set. The lists available at the NAHLN Terminology Services website (<http://vtsl.vetmed.vt.edu/nahln/main.cfm>) are the officially allowable values. **If this document conflicts with the terminology services, the terminology services set supersedes this document.**

Message Flow

General Data Flow

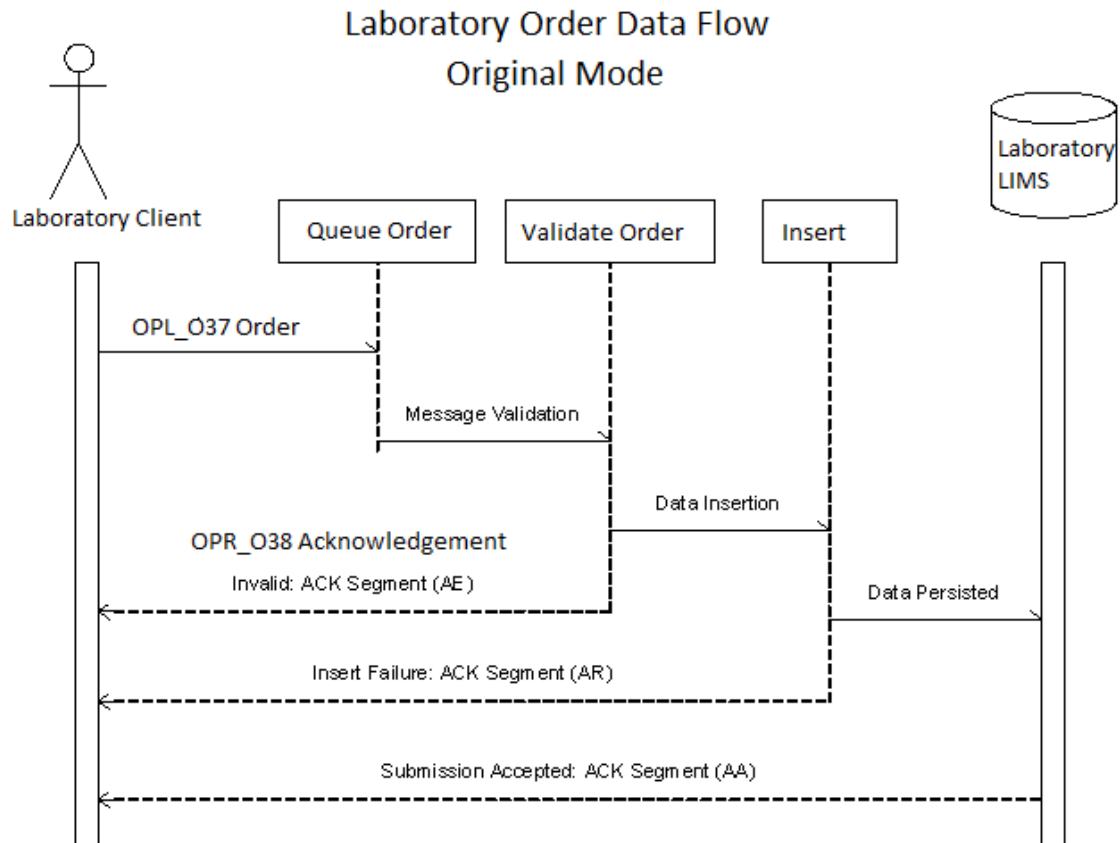
The information flow begins when a submitting system has an order for laboratory testing for submission to a participating laboratory. The OPL message is populated with Role, Patient, Specimen and Order information very similar to the OPU message. (An exception is that PV1 cannot be provided because of the usage as laboratory accession.)

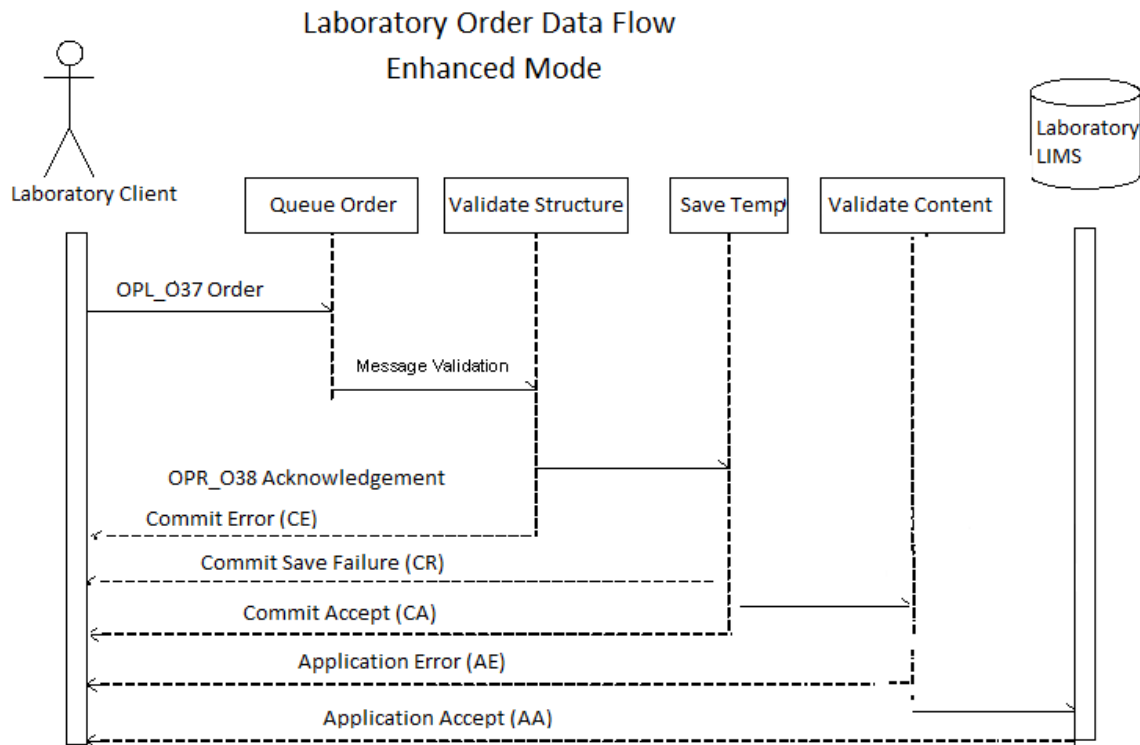
The Laboratory's Messaging System will receive the message, confirming any security envelopes, sender authentication, etc., as defined in the communications protocols. The lab will then parse the incoming message structure and accept responsibility for further processing of the contents. In Original Mode processing, the lab continues to evaluate the content to ensure that it can accept the order for testing and return an OPR acknowledgement (AA if acceptable). In Enhanced Mode processing the lab system returns a commit level acknowledgment OPR with CA if it can accept the message for processing. It later sends an application level acknowledgment OPR with AA if it can perform the testing ordered.

Many key data flows occur outside the scope of this guide. Notably, all transactions necessary to manage access control occur via mechanisms defined elsewhere. In some cases, these transactions depend on the content of specific messages defined in this guide. In those cases, the guide will address the access control implications of specific segments and fields, but not the actual access control mechanisms.

The interaction diagram in Figure 2a shows the original mode acknowledgement interaction. Figure 2b shows an enhanced mode acknowledgement.

Figure 2.





Exceptional Data Flows

In the event of errors in parsing the message structure, the acknowledgment message will contain enough information to allow debugging of the source system. See discussion of the ERR segment in the ACK message below.

The receiving system is expected to be able to parse any message that conforms to the HL7 v2.xml specification for the message specified. If message components are received that are not specified as required by this guide, they may be ignored by the receiving system. A receiving system may reject a message that fails to provide data for an element designated as required or conditional by this guide, even if the element is optional in the standard. These rules are designed to allow maximum reuse of any existing components while still enforcing essential content requirements.

Laboratory logic rules such as specimen type to test agreement may result in errors in the application acknowledgement in either original or enhanced mode.

Receipt of a commit or application error indicates a structural or content error that must be corrected prior to resubmitting the order. Receipt of a commit or application reject (CR or AR) implies a system error that may or, more likely, may not be related to the structure of the message. Resubmitting the order later may succeed. A commit accept means the receiving system has successfully parsed and stored the message. Only an application accept (AA) means the laboratory has accepted the order.

Note on Field Value States⁴

A field may exist in one of three population states in an HL7 message:

Populated. (Synonyms: valued, non-blank, not blank, not empty, non-null) The sending system sends a value in the field. For example, if a sending system includes an accession record number, it would be communicated as:

```
<PV1.19>
<CX.1>D0500675</CX.1> (Accession number)
  <CX.4>
    <HD.2>2.16.840.1.113883.3.5.1.2.1</HD.2> (Assigning authority, see below)
    <HD.3>ISO</HD.3> (Assigning authority type, see below)
  </CX.4>
</PV1.19>
```

Note that the field might be populated with a code that means “no information” or “unknown”.

Not populated. (Synonyms: unpopulated, not valued, unvalued, blank, empty, not present, missing.) The sending system does not supply a value for the field. The sender might or might not have a value for the field. In the absence of a Conformance Profile governing the implementation, no conclusion regarding the absence of an element value can be reached. However, if there is a Conformance Message Profile in effect, then special rules apply. In this case the tags may be omitted.

Null. Any existing value for the corresponding data base element in the receiving application should be deleted. This is symbolically communicated as two double-quotes between the XML tags (i.e., <tag>""</tag>). Employing consecutive double quote characters as the only content of a field for other purposes is prohibited. Order messages would seldom use explicit null values.

Note on Identifiers and Their Assigning Authorities

A key to making data universally useful is for identifiers to be universally unique. With multiple agencies issuing identifiers for various entities and objects, the only way to ensure this uniqueness is to include information about the issuer of each identifier, i.e.; its “assigning authority.” Of course, the identifiers for these assigning authorities must be universally unique. This can become an infinite recursion. To avoid this, HL7 has recognized a list of “universal identifier types” that are intrinsically universally unique. The universal identifier type used by the NAHLN is the International Standards Organization (ISO) Object Identifier (OID) (<http://www.alvestrand.no/objectid/top.html>). The vast majority of OIDs used in the NAHLN can be found on the AAVLD OID registry at: https://vdl.iastate.edu/aavld_oid.

Identifier-Assigning Authority pairs appear in three slightly different forms in NAHLN HL7 messages:

- 1) Most frequently, an identifier field of type ID⁵ (identifier) is associated with a second field of type HD⁶ (hierarchical designator) in which the second component (HD.2) contains the identifier for the assigning authority.
- 2) In other cases, related historically to HL7 limitations of nesting of fields in fields, the identifier and assigning authority are combined in a single element of type EI⁷ (Entity Identifier). The first component of an EI

⁴ HL7 Version 2.6 Chapter 2 Section 2.5.3

⁵ HL7 version 2.6 Chapter 2.A.35

⁶ HL7 version 2.6 Chapter 2.A.33

⁷ HL7 version 2.6 Chapter 2.A.25

(EI.1) is identical in meaning to the ID identifier field and the last three components (EI.2, EI.3, and EI.4) are identical to the three fields of the HD for assigning authority. In these cases, the NAHLN uses EI.1 for the ID, EI.3 for the OID of the assigning authority, and EI.4 is always “ISO.”

3) Lastly, in a few cases the HD stands on its own as a hierarchical identifier. In these cases HD.1 is the identifier and HD.2 is the universal ID of the assigning authority. When this case is true for NAHLN messages, the identifier will always be an Animal Disease Traceability (ADT) Premises (or Non-Producer Participant) ID and the Assigning Authority will always be the OID for the ADT Premises ID Allocator.

Whenever practicable, the assigning authority will be identified by an OID and the type identified as “ISO”, the HL7 designation for ISO OIDs. In these cases, HD.1 is empty and the OID is in HD.2 with “ISO” in HD.3. For the current NAHLN release, this is the only supported structure.

Member laboratories are both identified entities in the sense of sending and receiving facilities and assigning authorities of identifiers used by others. As assigning authorities, laboratories are identified by their root OIDs. As identified entities within the NAHLN, laboratories are identified by their ADT Premises or Non-Producer Participant IDs. This adds flexibility in the sense that one laboratory may issue identifiers for different types of entities using different identifier systems. All that is needed to make this universally workable is for the laboratory to assign a unique OID to each identifier system under their root OID. Alternatively, to simplify OID management, since the location of an identifier within the message provides context, a laboratory’s root OID may be used in cases where all IDs are assigned by the same “system”. If a laboratory makes a change such as implementing a new LIMS that could possibly reuse existing identifiers, it *must* issue a new OID for that system and use that new OID as the root for all identifiers issued under the new system.

Don’t Have an ADT Number?

In order to send messages to the NAHLN, each “sending facility” is required to obtain an ADT ID. For each state, this is assigned by the state Premises ID allocator.

Contact your state veterinarian’s office for information on obtaining this ID for your laboratory.

Note on Coded Entries

Many fields in the HL7 messages are sent as codes from a specified coding system. Starting with version 2.6 of HL7, each coded entry field specifies a coding strength. Each coded entry element includes three essential components. The first is the code. The second is the text representation of that value as defined by the coding system. For example, if the code is a LOINC code, the text is the LOINC common long name (preferred), LOINC short name or LOINC display name. The third element is an abbreviation or OID of the coding system—LN for LOINC. The NAHLN approved coding for each coded field is specified in this guide.

Coding Strength

Some fields are coded, but do allow exceptions in the case that something must be sent that cannot be coded in the restricted value set specified. These use the Coded With Exceptions (CWE) data type. Most coded entries in the NAHLN order message are of this type. In the vast majority of cases these should be sent properly coded using the value sets provided by the NAHLN terminology services. In the event of a new value not yet included in the NAHLN terminology subset, or if the local code cannot be confidently mapped to the standard system, the alternate coding system and/or original text may be sent without the primary code (in components 4-6 and 9 respectively), without the message being rejected. Once a code is assigned, the database can be updated, using the new mapping. These should be very rare events especially after initial system deployment.

A few fields use coded values where all possible values have been supplied in the subsets provided by the NAHLN. For these fields no value other than those specified codes makes sense or can be used by the NAHLN. These Fields use the Coded No Exceptions (CNE) data type and only the first three components are allowed. Any attempt to send codes either not in the NAHLN terminology subset for the field or as alternative codes will result in the message being rejected.

XML encoding of the CNE data type is problematic. CNE is intended to be a proper constraint on the CWE datatype. Any element that was valid as CNE would also be valid as CWE; though not visa-versa. But in xml,

the tag name matters. <CNE> cannot be simply substituted for <CWE> as a more constrained version of the same thing. For this reason, the NAHLN encodes all coded elements with <CWE> tags even when enforcing CNE code strength.

Alternative Codes

For coded concepts with a coding strength of CWE, if a coded concept is required that does not exist in the NAHLN approved coding system, but exists in some other standard coding system, the alternate code, text, and system can be sent in the fourth through sixth components of the data type. Finally, if the required concept does not exist as a coded value in either the NAHLN approved coding system, or an alternative coding system (including local codes), the original text value should be sent in the Original Text component (ninth). It is essential to note that all these representations—the code with its text, the alternate code with its text, and the original text—must represent exactly the same concept. The only reason for sending alternate codes or original text is to facilitate mapping the original concept and/or verification of mapping that has already been done.

Note on Data Lengths

The definition of each of the segments includes a maximum data length for each field. The total length of the data in each of the components of the field should be no more than these limits. However, these are not consistently enforced by any of the typical pieces of the messaging infrastructure. NAHLN will check all buffer lengths prior to any action that depends on them. If a data element has exceeded its maximum number of characters, a corresponding message will be returned in the ACK.

Note on Optionality and Repeatability

In the optionality column of the tables that define each segment group, segment and field, we have included the optionality for NAHLN usage. These codes are a variation on the optionality settings used in HL7 conformance profiles. Values include:

R	Required	<p>A sending application shall populate all “R” elements with a non-empty value. The receiving application shall process (save/print/archive/etc.) the information conveyed by required elements. The receiving application must raise an error due to the absence of a required element.</p> <p>In a few cases there may be supplied null values. These are cases where requiredness is inherited from the standard but in NAHLN application values may not exist.</p>
RE	Required or Empty	<p>An “RE” element may be missing from the message, but should be sent by the sending application if there is relevant data.</p> <p>Receiving applications will be expected to process (save/print/archive/etc.) data contained in the element, but must be able to successfully process the message if the element is omitted (no error message should be generated because the element is missing).</p>
C	Conditional	<p>This usage has an associated condition predicate.</p> <p>When the predicate is satisfied:</p>

		<p>The sending application must always send the element. The receiving application must process data in the element. It should raise an error if the element is not present.</p> <p>When the predicate is NOT satisfied:</p> <p>The sending application must NOT send the element. The receiving application must NOT raise an error if the condition predicate is false and the element is not present, though it may raise an error if the element IS present.</p>
CE	Conditional or Empty	<p>This usage has an associated condition predicate.</p> <p>When the predicate is satisfied:</p> <p>If the sending application contains the required values for the element, then the application should send the element. If the sending application does not contain the values required for this element, then the element shall be omitted.</p> <p>If the element is present, the receiving application shall process (display/print/archive/etc.) the values of that element. If the element is not present, the conformant receiving application shall not raise an error due to the presence or absence of the element.</p> <p>When the predicate is not satisfied:</p> <p>The sending application shall not populate the element.</p> <p>The receiving application may raise an application error if the element is present.</p>
O	Optional	<p>The field is not required to be supported by the receiver of the message. If sent, the receiver may ignore the data, but may not send a reject acknowledgement to the sender.</p> <p>Optional fields are retained in the profile for compatibility with systems that may use them for their own purposes but are not required or expected by any known NAHLN participant. Optional is being used for some elements that have not found significant use but are not yet considered deprecated.</p>
D	Deprecated	<p>This field is no longer used and will be dropped from some future version of the profile.</p>

Some fields are allowed to repeat in the HL7 standard message structure. Some of these will be represented in NAHLN messages in a form that allows multiple values. In other cases, only the first value will be retained. If

the repeatability column of the segment table is blank, the field may not repeat and only a single value may be sent. Other values include:

Y **Yes** Repeatable in the standard and multiples will be retained by NAHLN

N **No** Repeatable in the standard but repeats are not allowed in NAHLN usage. Only the first value will be retained. Additional values if sent will be discarded.

The number of allowable repeats in the RP/# column indicates the number usable by the NAHLN and may be smaller than the standard. Repeats beyond this limit will be discarded. For example: N would indicate that only one value will be retained. Y/3 would indicate that up to three values will be retained.

OPL - Population/Location-Based Laboratory Order Message (Event O37)

This message and event type are designed to facilitate communication of location-based laboratory results that are associated with a specimen or specimens. As the NAHLN refines the set of tests for which data are collected for each program, the use of these segments will be defined more precisely in usage note areas of this guide.

NAHLN Constrained OPL_O37 Abstract Message Structure

<u>OPL^O37^OPL_O37</u>	<u>Population/Location-Based Laboratory Order Message</u>	<u>Chapter</u>
MSH	Message Header	2
{ ROL }	Role	15
{	--- ORDER begin	
NK1	Next of Kin/Associated Parties	3
[---PATIENT begin	
PID	Patient	3
[{OBX}]	Observations on the Patient	7
]	--- PATIENT end	
{	--- SPECIMEN begin	
SPM	Specimen	7
[{OBX}]	Observation/Result related to specimen	7
{	--- OBSERVATION REQUEST begin	
ORC	Common Order	4
OBR	Observation Request	4
[{	--- TIMING begin	
TQ1	Timing/Quantity	4
}]	--- TIMING end	
}	--- OBSERVATION REQUEST end	
}	--- SPECIMEN end	
}	--- ORDER end	

The message as described in the table above provides results of one test or set of tests ordered under a single accession. These tests can be associated with specimens that may or may not be associated with an animal (patient). In NAHLN usage, “patient” may refer to a single animal or to a group of animals such as a herd or flock that are being studied as a single entity. The tests for a patient (or patient group) pertain to one “patient visit” or encounter. If laboratory analysis results would be logically interpreted as indicative of the state of health or disease of only a single animal, they should be ordered individually. If they are interpreted as indicative of disease in the entire population, they may be ordered by group. In each of these cases, the PID segment is used to provide the taxon (commonly referred to as “species” and/or breed), if applicable, and individual or group identifiers. Multiple taxons⁸ may be transmitted in a single message, however, if specimens from multiple taxons are sent, they must be put under the separate ORDER groups each with a distinct PATIENT group with a PID segment representing the taxon of origin. Mixed taxa within a single PID segment are not allowed.

Each patient, group, or the environment of the location is contained in a group labeled "ORDER". Note that this is an inconvenient name collision with the OPU_R25.ORDER group that more closely resembles the OPL_O37.OBSERVATION_REQUEST group. The OPL_O37.ORDER corresponds with the OPU_R25.ACCESSION_DETAIL group.

⁸ Correct plural “taxa.” But that seems to not make the point.

The message can also be used to transmit data concerning environmental specimens in which there is no associated animal source. In this case the PID segment is not required. Premises ID and state of origin are carried in a ROL segment immediately following the MSH.

Each specimen is contained within a SPECIMEN group. Each specimen may, in turn, have one or more observation requests. An observation request refers to a test or set of tests that would be requested individually or together as a battery or panel (see sidebar) and logically interpreted as a group and would therefore be reported as such.

For each Accession, State of origin is always required for access control purposes. Because of this requirement the Premises of Origin segment (ROL with role code of "PREM") is required. Other ROL segments will also be used for submitter, collector, referring laboratory, etc. Uses of this structure outside the NAHLN/LMS *may* relax this constraint if for some reason the state of origin is not important.

Panel or Protocol?

These two terms are often used interchangeably, but for the purposes of the NAHLN we will adhere to the following definitions:

Panel: A convenient method to order a set of analyses on a specimen. This set of tests must all be resulted or cancelled for the panel to be complete.

Protocol: A convenient way to order a sequential series of analyses. Assays are performed in order based on the result of the first and subsequent analyses. Similar to a reflex order.

Detailed Message Walk-Through

In the following sections, specific details of the appropriate use of each segment and field in the NAHLN Result Base message will be discussed.

Message Header Segment (MSH)

The message header segment contains the detailed information concerning the intent, source, timing, destination and identity of messages. The fields used are all either constants or system-generated, such as sequence numbers or time stamps. Thus, users need not worry about any of these except during interface set-up, mapping, and debugging.

MSH Segment Structure

The following table defines the structure of the MSH segment. The table includes the field number (SEQ), field length (LEN), data type (DT), optionality as defined in the NAHLN (OPT), repeatability or number allowed (RP/#), source table if the field is a coded value (TBL), and element name. Only those fields used in the NAHLN message are shown.

NAHLN Supported Fields for the MSH Segment

SEQ	LEN	DT	OPT	RP/#	TBL#	ELEMENT NAME
1	1	ST	R			Field Separator
2	4	ST	R			Encoding Characters
3	227	HD	RE		0361	Sending Application
4	227	HD	R		0362	Sending Facility
5	227	HD	C		0361	Receiving Application
6	227	HD	C		0362	Receiving Facility
7	24	DTM	R			Date/Time of Message
9	15	MSG	R			Message Type
10	199	ST	R			Message Control ID

SEQ	LEN	DT	OPT	RP/#	TBL#	ELEMENT NAME
11	3	PT	R			Processing ID
12	60	VID	R			Version ID
21	427	EI	R	Y		Message Profile Identifier

The following sections describe in greater detail each of the elements that are in use within the MSH segment. The description provided in this document represents the NAHLN-specific definition and should be used to determine how each field should be populated for a particular laboratory.

MSH.1 and MSH.2 - Field Separator and Encoding Characters (ST) - Required

The first two named fields of the MSH segment define delimiters for the rest of the message. These fields are used by the ASCII format ER7 encoding, but are not required in XML encoding. They are included here for conformance with the ER7 encoding in order to allow transformation between XML and ER7. The MSH.1 should be defaulted to "|" and MSH.2 should be defaulted to "^~\&"

Example:

```
<MSH.1>|</MSH.1>
<MSH.2>^~\&&&</MSH.2>
```

Note: To conform to the proper usage of special characters in XML, the ampersand in the MSH.2 field is represented as & .

MSH.3 - Sending Application (HD) - Required Or Empty

This field provides the identifier of the sending application when the sending facility may have more than one application sending messages. The sending application is encoded as a hierarchical designator (HD) element. This is one of four fields (MSH.3, MSH.4, MSH.5 and MSH.6) where the use of the HD data type conforms to the first pattern described above.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	IS	R	0300	Namespace ID	The name of the application as assigned by the sender.
2	999	ST	R		Universal ID	The ID of the code system from which the namespace ID originates. For the NAHLN this will be either the laboratory's root OID or an OID for its internal application ID system.
3	6	ID	R	0301	Universal ID Type	The type of the universal ID. For the NAHLN this will always be ISO.

Example:

```
<MSH.3>
  <HD.1>EMRS2</HD.1>                                <!--Example application name-->
  <HD.2>2.16.840.1.113883.3.5.1.8.1</HD.2>            <!-- OID for NAHLN Assigned System IDs -->
  <HD.3>ISO</HD.3>                                     <!--Default ID Type for OIDs-->
</MSH.3>
```

MSH.4 - Sending Facility (HD) - Required

This field provides the identifier of the sending facility or laboratory. The sending facility is encoded as a hierarchical designator (HD) element. For this element, the laboratory ADT ID must be used as the namespace ID.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	IS	R	0300	Namespace ID	Unique identifier as assigned by the organization represented by the universal ID. For the NAHLN this shall be the ADT Premises ID or Non-Producer Participant ID.
2	999	ST	R		Universal ID	The code system from which the namespace id originates. For the NAHLN this will be the OID for the ADT Premises ID system.
3	6	ID	R	0301	Universal ID Type	The identifier type of the universal ID. For the NAHLN this will always be ISO.

Example:

```
<MSH.4>
  <HD.1>0031S80</HD.1>                                <!--Example ADT Premises ID-->
  <HD.2>2.16.840.1.113883.3.5.6.1.4</HD.2>            <!--OID for ADT Premises ID System-->
  <HD.3>ISO</HD.3>                                     <!--Default ID Type for OIDs-->
</MSH.4>
```

MSH.5 - Receiving Application (HD) - Conditional

This field provides the identifier of the receiving application when messages are sent intra- or inter-facility. The receiving application is encoded as a hierarchical designator (HD) element. Either the receiving application or the receiving facility or both shall be supplied depending on whether the message is intra- or inter- facility.

Condition: This field shall be populated if MSH.6 (Receiving Facility) is not valued.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	IS	R	0300	Namespace ID	The name of the application as assigned by the assigning authority.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
2	999	ST	R		Universal ID	The ID of the code system from which the namespace ID originates. For the NAHLN this may be the OID for Repositories or Routes. (2.16.840.1.113883.3.5.1.8.1)
3	6	ID	R	0301	Universal ID Type	The identifier type of the universal ID. For the NAHLN this will always be ISO.

Example:

```

<MSH.4>
  <HD.1>USALIMS</HD.1>                                <!--Example application name-->
  <HD.2>2.16.840.1.113883.3.5.1.9</HD.2>                <!--Example Root OID of
                                                           application owner-->
  <HD.3>ISO</HD.3>                                       <!--Default ID Type for OIDs-->
</MSH.4>

```

MSH.6 - Receiving Facility (HD) - Conditional

This field provides the identifier of the receiving facility and for the purposes of NAHLN Result messaging refers to the NAHLN result repository system. The receiving facility is encoded as a hierarchical designator (HD) element. The receiving application or the receiving facility or both shall be supplied depending on whether the message is intra- or inter- facility and whether, if inter-facility, the receiving facility has multiple systems involved in messaging.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	IS	R	0300	Namespace ID	Facility unique identifier as assigned by the organization represented by the universal ID. For the NAHLN this shall be the NAIS Premises ID or Non-Producer Participant ID.
2	999	ST	R		Universal ID	The code system from which the namespace id originates. For the NAHLN this will be the OID for the NAIS Premises ID system.
3	6	ID	R	0301	Universal ID Type	The identifier type of the universal ID. For the NAHLN this will always be ISO.

Condition: This field shall be populated if MSH.5 (Receiving Application) is not valued.

An example of MSH.6 is shown below:

```
<MSH.6>
  <HD.1>003EZUN</HD.1>          <!--ADT Premises ID for NAHLN Repository-->
  <HD.2>2.16.840.1.113883.3.5.6.1.4</HD.2> <!--OID Root for NAIS Premises ID System-->
  <HD.3>ISO</HD.3>              <!--Default ID Type for OIDs-->
</MSH.6>
```

MSH.7 - Date/Time of Message (DTM) - Required

The local time Date/Time of the message is sent as a timestamp (DTM) data type using the ISO 8824-1987 format:

(YYYY[MM[DD[HH[MM[SS[.S[S[S[S]]]]]]]]][+/-ZZZZ].

This should be a System-generated date and time to the second that the message was created. It is not clinically relevant time, but essential for system analysis, tuning, etc.

The number of places included indicates the precision. Participating systems should use the Network Time Protocol (NTP) or other reliable mechanism to maintain accurate system time and provide accurate timestamps in order to maintain a proper sequence of events in all connected systems. We strongly encourage use of the time zone +/-ZZZZ (as HHMM) element to simplify time calculations. Without this, the default is to use the time zone of the sender. Example:

Note: At a minimum, the DTM data type must be populated with a four digit year; however, it is recommended to provide the most detailed precision possible from the laboratory's system.

```
<MSH.7>20081219081023-0800</MSH.7>          <!--Example Date/Time of Message-->
```

MSH.9 - Message Type (MSG) - Required

This field identifies the specific message type and structure. For the NAHLN, all components of this field are required and may be defaulted as described in the component table below.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	3	ID	R	0076	Message Code	This shall be defaulted to "OPU".
2	3	ID	R	0003	Trigger Event	Specimen-based observation. This shall be defaulted to "R25".
3	7	ID	R	0354	Message Structure	This is the message structure and shall be defaulted to "OPU_R25".

Example:

```
<MSH.9>
  <MSG.1>OPL</MSG.1>          <!--HL7 Message Type-->
  <MSG.2>037</MSG.2>          <!--HL7 Event Type-->
  <MSG.3>OPL_037</MSG.3>      <!--HL7 Message Structure-->
</MSH.9>
```

MSH.10 - Message Control ID (ST) - Required

The message control ID is a system-generated unique identifier assigned by the sending system. The system generating these shall ensure that they are unique for the full life of the program. Other than that, there are no

requirements for internal structure of the identifier. Message Control ID is of no interest to human users of the system. It is very important to the various software processes to keep track of which messages have been sent, received, accepted, etc.

Example:

```
<MSH.10>1003456</MSH.10>                                <!--Example Message Control ID-->
```

MSH.11 - Processing ID (PT) - Required

This field specifies whether this is a production, training, or debugging message. Only the first component of this data type is supported. The values present in this field can either be:

- P Production
- D Debugging
- T Training

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	1	ID	R	0103	Processing ID	Specifies whether this is a production, test, or debugging message.

In practice, this field is not used to divert messages in testing and debugging. But good practice would indicate proper usage for future reference.

Example:

```
<MSH.11>
  <PT.1>P</PT.1>                                <!--Example Message Processing ID-->
</MSH.11>
```

MSH.12 - Version ID (VID) - Required

The version ID of all messages covered by this guide will be 2.6. All messages shall contain this value to ensure forward compatibility with future revisions that may move to later versions. The data type is VID but only the first component of the data type is supported by the NAHLN.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	5	ID	R	0104	Version ID	HL7 version of this message. For NAHLN 2.0, "2.6" should be sent. This field is present for forward compatibility with later versions.

Example:

```
<MSH.12><VID.1>2.6</VID.1></MSH.12>
```

MSH.21 - Message Profile Identifier (EI) - Required

A message profile is the set of rules about which elements of an HL7 message are being used, required, etc., in a given implementation. As the NAHLN messaging implementation evolves there will be inevitable delays

between new versions of the message profile and all labs' implementation of new profiles. The Message Profile Identifier allows the sender to indicate which specific version of the profile was used in validating the message to be sent. The receiving system can use this information to more correctly apply validation rules. The most current version of message profiles supported by the NAHLN may be found at <http://vtsl.vetmed.vt.edu/nahln/main.cfm> under the resources button. This should be the filename of the schema used, including version without the .xsd extension. Example: "NAHLNOrderBasev2.1".

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	199	ST	R		Entity Identifier	Profile Identifier.
3	199	ST	RE		Universal ID	OID for NAHLN message profiles.
4	6	ID	RE	0301	Universal ID Type	The identifier type of the universal ID. This should be ISO (ISO OID)

If a message has been built upon a more specific schema such as those for specific surveillance programs, the name of the appropriate schema—minus the .xsd—should be provided as the Profile Identifier.

Example:

```
<MSH.21>
  <EI.1>NAHLNOrderBasev2.1</EI.1>  <!--Example name of the profile used -->
  <EI.3>2.16.840.1.113883.3.5.9</EI.3>  <!--The AAVLD OID for message profiles-->
  <EI.4>ISO</EI.4>
</MSH.21>
```

Role Segment (ROL)

More recent HL7 standards such as Fast Healthcare Information Resources (FHIR) introduce the concept of "slicing" to standard profiles. Slices impose different requirements on the same resource (segment) depending on its specific usage. The various uses of the ROL segment in the NAHLN Result Message can be thought of as slices. The v2.xml schema and schema validation do not allow the schema to enforce these use-specific requirements. They should be spelled out in any program-specific guides that depend on them.

The role segment represents:

- the person(s) or organization submitting the laboratory request,
- the premises from where the specimens submitted originated,
- the attending veterinarian on the case,
- the parent company,
- the referring lab,
- other interested parties (not currently supported by the NAHLN repository).

The roles recognized by NAHLN are provided by the NAHLN Terminology Services (See ROL.3). The ROL segment is repeatable and hence can represent any or all of the roles associated with the submission. The ROL segment is not required by the schema however only rarely is a premises ROL with a minimum of source state required. In the case of the PREM role the minimum information required is the source state (ROL.11/XAD.4). For other roles more complete contact information is required. For virtually all regulatory testing at least a PREM role including the animal location state is essential for proper attribution of results.

NAHLN Supported Fields for the ROL Segment

SEQ	LEN	DT	OPT	RP/#	TBL#	ELEMENT NAME
1	60	EI	RE			Role Instance ID
2	2	ID	R		0287	Action Code
3	250	CWE	R		0443	Role-ROL
4	250	XCN	R			Role Person
11	250	XAD	RE			Office/Home Address
12	250	XTN	RE	Y		Phone
13	1230	PL	CE			Person or Premises Location

The following is an example ROL segment:

```

<ROL>
  <ROL.1>
    <EI.1>232345</EI.1>                                <!--Example Role instance ID-->
    <EI.3>2.16.840.1.113883.3.5.6.2</EI.3> <!--Example OID for Role Instance assigning
authority-->
    <EI.4>ISO</EI.4>
  </ROL.1>
  <ROL.2>UC</ROL.2>                                     <!--Default Role Action Code-->
  <ROL.3>
    <CWE.1>SUB</CWE.1>                                   <!--Example Role Code-->
    <CWE.2>Submitter</CWE.2>                             <!--Example Role Description-->
    <CWE.3>HL70443</CWE.3>                               <!--HL7 User Defined Table ID-->
  </ROL.3>
  <ROL.4>
    <XCN.1>GIB001</XCN.1>                                <!--Example Role Person Identifier-->
    <XCN.2>
      <FN.1>Gibson</FN.1>                                <!--Example Role Person Last Name-->
    </XCN.2>
    <XCN.3>Henry</XCN.3>                                  <!--Example Role Person First Name-->
    <XCN.4>T.</XCN.4>                                     <!--Example Role Person Middle Initial-->
    <XCN.5>Jr.</XCN.5>                                   <!--Example Role Person Name Suffix-->
    <XCN.9>
      <HD.2>2.16.840.1.113883.3.5.1.2.2</HD.2> <!--Example Person ID assigning Authority-->
      <HD.3>ISO</HD.3>
    </XCN.9>
  </ROL.4>
  <ROL.11>
    <XAD.1>
      <SAD.1>1234 Elm Street</SAD.1>                     <!--Example Role Person Street Address-->
    </XAD.1>
    <XAD.3>Anytown</XAD.3>                               <!--Example Role Person City-->
    <XAD.4>CA</XAD.4>                                    <!--Example Role Person State-->
    <XAD.5>99999-9999</XAD.5>                             <!--Example Role Person Zipcode-->
  </ROL.11>
  <ROL.12>
    <XTN.2>WPN</XTN.2>                                   <!--Example Role Person Phone Use Code-->
    <XTN.3>PH</XTN.3>                                    <!--Role Person Phone Equipment Type Code-->
    <XTN.6>888</XTN.6>                                    <!--Example Area Code-->
    <XTN.7>5552323</XTN.7>                               <!--Example Phone Number-->
    <XTN.8>4232</XTN.8>                                  <!--Example Phone Number Extension-->
  </ROL.12>
</ROL>

```

An example of the ROL segment being used to represent a premises is included in the example message (Appendix B)

ROL.1 - Role Instance ID (EI) - Required or Empty

This field represents the ID of the person in this role. So if the role were gym member, it would be the person's membership card number, *not* their driver's license or ssn. Those go into the ROL.4 field as *person* identifiers. This is likely to be a very seldom used field.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	199	ST	R		Entity Identifier	Identifier assigned by the organization/entity. For the NAHLN this is the identifier that indicates this person is authorized in the stated role.
3	199	ST	R		Universal ID	The code system from which the namespace id originates. This is usually the OID assigned for the name of the code system or the program.
4	6	ID	R	0301	Universal ID Type	The identifier type of the universal ID. This should be ISO (ISO OID).

ROL.2 - Action Code (ID) - Required

ROL.2 is a required field in HL7 version 2.6. Since NAHLN result messages are not being used to add or update Role information, this field value may be defaulted to UC (Unchanged).

Example:

<ROL.2>UC</ROL.2>

ROL.3 - Role-ROL (CNE) - Required

The Role-ROL field is a coded entry that contains the functional designation for the role that is being sent. For NAHLN result messaging, if the ROL segment is sent, at least one segment with the role of Premises of origin (PREM) is required. Additional codes (e.g. Submitter, Collector, or Referring Laboratory) may be found at the NAHLN Terminology Services:

ROL.3 is a required field when the segment is sent.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	R		Identifier	Identifier for the type of role.
2	199	ST	RE		Text	Text describing the role type.
3	20	ID	R	0396	Name of Coding System	In this instance, HL70443 or L.

Example:

```
<ROL.3>
  <CWE.1>SUB</CWE.1>
  <CWE.2>Submitter</CWE.2>
  <CWE.3>HL70443</CWE.3>
</ROL.3>
```

USER Table 0443

PREM	Source Premises
SUB	Submitting Party
COL	Specimen Collector
LAB	Referring Laboratory
DIST	Additional Report Distribution
PAY	Additional Payor Information
AT	Attending Veterinarian
PAR	Parent Company

ROL.4 - Role Person (XCN) - Required

This field contains identifying information about the party (person or organization) filling this role. It may contain the name of the party along with an ID and corresponding Assigning Authority. Only a single name assigned to a given role may be included however for some roles there may be multiple ROL segments of the same type. This would mainly apply to DIST or PAY. NOTE: For the PREM role, there is no "person" involved. The NAHLN has pre-adopted the concept from later versions of HL7 of participant that can be a person or other entity such as a farm. To comply with the 2.6 schema when no actual person is involved, the ROL.4 can consist of only the XCN.1/FN.1 component with a "flavor of null" ideally "NA".

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	15	ST	RE		ID Number	ID Number for the person with this role, as assigned by the organization represented by the universal ID of the assigning authority.
2	194	FN	R		Family Name	Last name of person.
3	30	ST	RE		Given Name	First name of person.
4	30	ST	RE		Second and Further Given Names or Initials Thereof	Middle name or initial of the person
5	20	ST	RE		Suffix (e.g., JR or III)	Additional suffix for name (e.g. Jr., III)
9	227	HD	C	0363	Assigning Authority	Authority that assigned that Role's ID number. Conditionality: This component must be valued if the ID is provided.

An example of the ROL.4 (Role Person) XML is provided below:

```
<ROL.4>
  <XCEN.1>GIB001</XCEN.1>
  <XCEN.2>
    <FN.1>Gibson</FN.1>
  </XCEN.2>
  <XCEN.3>Henry</XCEN.3>
  <XCEN.4>T.</XCEN.4>
  <XCEN.5>Jr.</XCEN.5>
  <XCEN.9>
    <HD.2>2.16.840.1.113883.3.5.1.2</HD.2>
    <HD.3>ISO</HD.3>
  </XCEN.9>
</ROL.4>
```

ROL.4.1 ID – Number (ST) - Required or Empty

This component contains the Identifier that can be used to identify this person. This component may be left out of the message if the data are not available,

ROL.4.2 – Family Name (FN) - Required

The Family Name component holds the last name of the person. This component shall be populated whenever the ROL segment is sent.

ROL.4.2.1 – surname - Required

This sub-component contains the last name of the person. It must be valued if the ROL segment is sent. If the name is not available, then the value “Not Provided” shall be sent if the role is filled by a person or “NA” in the case of a premises role.

ROL.4.3 - Given Name – Required or Empty

This component contains the first name of the person. This component may be left out of the message if the data are not available,

ROL.4.4 - Middle Name – Required or Empty

This component contains the middle name of the person. This component may be left out of the message if the data are not available,

ROL.4.5 - Name Suffix – Required or Empty

This component contains the any string that is placed after the name of the person. This component may be left out of the message if the data are not available,

ROL.4.9 - Assigning Authority (HD) - Conditional

This component uniquely identifies the Authority that assigned that person's Identifier (ROL.4.1). The Assigning Authority is encoded as a hierarchical designator (HD) element. This component may be left out of the message if ROL.4.1 is not valued,

Condition: A value for Assigning Authority shall be sent if ROL.4.1 is valued.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
2	999	ST	R		Universal ID	OID for the organization that assigned the person's ID.
3	6	ID	R	0301	Universal ID Type	The identifier type of the universal ID. For OIDs this defaults to ISO

ROL.11 - Office/Home Address (XAD) - Required or Empty

This field contains the address for person or premises in the role.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	184	SAD	RE		Street Address	Fully qualified street name. I.e., 123 Magnolia Street
2	120	ST	RE		Other Designation	An additional address qualifier. E.g. Suite 111
3	50	ST	RE		City	City
4	50	ST	RE		State or Province	State
5	12	ST	RE		Zip or Postal Code	Zip Code
8	50	ST	RE		Other Geographic Designation	This field may carry spatial attributes such as latitude and longitude

Example:

```

<ROL.11>
  <XAD.1>
    <SAD.1>1234 Elm Street</SAD.1>
    <SAD.3>Apt 2A</SAD.3>
  </XAD.1>
  <XAD.2>Suite 111</XAD.2>
  <XAD.3>Anytown</XAD.3>
  <XAD.4>CA</XAD.4>
  <XAD.5>99999-9999</XAD.5>
</ROL.11>

```

ROL.11.1 Street Address (SAD) – Required or Empty

This field contains the street address and dwelling number for the person or organization represented in this ROL segment. For NAHLN usage component 2 is ignored and only components 1 and 3 are supported. If the address does not contain an apartment or dwelling number, component 3 may be left out of the message. It is acceptable, if not preferable, to put the entire delivery street address in SAD.1 rather than splitting apartment number off into SAD.3. NOTE: Within XAD.1 SAD.1 is Required. If no Street Address exists, the entire XAD.1 may be omitted but not just SAD.1.

ROL.11.1.1 Street or Mailing Address (ST) – Required

This component contains the street number and name of the address. It must contain sufficient information to allow geocoding of physical addresses or delivery to PO boxes.

ROL.11.1.3 Dwelling Number (ST) – Required or Empty

This component contains additional address designations such as apartment number.

ROL.11.2 Other Designation (ST) – Required or Empty

This component contains the second line of address. In US usage, it qualifies address. For example: Fourth Floor. It includes only information *not* needed for geocoding of addresses.

ROL.11.3 City (ST) – Required or Empty

This component contains the city of residence associated with the address.

ROL.11.4 State or Province (ST) – Required

This component contains the state associated with the address. For the NAHLN the two-letter state codes will be used.

ROL.11.5 Zip or Postal Code (ST) – Required or Empty

This component contains the official zip or postal code associated with the address. A minimum of the 5-digit zip code is required.

ROL.11.8 Other Geographic Designation (ST) – Required or Empty

This component may contain the GPS or other geographic coordinates associated with the address.

ROL.11.9 County/Parish Code (IS) – Required or Empty

A code that represents the county in which the specified address resides.

Allowable code values: codes defined by government (such as FIPS codes <http://www.census.gov/geo/www/fips/fips.html>).

ROL.12 - Phone (XTN) - Required or Empty

This component provides the telecommunications contact information for the person or organization in the role. It is repeatable, which means that multiple contact phone numbers or email addresses can be provided for a particular role. Note: the trend is away from providing phone number parsed into components and toward providing the whole phone number in XTN.12.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
2	3	ID	R	0201	Telecommunication Use Code	
3	8	ID	R	0202	Telecommunication Equipment Type	
4	199	ST	RE		Communication Address	
6	5	NM	C		Area/City Code	
7	9	NM	C		Local Number	

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
8	5	NM	CE		Extension	
9	199	ST	O		Any Text	
10	4	ST	O		Extension Prefix	
11	6	ST	O		Speed Dial Code	
12	199	ST	C		Unformatted Telephone number	

An example of ROL.12 (Work Phone):

```
<ROL.12>
  <XTN.2>WPN</XTN.2>
  <XTN.3>PH</XTN.3>
  <XTN.12>88855523234232</XTN.6>
</ROL.12>
```

An example of ROL.12 (Email address):

```
<ROL.12>
  <XTN.2>NET</XTN.2>
  <XTN.3>Internet</XTN.3>
  <XTN.4>hgibson@chickenvet.com</XTN.4>
</ROL.12>
```

HL7 Table 0201

ASN	Answering Service Number
BPN	Beeper Number
EMR	Emergency Number
NET	Network (email) Address
ORN	Other Residence Number
PRN	Primary Residence Number
VHN	Vacation Home Number
WPN	Work Number

HL7 Table 0202

BP	Beeper
CP	Cellular Phone
FX	Fax
Internet	Internet Address: Use Only If Telecommunication Use Code Is NET
MD	Modem
PH	Telephone
TDD	Telecommunications Device for the Deaf
TTY	Teletypewriter

X.400	X.400 email address: Use Only If Telecommunication Use Code Is NET
-------	-----------------------------------------------------------------------

ROL.13 - Person's Location (PL) - Conditional or Empty

This field is used to specify Premises ID or Non-Producer Participant ID for facilities for this role. If ROL.3 has a value indicating it to be the premises (PREM) from which the animal or specimens originated, then this field should be valued.

Condition: This field must be valued if ROL.3 is PREM.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
6	20	IS	RE	0305	Person Location Type	The type of location represented by the Role.
9	199	ST	O		Location Description	String description of a location – human readable
10	427	EI	RE		Comprehensive Location Identifier	Location identifier, as assigned by the organization represented by the universal ID.

An example of ROL.13 (Person Location):

```
<ROL.13>
  <PL.6>P</PL.6>
  <PL.9>Second to the last farm on the road</PL.9>
  <PL.10>
    <EI.1>000UDC0</EI.1>
    <EI.3>2.16.840.1.113883.3.5.6.1.1</EI.3>
    <EI.4>ISO</EI.4>
  </PL.10>
</ROL.13>
```

ROL.13.6 Person Location Type (IS) – Required or Empty

This field represents the type of **premises** represented in the ROL segment. This is an adaptation of the use of the field as described in the HL7 standard, where the ROL segment is typically used only for persons. The value set is based on the operation type codes described in the USDA National Animal Disease Traceability Program Standards and Technical Reference (<http://www.aphis.usda.gov/traceability>)⁹ Note: There is significant dissatisfaction with this list. Expect efforts to enhance it in the future.

HL7 User Defined Table 0305

CODE	Description
B	Port of Entry
C	Clinic

⁹ We cannot locate current reference to this list. We will update when available. Previous draft available at: <https://www.aphis.usda.gov/traceability/downloads/archives/nais-descriptive-document-program-standards.pdf>

E	Exhibition
L	Laboratory
M	Market/Collection Point
N	Non-producer participants
O	Boarding Facility
P	Production Unit
Q	Quarantine Facility
R	Rendering
S	Slaughter Plant
T	Tagging Site

ROL.13.9 Location Description (ST) – Required or Empty

This field contains a text-based description of the location. For the purposes of the NAHLN, this description may be used to annotate the location description. For related applications it is a convenient place for human-readable further classification of the source premises.

ROL.13.10 Comprehensive Location Identifier (EI) – Required or Empty

This field contains the unique identifier for the location. For the purposes of the NAHLN, this identifier is the Animal Disease Traceability Program Premises ID or Location ID. The assigning authority for the identifier is listed in component 3.¹⁰

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	199	ST	R		Entity Identifier	Identifier assigned by the organization/entity. For the NAHLN this is the Premises ID
3	199	ST	R		Universal ID	The code system from which the namespace id originates. This is usually the OID assigned for the name of the code system or the program.
4	6	ID	R	0301	Universal ID Type	The identifier type of the universal ID. This should be ISO (ISO OID).

ORDER SEGMENT GROUP

The ORDER group (OPL_O37.ORDER) contains information relevant to the accession, including information on the Owner, Animal, Specimen, Order, and Results. This group is roughly equivalent to the ACCESSION_DETAIL group in the Result message but, of course, without the result. The ORDER group is required and repeatable. The ORDER group XML start tag is provided below:

¹⁰ In the case of LIDs, the “assigning authority” is still the ADT program because it controls the uniqueness of issued LIDs through its standards even though it is the states actually assigning the numbers.

<OPL_037.ORDER>

Next of Kin/Associated Parties Segment (NK1)

Every group in HL7 must start with a required segment. The Next of Kin segment holds this place in the ACCESSION DETAIL group of the NAHLN result message and the ORDER group in the order and response messages.

The Next of Kin segment (NK1) provides owner or responsible party information for the patient and/or specimen. A responsible party or owner always exists, even if the information is not provided to the sending laboratory; however, there won't necessarily be an animal associated with the specimen (as in the case of environmental specimens). "Owner" in this usage is the person with primary responsibility for the animal(s), herd, or premises that is the focus of the testing. While this segment may repeat in the standard, it is constrained to one in the NAHLN usage. Only the primary contact person should be placed in this segment. Other interested or related parties should be communicated using ROL segments.

NAHLN Supported Fields for the NK1 Segment

SEQ	LEN	DT	OPT	R P/#	TBL#	ITEM#	ELEMENT NAME
1	4	SI	R			00190	Set ID - NK1
2	250	XPN	CE		0200	00191	Name
3	705	CWE	C		0063	00192	Relationship
4	250	XAD	O			00193	Address
5	250	XTN	O	Y		00194	Phone Number
6	250	XTN	O	Y		00195	Business Phone Number
13	250	XON	C			00202	Organization Name - NK1
20	705	CWE	O		0296	00118	Primary Language

Below are two examples of the NAHLN constrained NK1 segment:

The first example is when no owner or responsible party is known or sent. The segment is required by the standard as a marker for the start of the group if the message is sent in the old pipe-delimited form. So we send a minimum here:

```
<NK1>
  <NK1.1>1</NK1.1>
</NK1>
```

The second example is a very complete set of information about the owner. Most instances will be something in between in terms of completeness.

```
<NK1>
  <NK1.1>1</NK1.1>
  <NK1.2>
    <XPN.1>
      <FN.1>Smith</FN.1>
    </XPN.1>
    <XPN.2>John</XPN.2>
    <XPN.3>Q.</XPN.3>
    <XPN.4>Jr.</XPN.4>
  </NK1.2>
  <NK1.3>
    <CWE.1>OWN</CWE.1>
    <CWE.2>Owner</CWE.2>
    <CWE.3>HL70063</CWE.3>
```

```

</NK1.3>
<NK1.4>
  <XAD.1>
    <SAD.1>348735 Laguna Pl.</SAD.1>
  </XAD.1>
  <XAD.3>Agtown</XAD.3>
  <XAD.4>CA</XAD.4>
  <XAD.5>95999</XAD.5>
</NK1.4>
<NK1.5>
  <XTN.2>PRN</XTN.2>
  <XTN.3>PH</XTN.3>
  <XTN.6>555</XTN.6>
  <XTN.7>4444444</XTN.7>
</NK1.5>
<NK1.6>
  <XTN.2>WPN</XTN.2>
  <XTN.3>PH</XTN.3>
  <XTN.6>555</XTN.6>
  <XTN.7>3333333</XTN.7>
</NK1.6>
<NK1.13>
  <XON.1>Fred's Free Range Feasants</XON.1>
</NK1.13>
<NK1.20>
  <CWE.1>Eng</CWE.1>
  <CWE.2>English</CWE.2>
  <CWE.3>ISO639</CWE.3>
</NK1.20>
</NK1>

```

NK1.1 Set ID - NK1 (SI) - Required

This field is required for HL7 conformance and should be defaulted to 1. In messages with multiple ORDER groups, this can be used to enumerate the groups by incrementing in each successive NK1. In this usage, it is functioning as the Set ID for the group. This usage is optional and should not be relied upon by receiving systems.

NK1.2 - Name (XPN) - Conditional or Empty

This field contains the first name, last name, middle initial and suffix of the related party. It is a constrained version of the full XPN data type, which provides additional information about the name type, name validity dates and other administrative attributes of name. For the purposes of the NAHLN, only the first four components of the field are supported. Use is required if further elements are to be included.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	194	FN	R		Family Name	Surname or last name
2	30	ST	RE		Given Name	First name
3	30	ST	RE		Second and Further Given Names or Initials Thereof	Middle name or initial

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
4	20	ST	RE		Suffix (e.g., JR or III)	

NK1.2.1 Family Name (FN) Required

This component allows full specification of the surname of the person using the FN complex data type. For the purposes of the NAHLN only the first subcomponent of the data type is required.

NK1.2.1.1 Surname (ST) Required

This subcomponent represents the last name of the person.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	50	ST	R		Surname	

NK1.2.2 Given Name (ST) Required or Empty

First name of person.

NK1.2.3 Second and Further Given Names or Initials Thereof (ST) Required or Empty

Multiple middle names of the person may be included by separating them with spaces.

NK1.2.4 Suffix (ST) Required or Empty

Used to specify a name suffix (e.g., Jr. or III) for the person.

NK1.3 - Relationship (CNE) - Conditional

This field is required to indicate the nature of the relationship between the primary responsible person and the animal(s) or location being tested. Values come from HL7 USER table 0063 as restricted and extended by NAHLN. Its use is required if other elements of NK1 beyond SetID are supplied.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	R		Identifier	Code representing the type of relationship (e.g. OWN for owner)
2	199	ST	RE		Text	Text description from table
3	20	ID	R	0396	Name of Coding System	HL7 User defined table HL70063

Example:

```

<NK1.3>
  <CWE.1>OWN</CWE.1>
  <CWE.2>Owner</CWE.2>
  <CWE.3>HL70063</CWE.3>
</NK1.3>

```

HL7 Table 0063 (limited to NAHLN usage)

ASC	Associate
EMC	Emergency contact
GRD	Guardian
MGR	Manager
OWN	Owner
TRA	Trainer
UNK	Unknown

NK1.4 - Address (XAD) - Optional

This field contains the address for the responsible party. See discussion of XAD components under ROL.11.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	184	SAD	R		Street Address	Street name, suite number, apt. number
2	120	ST	RE		Other Designation	An additional address qualifier. E.g. Suite 111
3	50	ST	RE		City	City
4	50	ST	RE		State or Province	2 letter state code
5	12	ST	RE		Zip or Postal Code	Zip code
8	50	ST	RE		Other Geographic Designation	This field may carry spatial attributes such as latitude and longitude or PIN
9	20	IS	RE	0289	County/Parish Code	The local jurisdiction at the county level.

Example:

```

<NK1.4>
  <XAD.1>
    <SAD.1>348735 Laguna P1.</SAD.1>
  </XAD.1>
  <XAD.3>Agtown</XAD.3>
  <XAD.4>CA</XAD.4>
  <XAD.5>95999</XAD.5>
</NK1.4>

```

NK1.5 - Phone Number (XTN) - Optional

Phone Number and/or email address for the related party. This element can repeat to send multiple phone numbers.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
2	3	ID	R	0201	Telecommunication Use Code	A code that represents a specific use of a telecommunication number
3	8	ID	R	0202	Telecommunication Equipment Type	A code that represents the type of telecommunication equipment
4	199	ST	C		Communication Address	Email address
6	5	NM	C		Area/City Code	Area code
7	9	NM	C		Local Number	Phone number
8	5	NM	CE		Extension	Extension
12	199	ST	C		Unformatted Telephone number	An expression of the telephone number as an unparsed string

Example:

```

<NK1.5>
  <XTN.2>PRN</XTN.2>
  <XTN.3>PH</XTN.3>
  <XTN.6>555</XTN.6>
  <XTN.7>4444444</XTN.7>
</NK1.5>

```

NK1.6 - Business Phone Number (XTN) - Optional

Business Phone Number and email address for the related party. This element can repeat to send multiple phone numbers.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
2	3	ID	R	0201	Telecommunication Use Code	A code that represents a specific use of a telecommunication number
3	8	ID	R	0202	Telecommunication Equipment Type	A code that represents the type of telecommunication equipment
4	199	ST	C		Communication Address	Email address
6	5	NM	C		Area/City Code	Area code
7	9	NM	C		Local Number	Phone number
8	5	NM	CE		Extension	Extension
12	199	ST	C		Unformatted Telephone number	An expression of the telephone number as an unparsed string

Example business phone number:

```
<NK1.6>
  <XTN.2>WPN</XTN.2>
  <XTN.3>PH</XTN.3>
  <XTN.6>555</XTN.6>
  <XTN.7>3333333</XTN.7>
</NK1.6>
```

Example business email:

```
<NK1.6>
  <XTN.2>NET</XTN.2>
  <XTN.3>Internet</XTN.3>
  <XTN.4>jsmith@busyness.com</XTN.4>
</NK1.6>
```

NK1.13 - Organization Name (XON) - Conditional

Organization name in for owners or other responsible parties that are, or represent, an organization. If a person name is not supplied in NK1.2, then this field shall be valued. Only the first component of the data type is supported in the NAHLN and must be valued if the Organization Name is supplied.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	50	ST	R		Organization Name	The name of the organization associated with the person named in this segment.

Example:

```
<NK1.13>
  <XON.1>Fred's Free Range Pheasants</XON.1>
</NK1.13>
```

NK1.20 - Primary Language (CWE) - Optional

This field captures the primary language spoken by the responsible party. The code system used for this field is the ISO 639 language codes. Please note that the HL7 table used for this component is user defined table 0296 which is populated by the ISO 639 table. Either two- or three-letter codes may be sent. The full language reference table is available from the NAHLN central terminology services. If the first three components are not valued, component 9, original text must be valued if this field is sent. Original text may be included as a cross check for the assigned code as well.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	RE		Identifier	Code for language
2	199	ST	RE		Text	Textual from table
3	20	ID	RE	0396	Name of Coding System	Languages will be drawn from the ISO639 standard. Default value will be LISO639.
4	20	ST	CE		Alternate Identifier	Local code or other alternative language code
5	199	ST	CE		Alternate Text	Textual description of the language
6	20	ID	CE	0396	Name of Alternate Coding System	L for local code
9	199	ST	C		Original Text	Text used to assign the code

Example:

```
<NK1.20>
  <CWE.1>Eng</CWE.1>
  <CWE.2>English</CWE.2>
  <CWE.3>LISO639</CWE.3>
</NK1.20>
```

Below is a highly abridged subset of the ISO 639 language codes:

ISO 639: 3-letter codes	ISO 639: 2-letter codes	Description
Ara	ar	Arabic
Arc		Aramaic
Arm/hye	hy	Armenian
art		Artificial (Other)
Aze	az	Azerbaijani
Baq/eus	eu	Basque
Bul	bg	Bulgarian
Cai		Central American Indian (Other)

Chi/zh	zh	Chinese
Dut/nla	nl	Dutch
Eng	en	English
Epo	eo	Esperanto
fra/fre	fr	French
Deu/ger	de	German
Heb	he	Hebrew
Ice/isl	is	Icelandic
Ind	id	Indonesian
ira		Iranian (Other)
ita	it	Italian
Jpn	ja	Japanese
Kor	ko	Korean
may/msa	ms	Malay
mul		Multiple languages
Nor	no	Norwegian
Nno		Norwegian (Nynorsk)
Fas/per	fa	Persian
Pol	pl	Polish
Por	pt	Portuguese
Rus	ru	Russian
San	sa	Sanskrit
	sr	Serbian
Som	so	Somali
esl/spa	es	Spanish
Tha	th	Thai
Ukr	uk	Ukrainian
Yid	yi	Yiddish
Zul	zu	Zulu

PATIENT GROUP

The PATIENT group (OPL_O37.PATIENT) contains information about an individual animal or a population of animals that are the subject of the observation(s) that immediately follow in the message. The PATIENT group is conditional. If the specimens submitted are not associated with an animal, the Patient group is not sent. It is not repeatable *within* an ORDER group, although ORDER may repeat. If the PATIENT group is included in the message, the PID segment is Required. Only one animal or animal group shall be sent per accession detail. The general structure of the patient group is described below:

```
[
    --- PATIENT begin
        PID - Patient
        [{OBX - Observations on Patient}]
    ]
    --- PATIENT end
```

PATIENT groups contain a single PID segment something like that shown here.

Example PID:

<PID>

```

<PID.3>
  <CX.1>Y_1234</CX.1>          <!--Example Animal ID-->
</PID.3>
<PID.5>
  <XPN.1><FN.1>NA</FN.1></XPN.1>
</PID.5>
<PID.7>200804</PID.7>          <!--Example Date/Time of Birth-->
<PID.8>X</PID.8>              <!--Example Gender-->
<PID.10>
  <CWE.9>white</CWE.9>        <!--Example Color-->
</PID.10>
<PID.29>20080814</PID.29>     <!--Example Date/Time of Death-->
<PID.30>Y</PID.30>           <!--Example Death Indicator-->
<PID.35>
  <CWE.1>35839008</CWE.1>     <!--Example Species SNOMED Code-->
  <CWE.2>Leghorn Chicken </CWE.2> <!--Example SNOMED Preferred Term-->
  <CWE.3>SCT</CWE.3>          <!--Term drawn from SNOMED-CT Code System-->
  <CWE.4>CHI</CWE.4>          <!--Example alternate code-->
  <CWE.5>Chicken</CWE.5>     <!--Example Alternate Description-->
  <CWE.6>NAIS</CWE.6>        <!--Example Code system for Alternate Code-->
</PID.35>
<PID.38>
  <CWE.1>LY</CWE.1>          <!--Example Production Class Code-->
  <CWE.2>L ayer</CWE.2>       <!--Example Production Class Description-->
  <CWE.3>HL70429</CWE.3>     <!--Production Class code table ID-->
</PID.38>
</PID>

```

Patient Identification Segment (PID)

The patient identification segment is used to identify the animal or population source for the specimen for which the results are being reported. Whenever the results reported relate to a specific animal or group, the patient group and PID segment shall be included. The PID contains information relevant to the animal or group so that each field in the PID is interpreted as relating to that unit. For a herd or flock, the Patient Identifier List (PID.3) may contain the ADT Group Identification Number (GIN) or other herd or flock ID. Data such as species, and date of birth may be transmitted using this segment. For animal groups, each field is filled in with as much specificity as appropriate to represent the group as a whole.

The PID segment is not repeatable. It is required within the Patient group.

NAHLN Supported Fields for the PID Segment

SEQ	LEN	DT	OPT	RP/#	TBL#	ELEMENT NAME
3	250	CX	R	Y		Patient Identifier List
5	250	XPN	R	Y	0200	Patient Name
7	24	DTM	RE			Date/Time of Birth
8	1	IS	RE		0001	Administrative Sex
10	705	CWE	O	Y	0005	Race
11	250	XAD	O			Patient Address
29	24	DTM	CE			Patient Death Date and Time
30	1	ID	R		0136	Patient Death Indicator
31	1	ID	C		0136	Identity Unknown Indicator

SEQ	LEN	DT	OPT	RP/#	TBL#	ELEMENT NAME
35	705	CWE	R		0446	Species Code
37	80	ST	O			Strain
38	705	CWE	R	2	0429	Production Class Code

PID.3 - Patient Identifier List (CX) - Required

The patient identifier list is a required and repeatable CX (Extended composite ID) field. In NAHLN usage this shall contain either an identifier for an individual animal or an identifier of the group (herd/flock).

If this message pertains to a specific individual animal, the animal's identifier goes here. Any number of identifier systems is acceptable. Refer to the Animal Disease Traceability Program. In general, the most universal identifier available should be the first (or only) identifier.¹¹ The identifier system is identified in the “Assigning Authority” component. If more than one identifier is provided, each instance refers to the *same* patient or population. **It is *not* a list of different patients.** If a population is being identified, a herd/flock identifier should be used. Similarly, if this message deals with a group of animals, the appropriate group identifier should be provided rather than a list of individual animal identifiers.

Note: Some surveillance programs do not identify individual animals but simply track specimens on a one-to-one basis with animals. In these cases the best identifier for the animal will be the specimen ID itself which should be used here. This usage applies *only* if no actual animal or group identifiers are available.

The animal ID messaged should be:

1. The official animal identification number and designated as the preferred identifier (placed first in the PID.3 listing)
2. The herd/flock/pen ID if the specimen was pooled from a group of animals.
3. The official program barcode specimen ID if provided without other animal identification.
4. “Not Provided” if unknown
5. “MASK” if the ID is withheld for confidentiality

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	15	ST	R		ID Number	Identification number/code for patient/subject. (either animal or group)
4	227	HD	R	0363	Assigning Authority	The Authority that assigns this subject's ID number.
5	5	ID	R	0203	Identifier Type Code	Type of identifier, such as Ear Tag, Implant, Back Tag, Official ID, Flock ID, etc.

An example of PID.3 is provided below:

¹¹ Technically, the order of repeats is meaningless in HL7, however putting the most generally accepted ID first is a useful convention.

```

<PID.3>
  <CX.1>840212000000023</CX.1>          <-- US Animal Identification Number -->
  <CX.4>
    <HD.2>2.16.840.1.113883.3.5.6.1.2</HD.2> <-- OID for ADT Animal ID system -->
    <HD.3>ISO</HD.3>
  </CX.4>
  <CX.5>E</CX.5>
</PID.3>

```

PID.3.1 – ID Number (ST) - Required

This field contains the identifier for the animal or group. In combination with the assigning authority, it should allow for the unique identification of an animal or animal group. For the NAHLN, the preferred identifiers are the ADT Animal Identification Number (AIN) or the ADT Group/Lot Identification Number (GIN).

PID.3.4 - Patient Identifier Assigning Authority (HD) - Required or Empty

An Assigning Authority component should be provided for any ID, if the information is available. Assigning authorities consist of a NamespaceID, Universal ID and Universal ID type. The Namespace ID should only be used if a Universal ID is not available, such as when the only ID available is a farm ID, etc. If the Universal ID is supplied (usually an OID), the Universal ID Type shall also be valued (this will normally be ISO). This field may be omitted if the source of the identifier is not provided.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	IS	C	0300	Namespace ID	Rarely used in this context. If the entity that assigned the animal ID does not have an OID, but does have an ID assigned under a program such as the ADT program, such as a PIN or LID for farm tags, that ID goes here and the assigner of that ID in HD.2.
2	999	ST	C		Universal ID	OID for the organization that assigned the patient/subject ID. For example, the OID for an NAIS Individual Animal ID. Conditionality: This field must be valued if a Namespace ID is not provided.
3	6	ID	C	0301	Universal ID Type	The identifier type of the universal ID. For the NAHLN, this should be ISO (ISO OID). Conditionality: This field must be valued if a Universal ID is provided.

PID.3.5 - Identifier Type Code (ID) - Required or Empty

This field contains a code representing the type of identifier valued in PID.3.1. The allowed values for this field component may only be drawn from the NAHLN supported values in HL7 table 0203. HL7 Table 0203 has been extended by the NAHLN to support animal specific identification types. This is allowed as long as local extensions do not conflict with existing codes in the table. The NAHLN supported values for this field may be accessed from:

<http://vtsl.vetmed.vt.edu/nahln/main.cfm>

In practice this field is seldom used.

PID.5 - Patient Name (XPN) - Required

Patient Name is required by the standard if the PID segment is sent in the message. If real data are not available, you may send the term “Not Provided” as a flavor of null for this field. In something of a fluke of the way HL7 works, a full animal name would be provided in the FN.1 component.

Example:

```
<PID.5>
  <XPN.1>
    <FN.1>Not Provided</FN.1>
  </XPN.1>
</PID.5>
```

Example:

```
<PID.5>
  <XPN.1>
    <FN.1>Smar-tee Jones</FN.1>
  </XPN.1>
</PID.5>
```

PID.7 - Date/Time of Birth (DTM) - Required or Empty

The patient's Date/Time of birth is sent as a timestamp (DTM) data type using the ISO 8824-1987 format (YYYY[MM[DD[HH[MM[SS[.S[S[S[S]]]]]]]]][+/-ZZZZ] Precision is indicated by the number of places included. The precision component is only included in the standard for backward compatibility. The minimum allowable value is year. This field is “Required or Empty” and should be provided if logically and clinically relevant to the results reported. For results from an individual patient this will be the date/time of birth to the precision known. If age is known but not to a precision that can be expressed using this method (i.e., to a month, year, etc.) then Age and Age units can be sent in the Observation that follows the PID using LOINC code 21611-9 (Age Estimated). For a homogeneous group specimen (all members of the group are the “same” age) it should contain a date with precision set to encompass the group, thus indicating the age range of the animals affected.

A date of birth example, to the day is shown below:

```
<PID.7>20080814</PID.7>
```

PID.8 - Administrative Sex (IS) - Required or Empty

This field contains the gender code for the animal or all animals in the group represented if applicable. Gender codes used are from the NAIS. Use the codes defined in the user defined table 0001.

```
<PID.8>M</PID.8>
```

HL7 User defined Table 001 – Administrative Sex

F	Female
S	neutered female (spayed)
M	Male
C	neutered male (castrated)
U	gender unknown
X	Multiple genders

PID.10 - Race (CWE) - Optional

This field is normally used to transmit the race or ethnicity of a person. For the NAHLN we have co-opted the field to convey the coloring and markings of the animal. A comprehensive standard table of markings and colors has not been developed so laboratories may send either local codes (components 4-6) or original text (component 9). This field may repeat

SEQ	LEN	DT	TBL#	OPT	Component NAME	Description
1	20	ST		RE	Identifier	Code for color and/or markings
2	199	ST		RE	Text	Text description
3	20	ID		RE	Name of Coding System	There is no standard code for this field.
4	20	IS		CE	Alternate Identifier	Local code or other alternative color and/or markings code
5	199	ST		CE	Alternate Text	Textual description of the color or marking
6	20	ID	0396	CE	Name of Alternate Coding System	L for local code
9	199	ST		C	Original text	Text used to assign the code

PID.29 - Patient Death Date Time (DTM) - Conditional or Empty

This field contains the date of death for necropsy cases—except those on animal sacrificed for necropsy—or other cases where animal has died. It follows the same date time format as other date fields.

<PID.29>200812051025-0800</PID.29>

If PID.30 (Patient Death Indicator) is valued with a “Y” this field may be valued with the date/time of death if available. The minimal value for this field would include the date of death.

PID.30 - Patient Death Indicator (ID) - Required or Empty

This is a simple Y/N to indicate death. Cases in which one or more animals are sacrificed for necropsy or sampling takes place at slaughter are *not* considered to be patient death. If PID.29 is valued, this field must be either populated with “Y” or not sent.

Example:

<PID.30>Y</PID.30>

PID.31 - Identity Unknown Indicator (ID) - Conditional

This is a simple Y/N to indicate that the animal source of the specimen cannot be identified. This value shall be sent if the animal had no demonstrable identifiers associated with it (example, wild birds for AI surveillance)). This field adds the information that even the lab cannot identify the source animal or farm such as in anonymous test streams.

Example:

<PID.31>Y</PID.31>

PID.35 - Species (CWE) - Required

This field contains the code value and description for an animal or animal group's species. Species is sent as a CWE data type. The following table describes the usage of this field. Species is a Required field if the PID segment is sent. The coding system for the first identifier is to be SNOMED-CT.

In cases where the specific species is not known, the lowest level of taxonomy should be sent. For example, if specimens from a parrot species are submitted without more identifying information, the proper code to send would be: 28631000009108, Parrot.

Animal taxonomy codes can be found at

<http://vtsl.vetmed.vt.edu/nahln/main.cfm?page=subset&subset=species>

NOTE: The HL7 standard supports two fields to represent species and breeds in the result message. This structure was created to support the most common way existing veterinary LIMS capture taxonomy. However, in version 3 of HL7 it has been recognized that breed is a continuum with species in the taxonomic tree and only requires a single field to fully represent the taxonomy of an organism (this is currently the way SNOMED handles breeds as well). Thus for the purposes of the NAHLN, a laboratory must transmit animal taxonomy by putting the most granular taxonomy known in the species field, up to and including breed, but not strain. The second set of components (CWE.4-CWE.6) may be used if the taxonomy of the animal is not represented in the NAHLN reference tables for species or breed. The original text description should also be sent in component 9 of the CWE data type. If neither the NAHLN reference tables nor the local laboratory Taxonomy list contains an adequate representation of the Taxonomy then component 9 (original text) shall be sent.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	RE		Identifier	SNOMED-CT code for taxonomy
2	199	ST	RE		Text	Textual description of the taxonomy
3	20	ID	RE	0396	Name of Coding System	Always SCT for SNOMED
4	20	ST	CE		Alternate Identifier	Local code or other alternative taxonomy code (e.g.NAIS three character species code)
5	199	ST	CE		Alternate Text	Textual description of the species
6	20	ID	CE	0396	Name of Alternate Coding System	L for local code or NAIS for NAIS Species codes

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
9	199	ST	C		Original Text	The original text string submitted on the form

Example:

```
<PID.35>
  <CWE.1>47290002</CWE.1>
  <CWE.2>Gallus gallus</CWE.2>
  <CWE.3>SCT</CWE.3>
  <CWE.4>CHI</CWE.4>
  <CWE.5>Chicken</CWE.5>
  <CWE.6>ADT</CWE.6>
  <CWE.9>wild chicken in backyard</CWE.9>
</PID.35>
```

Or more commonly

```
<PID.35>
  <CWE.1>47290002</CWE.1>
  <CWE.2>Gallus gallus</CWE.2>
  <CWE.3>SCT</CWE.3>
</PID.35>
```

*(Note: Code used from SNOMED CT is the ConceptID, not the Legacy Code)

PID.37 - Strain (ST) - Optional

The PID.37 is a free text field that allows additional taxonomic information (strain or variant) to be included.

Example:

```
<PID.37>DXL</PID.37>
```

PID.38 - Production Class Code (CWE) - Required or Empty

Production class indicates the general category of use of the animal or group being tested. The production class is provided as a coded element (CWE) data field and is required or may be empty. The user-defined table 0429 contains the Production Class codes. The supported codes for the NAHLN may be downloaded from the NAHLN terminology site at: <http://vtsl.vetmed.vt.edu/nahln/>

The following table describes each component of the coded entry for Production Class.

The conditionality of this field is the same as that for most other CWE coded fields. The second set of components (CWE.4-CWE.6) may be used if the production class of the animal is not represented in the NAHLN reference tables for breed. The original text description should also be sent in component 9 of the CWE data type. If neither the NAHLN reference tables nor the local laboratory Production Class list contains an adequate representation of the Production Class then component 9 (original text) shall be sent.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	RE		Identifier	HL7 code for Production Class

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
2	199	ST	RE		Text	Textual description of the Production Class
3	20	ID	RE	0396	Name of Coding System	In this case, field should be hard-coded to HL70429
4	20	ST	CE		Alternate Identifier	Local code or other alternative production class code
5	199	ST	CE		Alternate Text	Textual description of the production class
6	20	ID	CE	0396	Name of Alternate Coding System	L for local coding system
9	199	ST	C		Original Text	The original text string submitted on the form

Example:

```
<PID.38>
  <CWE.1>LY</CWE.1>
  <CWE.2>Layer</CWE.2>
  <CWE.3>HL70429</CWE.3>
</PID.38>
```

Production class codes can be found at

http://vtsl.vetmed.vt.edu/nahln/main.cfm?page=subset&subset=production_class

Patient Observation/Result Segment (OBX)

This segment represents a set of observations related to the patient other than laboratory observations. Specific observations supported for each test type will be listed in the instructions for that testing program. Any other OBX segments sent at this level in the message will be ignored. This segment may repeat.

This segment will likely be more useful in the order message than it has been in the result message sent without a corresponding electronic order. History of present illness provides any narrative the lab might find useful in performance or interpretation of testing.

NOTE: Unlike the result message, this OBX is not wrapped in a GROUP element but is simply an optional and repeatable OBX.

SEQ	LEN	DT	OPT	RP/#	TBL#	ELEMENT NAME
2	3	ID	R		0125	Value Type
3	705	CWE	R		9999	Observation Identifier
5	99999	varies	R	Y		Observation Value
6	705	CWE	C		Units	Units
11	1	ID	R		0085	Observation Result Status
14	24	DTM	RE		00582	Date/Time of Observation

The following are examples of PATIENT_OBSERVATION groups:

```

</PID>
<OBX>
  <OBX.2>ST</OBX.2>
  <OBX.3>
    <CWE.1>10164-2</CWE.1>
    <CWE.2>History of present illness Narrative</CWE.2>
    <CWE.3>LN</CWE.3>
  </OBX.3>
  <OBX.5>Flock has sudden increase in mortality </OBX.5>
  <OBX.11>F</OBX.11>
</OBX>
<OBX>
  <OBX.2>ST</OBX.2>
  <OBX.3>
    <CWE.1>46251-5</CWE.1>
    <CWE.2>Age Group</CWE.2>
    <CWE.3>LN</CWE.3>
  </OBX.3>
  <OBX.5>
    <CWE.1>28911000009108</CWE.1>
    <CWE.2>Suckling pig for meat production (organism)</CWE.2>
    <CWE.3>SCT</CWE.3>
  </OBX.5>
  <OBX.11>F</OBX.11>
</OBX>

```

OBX.2 - Value Type (ID) - Required

This field contains the identifier of the HL7 data type contained in the Observation Value (OBX.5) field. These two fields (OBX.2 and OBX.5) combined allow for flexibility in reporting a range of different types of observations. The receiving application shall read this field in order to parse the OBX.5 value correctly. The data type will be determined by the NAHLN IT CORE COMMITTEE for each patient observation type required.

OBX.3 - Observation Identifier (CNE) - Required

Observation Identifier is a field of CNE data type that unambiguously identifies the specific observation represented by this segment. For the NAHLN, only LOINC codes approved by the NAHLN IT CORE COMMITTEE may be transmitted. The first component contains the LOINC code, the second contains the LOINC Short name for the code, and the third is the string “LN” to identify the coding system as LOINC. Only the first three components of the CNE data type are supported in the NAHLN message and all are required. This is an example where CNE encoding strength is sent as XML tag CWE.

SEQ	Component NAME	LEN	DT	TBL#	OPT	Description
1	Identifier	20	ST		R	The LOINC code of the specific observation. This code will be established by the NAHLN Technical Committee for each observation required for specific tests or programs supported
2	Text	199	ST		RE	LOINC Long Common Name

SEQ	Component NAME	LEN	DT	TBL#	OPT	Description
3	name of coding system	20	ID	0396	R	The coding system from which the observation identifier originated. The value for this field shall be LN.

Note: See instructions for specific disease testing program for values of patient observations required by that program.

OBX.5 - Observation Value (VARIES) - Required

The Observation Value field will depend upon the type of observation being transmitted. This will be established on a test-by-test or program-by-program basis.

OBX.6 - Units (CNE) - Conditional

This field represents the unit of value for the data entered in OBX.5, if needed. The OBX.6 is conditional field as any OBX segment with a value of NM in OBX.2 shall have units associated with it, but no other value for OBX.2 requires units. Units are to be supplied as a coded entry (CNE) data type. The default coding system consists of the ISO abbreviation for a single case unit (ISO 2955-83) plus extensions that do not collide with ISO abbreviations. We designate this coding system as ISO+. ¹² The ISO+ abbreviations are the codes for the default coding system. Consequently, when ISO+ units are being used, only ISO+ abbreviations need to be sent. The Uniform Code for Units of Measure (UCUM) ¹³ system of units is rapidly overtaking ISO+ and may at some point replace it in the NAHLN standard.

SEQ	Component NAME	LEN	DT	TBL#	OPT	Description
1	Identifier	20	ST		R	Units abbreviated in ISO or ANSI standard abbreviation or Uniform Code for Units of Measure (UCIM) code.
2	Text	199	ST		RE	Textual description
3	Name of Coding System	20	ID	0396	R	Either ISO for metric units or ANS+ for "English" units, or UCUM for more current units.

An example of OBX.6 is shown below:

¹² Both the ISO unit's abbreviations and the extensions are defined in the HL7 standard Section 7.4.2.6.2, "ISO and ANSI customary units abbreviations." HL7 Messaging Standard Version 2.5, 2003

¹³ <https://ucum.nlm.nih.gov/>

```

<OBX.6>
  <CWE.1>G</CWE.1>
  <CWE.2>gram</CWE.2>
  <CWE.3>ISO</CWE.3>
</OBX.6>

```

OBX.11 - Observation Result Status (ID) - Required

As the observation result is assigned at the time the accession is received this observation status is always a final observation. The value is fixed as "F."

OBX-14 Date/Time of the Observation (DTM) - Required or Empty

This field represents the physiologically relevant date-time or the closest approximation to that date-time. In the case of observations about the patient such as categorical age, it is the date when that assessment was made or applies.

SPECIMEN GROUP

The SPECIMEN group (OPL_O37.SPECIMEN) is required and repeatable and contains a specimen, any observations directly on the specimen and all the orders and observations pertaining to it. It contains a required Specimen Segment (SPM) followed by a required OBSERVATION_REQUEST group. One or more OBSERVATION_REQUEST groups can be associated with a single specimen segment.

Specimen Group Abstract Message Structure

Segment	Description	HL7 Chapter
{	--- SPECIMEN begin	
SPM	Specimen	7
[{	--- SPECIMEN_OBSERVATION begin	
OBX	Observations on Specimen	
}]	--- SPECIMEN_OBSERVATION end	
{	--- OBSERVATION_REQUEST begin	
ORC	Common Order	4
OBR	Observation Order	7
[--- TIMING begin	
TQ1	Timing and Quantity	
]	--- TIMING end	
}	--- OBSERVATION_REQUEST end	
}	--- SPECIMEN end	

Specimen Segment (SPM)

The Specimen Segment (SPM) is Required and is used to collect information on the specimen tested. It includes the type of specimen, collection details, and number of specimens if pooled. This segment is not repeatable within the SPECIMEN group; however, multiple SPECIMEN groups are allowed per patient or ORDER group (when there is no PID).

SEQ	LEN	DT	OPT	RP/#	TBL#	ITEM #	ELEMENT NAME
2	855	EIP	R			01755	Specimen ID
4	705	CWE	R			01900	Specimen Type
6	705	CWE	RE	Y		01758	Specimen Additives
8	705	CWE	RE			01901	Specimen Source Site
11	705	CWE	R		0369	01762	Specimen Role
13	6	NM	C			01763	Grouped Specimen Count
14	250	ST	RE			01764	Specimen Description
17	49	DR	RE			01765	Specimen Collection Date/Time
21	705	CWE	O	Y	0490	01767	Specimen Reject Reason
22	705	CWE	O		0491	01768	Specimen Quality
23	705	CWE	RE		0492	01769	Specimen Appropriateness
24	705	CWE	RE	Y	0493	01770	Specimen Condition
26	4	NM	O			01772	Number of Specimen Containers
27	705	CWE	O		9999	01773	Container Type
28	705	CWE	O		0544	01774	Container Condition

The following sections described the fields within the SPM.

SPM.2 - Specimen ID (EIP) - Required

The Specimen ID is an EIP data type that contains the identifier assigned to the specimen by the sending facility (specimen collector) and the testing laboratory. This field is Required. The identifiers are used to track the specimen and associate it with corresponding Orders. For the order message, the PLACER order number is required. It should be some identifier that can be used to both identify the specific specimen in the shipment and also to link that specimen back to the appropriate source system record. Barcodes are extremely valuable here.

An example of SPM.2 is shown below:

```
<SPM.2>
  <EIP.1>
    <EI.1>AHM2005000012</EI.1>          <!--Placer assigned Specimen ID-->
    <EI.3>2.16.840.1.113883.3.5.8.1.3</EI.3> <!--OID for placer if EI.1 is unique-->
    <EI.4>ISO</EI.4>
  </EIP.1>
</SPM.2>
```

SPM.2.1 - Placer Assigned Identifier (EI) – Required

The Placer Assigned Identifier is an EI data type that contains the identifier assigned to the specimen by the facility requesting the tests. This identifier will often be in the form of a barcode attached to the specimen container.

In the case of a pooled specimen, aliquot, or cultured isolate where one or more SPM.3 parent specimen IDs are populated with placer specimen ID(s), this component should contain an identifier that would be used to communicate the identity of the specimen *to* the placer. This field is often the only text made available to analysts, etc., scanning results so some readable value must be present. An alternate usage for aliquots, isolates, etc., with a single parent specimen is to repeat the parent's placer specimen ID on this specimen. (It is how the placer would relate the culture, etc., to what it originally submitted.) For the order message this field will be seldom used and almost exclusively in referral cases where the referring lab has pooled the specimens.

If the identifier in EI.1 is unique in any namespace then EIP.3 should uniquely identify that namespace. For the NAHLN EI.3 will essentially always be an OID and EI.4 the value "ISO". If the identifier in EI.1 is not unique then EI.3 and EI.4 must be omitted.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	199	ST	R		Entity Identifier	Identifier assigned by the ordering submitter/facility with which specimen comes into the lab.
2	20	IS	CE	0363	Namespace ID	Rarely used in this context. Might be the Premises ID of a farm if the specimen came with a farm applied label.
3	199	ST	CE		Universal ID	This is usually the OID assigned of the code system or the program.
4	6	ID	C	0301	Universal ID Type	The identifier type of the universal ID. This should be ISO (ISO OID)

SPM.4 - Specimen Type (CWE) - Required

The Specimen Type field is a coded entry (CWE) that describes the precise nature of the entity that will be the source material for the observation. This field is required. While every effort will be made to provide coded values for specimen types being used in NAHLN agent testing, there may be cases where a coded value specific to a particular specimen type is not immediately available. In these instances, an alternative coded value and description of the specimen may be sent in components 4-6 of the CWE data type. In some cases the precise term is not available in the coded reference system. In these situations, it is allowable to send the original text of the specimen description in the CWE.9 component

The conditionality of this field is the same as that described for most other CWE coded fields. The second set of components (CWE.4-CWE.6) may be used if the specimen type is not represented in the NAHLN reference table. The original text description should also be sent in component 9 of the CWE data type. If neither the NAHLN reference tables nor the local laboratory Specimen Type list contains an adequate representation of the Specimen Type then component 9 (original text) shall be sent.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	RE		Identifier	Coded type of specimen, if available.
2	199	ST	RE		Text	Open text field describing the specimen type. If coded entry is not available for specimen type, users can fill in just the text field.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
3	20	ID	RE	0396	Name of Coding System	Name of coding system used for the identifier given. Can be filled in if available.
4	20	ST	CE		Alternate Identifier	Local code for specimen type
5	199	ST	CE		Alternate Text	Local coding system text for specimen type
6	20	ID	CE	0396	Name of Alternate Coding System	L for local code
9	199	ST	C		Original Text	Specimen description as recorded in source system.

An example of coded value for SPM.4 is shown below:

```
<SPM.4>
  <CWE.1>661000009100</CWE.1>
  <CWE.2>Oropharyngeal swab</CWE.2>
  <CWE.3>SCT</CWE.3>
  <CWE.9>OP swabs</CWE.9>
</SPM.4>
```

Specimen type codes can be found at

http://vtsl.vetmed.vt.edu/nahln/main.cfm?page=subset&subset=specimen_type

Program specific implementation note:

WS-AI Program: The CWE.1 field for this program must be valued using one of the following four specimen type SNOMED codes:

131000009104 – Cloacal Swab
 671000009109 –Tracheal swab
 30931000009104 - Pooled cloacal/oropharyngeal swab
 661000009100 - Oropharyngeal swab

CWE.3 must be populated with “SCT”.

CSF Program: The CWE.1 field for this program must be valued; however, the schema does not restrict the codes used for specimen type, but the allowed specimens are documented in the specific program requirements.

CWE.3 must be populated with “SCT”.

SPM.6 - Specimen Additives (CWE) - Required or Empty

This field identifies any additives or preservatives introduced to the specimen at the time of collection. These additives may be introduced in order to preserve, maintain or enhance the particular nature or a component of the specimen. Often these additives are in the form of contents of collection tubes, etc., used to contain the specimen submitted to the laboratory. Blood in a “purple top tube” for example, has a specimen type of “blood” and a specimen additive of “EDTA.” Values for this field are drawn from HL7 table 0371- Additive. This field may

repeat. Multiple values may be drawn from table 0371 and included in a single repeatable field. Completely correct usage would include additives such as BHI broth or viral transport medium used with swab specimen types however these are often omitted and simply assumed.

The conditionality of the components in this field is the same as that described for most other CWE coded fields. The second set of components (CWE.4-CWE.6) may be used if the additive type is not represented in the NAHLN reference table. The original text description should also be sent in component 9 of the CWE data type. If neither the NAHLN reference tables nor the local laboratory Additive list contains an adequate representation of the Additive then component 9 (original text) shall be sent.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	RE		Identifier	Coded type of specimen additives, if available.
2	199	ST	RE		Text	Text description of the specimen additive(s). If coded entry is not available for specimen type, users may send just the description.
3	20	ID	RE	0396	Name of Coding System	Name of coding system used for the identifier given. This may be defaulted to HL70371.
4	20	ST	CE		Alternate Identifier	Local code for additive type
5	199	ST	CE		Alternate Text	Local coding system text for additive type
6	20	ID	CE	0396	Name of Alternate Coding System	L for local code
9	199	ST	C		Original Text	Additive description as recorded in source system.

An example of SPM.6 is shown below:

```
<SPM.6>
  <CWE.1>VIRTM</CWE.1>
  <CWE.2>Viral transport Medium</CWE.2>
  <CWE.3>HL70371</CWE.3>
  <CWE.9>VTM</CWE.9>
</SPM.6>
```

Specimen additive codes can be found at

http://vtsl.vetmed.vt.edu/nahln/main.cfm?page=subset&subset=specimen_additive

SPM.8 - Specimen Source Site (CWE) - Required or Empty

The Specimen Source Site is a coded entry (CWE) that contains an identifier for the source of the specimen (i.e. the anatomical location, organ or site from which the specimen originated). This field is needed when the

SNOMED specimen hierarchy does not contain a precoordinated term that adequately describes the specimen. For example, in the case where tonsillar tissue is obtained from a pig by scraping, the source would be ‘Tonsillar structure (palatine)’ In general this field is only needed when additional information about the region from where the specimen was collected is needed. For environmental specimens this field may supply additional information on where the specimen originated. In cases where the specimen and specimen source are identical, this field need not be populated.

There is no one correct answer to precisely which detail should be provided by a pre-coordinated, more specific specimen type and which with a less specific type plus a specimen source. Many specimen/source combinations could be correctly expressed either way. The NAHLN will try to provide guidance on specific testing protocols. The best guidance currently is to consult with terminologist at the terminology services lab before resorting to use of specimen source site to refine specimen type.

The conditionality of the components in this field is the same as that described for SPM.4 (Specimen Type). The second set of components (CWE.4-CWE.6) may be used if the specimen source site is not represented in the NAHLN reference table. The original text description should also be sent in component 9 of the CWE data type. If neither the NAHLN reference tables nor the local laboratory Specimen Source list contains an adequate representation of the Specimen Source then component 9 (original text) shall be sent.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	RE		Identifier	Coded identifier for the source of the specimen, if used.
2	199	ST	RE		Text	Textual description of the specimen source site. Example in standard is “liver.”
3	20	ID	RE	0396	Name of Coding System	Name of coding system used, if identifier is filled in.
4	20	ST	CE		Alternate Identifier	Local code for source site
5	199	ST	CE		Alternate Text	Local coding system text for source site
6	20	ID	CE	0396	Name of Alternate Coding System	L for local code
9	199	ST	C		Original Text	Source site description as recorded in source system

An example of SPM.8, used in conjunction with SPM.4 is shown below:

```
<SPM.4>
  <CWE.1>128168004</CWE.1>
  <CWE.2>Tissue specimen from liver</CWE.2>
  <CWE.3>SCT</CWE.3>
</SPM.4>
<SPM.8>
  <CWE.1>89255003</CWE.1>
  <CWE.2>right lateral lobe of liver</CWE.2>
  <CWE.3>SCT</CWE.3>
</SPM.8>
```

Specimen source codes can be found at

http://vtsl.vetmed.vt.edu/nahln/main.cfm?page=subset&subset=specimen_source_site

SPM.11 - Specimen Role (CNE) - Required

The Specimen Role is a coded entry (CNE) that describes the role this specimen(s) is playing. The User Defined table 0369 contains valid values for this field. This is a required field.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	R		Identifier	The coded value representing the role for a specimen.
2	199	ST	RE		Text	Textual description of specimen role.
3	20	ID	R	0396	Name of Coding System	Name of coding system used for specimen role. For the NAHLN this value should be HL70369.

The only values currently used by the NAHLN is "P" "Patient Sample", "G" "Group" and "L" "Pooled".

An example of SPM.11 is shown below:

```
<SPM.11>
  <CWE.1>P</CWE.1>
  <CWE.2>Patient </CWE.2>
  <CWE.3>HL70369</CWE.3>
</SPM.11>
```

HL7 User Defined Table 0369

B	Blind Sample
C	Calibrator
E	Electronic QC, used with manufactured reference providing signals that simulate QC results
F	Specimen used for testing proficiency of the organization performing the testing (Filler)
G	Group (where a specimen consists of multiple individual elements that are not individually identified)

L	Pool (aliquots of individual specimens combined to form a single specimen representing all of the components.)
O	Specimen used for testing Operator Proficiency
P	Patient
Q	Control specimen
R	Replicate (of patient specimen as a control)
V	Verifying Calibrator, used for periodic calibration checks

SPM.13 - Grouped Specimen Count (NM) - Conditional

The Grouped Specimen Count is a numeric value that contains a count of the number of samples submitted together under the same specimen ID. This often occurs when specimens are taken from groups in which the individual animals do not have identifiers. The value of this field represents the number of unique animals sampled and should not be confused with the number of containers for a particular specimen (SPM.26). In general, grouped specimens are not reported as individual results, but as a distribution of results.

This is also used to convey the number of individual specimens combined into a pooled specimen. For field pooled specimens, this is the number of individual samples combined into the single tube represented by this SPM.

Conditionality: If the specimen's role (ROL.11) is "G" for grouped or "L" for pooled, then a numeric value shall be sent in this field.

An example of SPM.13 is shown below:

<SPM.13>5</SPM.13>

Version Note: The HL7 version we are implementing, 2.6 had a mistake and limited this field to Grouped, not Pooled specimens. That was corrected in version 2.9. Because this was a correction not a change, we have applied it retroactively to 2.6. The 2.9 standard now reads:

7.4.3.13 SPM-13 Grouped Specimen Count (NM) 01763

Definition: This field refers to the number of individual specimens of a particular type represented by this instance of a specimen. The use of this field is restricted to specimens upon which all specimen related attributes are identical. This field would only be valued if SPM-11 Specimen Role has the value "G" or "L".

SPM.14 - Specimen Description (ST) - Required or Empty

Specimen Description is a free text field that allows users to further describe their specimen. Text should be limited to descriptions specifically about the specimen.

An example of SPM.14 is shown below:

<SPM.14>Textual description of the specimen - up to 250 characters</SPM.14>

SPM.17 - Specimen Collection Date/Time (DR) - Required

Specimen Collection Date/Time is a date range data type, which means that it records both the starting and ending dates for an event. For NAHLN, just the range start date/time will be used. This field should contain the time at which collection of the specimen occurred.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	24	DTM	R		Range Start Date/Time	Specimen Collection start date/time in ISO format YYYYMMDDHHMM MSS[+-]HHMM

SPM.17.1 - Range Start Date/Time (DTM) - Required

The Range Start Date/Time is a DTM data type and is Required.

Note: While not applicable here, DR.2 would represent the time that collection ended. It is used especially for physiologic studies such as 24-hour urine chemistries.

An example of SPM.17 is shown below:

```
<SPM.17>
  <DR.1>200812050800-0800</DR.1>
</SPM.17>
```

SPM.22 - Specimen Quality (CWE) - Optional

This field contains the value for the quality specimen when sent. The Specimen Quality field is Required or Empty coded entry (CWE).

The conditionality of this field is the same as that described for most other CWE coded fields. The second set of components (CWE.4-CWE.6) may be used if the specimen quality is not represented in the NAHLN reference table. The original text description should also be sent in component 9 of the CWE data type. If neither the NAHLN reference tables nor the local laboratory Specimen Quality list contains an adequate representation of the Specimen Quality, then component 9 (original text) shall be sent.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	RE		Identifier	Specimen Condition Identifier.
2	199	ST	RE		Text	Optional Specimen Condition text.
3	20	ID	RE	0396	Name of Coding System	Coding system used to assign identifier. For the NAHLN this will be HL70491
4	20	ST	CE		Alternate Identifier	Local code for specimen quality
5	199	ST	CE		Alternate Text	Local coding system text for specimen quality
6	20	ID	CE	0396	Name of Alternate Coding System	L for local code

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
9	199	ST	C		Original Text	Specimen quality description as recorded in source system.

User-defined Table 0491 - Specimen Quality

Value	Description
E	Excellent
G	Good
F	Fair
P	Poor

An example of SPM.22 is shown below:

```
<SPM.22>
  <CWE.1>E</CWE.1>
  <CWE.2>Excellent</CWE.2>
  <CWE.3>HL70491</CWE.3>
</SPM.22>
```

SPM.24 - Specimen Condition (CWE) - Required or Empty

This field contains the condition of the specimen when sent. The Specimen Condition field is Required or Empty coded entry (CWE). Appropriate values come from HL7 User defined table 0493. The field can repeat for more complicated issues.

The conditionality of this field is the same as that described for most other CWE coded fields. The second set of components (CWE.4-CWE.6) may be used if the specimen condition is not represented in the NAHLN reference table. The original text description should also be sent in component 9 of the CWE data type. If neither the NAHLN reference tables nor the local laboratory Specimen Condition list contains an adequate representation of the Specimen Condition, then component 9 (original text) shall be sent.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	RE		Identifier	Specimen Condition Identifier.
2	199	ST	RE		Text	Optional Specimen Condition text.
3	20	ID	RE	0396	Name of Coding System	Coding system used to assign identifier. For the NAHLN this will be HL70493
4	20	ST	CE		Alternate Identifier	Local code for specimen condition
5	199	ST	CE		Alternate Text	Local coding system text for specimen condition
6	20	ID	CE	0396	Name of Alternate Coding System	L for local code

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
9	199	ST	C		Original Text	Specimen condition description as recorded in source system.

User-defined Table 0493 - Specimen Condition

Value	Description
AUT	Autolyzed
CLOT	Clotted
CON	Contaminated
COOL	Cool
FROZ	Frozen
HEM	Hemolyzed
LIVE	Live
ROOM	Room temperature
SNR	Specimen not received
WRM	Warm

An example of SPM.24 is shown below:

```
<SPM.24>
  <CWE.1>COOL</CWE.1>
  <CWE.2>Coo1</CWE.2>
  <CWE.3>HL70493</CWE.3>
</SPM.24>
```

SPM.26 - Number of Specimen Containers (NM) - Optional

This field represents the number of containers that a specimen is contained in. For example, a single blood collection into multiple red-top tubes (to provide more serum for testing) would have the number of tubes collected listed in this field. In the vast majority of cases specimens will be contained in a single container. This field provides a way to handle multiple containers for the same specimen.

An example of SPM.13 is shown below:

```
<SPM.26>2</SPM.26>
```

SPM.27 - Container Type (CWE) - Optional

This field contains the type of container used to submit the specimen. The Container Type field is Required or Empty coded entry (CWE). A standard table has not yet been developed for container types. Thus, it is permissible for this release of the NAHLN to value only the CWE.9 component with the original text description of the container.

The conditionality of this field is the same as that described for most other CWE coded fields. The second set of components (CWE.4-CWE.6) may be used if the Container Type is not represented in the NAHLN reference table. The original text description should also be sent in component 9 of the CWE data type. Because the NAHLN does not have a standard list of container types, in most cases component 9 (original text) will be sent.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	RE		Identifier	Container Type Identifier.
2	199	ST	RE		Text	Optional Specimen Condition text.
3	20	ID	RE	0396	Name of Coding System	Coding system used to assign identifier. There is currently no standard code system for container.
4	20	ST	CE		Alternate Identifier	Local code for container type
5	199	ST	CE		Alternate Text	Local coding system text for container type
6	20	ID	CE	0396	Name of Alternate Coding System	L for local code
9	199	ST	C		Original Text	Container type description as recorded in source system.

An example of SPM.27 is shown below:

```
<SPM.27>
  <CWE.9>Snap-cap Tube</CWE.9>
</SPM.27>
```

Specimen Observation/Result Segment (OBX)

This repeating segment represents a set of observations related to the specimen other than laboratory observations. Specific observation supported for each test type will be listed in the instructions for that testing program. Any other OBX segments sent at this level in the message will be ignored.

SEQ	LEN	DT	OPT	RP/#	TBL#	ELEMENT NAME
2	3	ID	R		0125	Value Type
3	705	CWE	R			Observation Identifier
5	99999	Varies	R			Observation Value
6	705	CWE	C			Units
11	1	ID	R		0085	Observation Result Status
14	24	DTM	RE		00582	Date/Time of Observation

The following is an example specimen related OBX segment. Here to convey the color of a urine specimen just as an example.

```
<OBX>
  <OBX.2>ST</OBX.2>
  <OBX.3>
    <CWE.1>5778-6</CWE.1>
```

```

    <CWE.2>Color of urine</CWE.2>
    <CWE.3>LN</CWE.3>
  </OBX.3>
  <OBX.5>Light Straw</OBX.5>
  <OBX.11>F</OBX.11>
</OBX>

```

OBX.2 - Value Type (ID) - Required

This field contains the identifier of the HL7 data type contained in the Observation Value (OBX.5) field. These two fields combined allow for flexibility in reporting a range of different types of observations. The receiving application shall read this field in order to parse the value correctly. The data type will be determined by the NAHLN IT CORE COMMITTEE for each specimen observation type required.

OBX.3 - Observation Identifier (CNE) - Required

Observation Identifier is a field of CNE data type that unambiguously identifies the specific observation represented by this segment. For the NAHLN, only LOINC codes approved by the NAHLN IT CORE COMMITTEE may be transmitted. The first component contains the LOINC code, the second contains the LOINC Short name for the code, and the third is the string “LN” to identify the coding system as LOINC. Only the first three components of the CNE data type are supported in the NAHLN message.

HL7 Component Table – CNE Coded No Exceptions

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	R		Identifier	The code of the specific observation. This code will be established by the NAHLN Technical Committee for each observation required for specific tests or programs supported
2	199	ST	RE		Text	Textual description of observation type. The LOINC short name or long name may be used in this field
3	20	ID	R	0396	Name of Coding System	The coding system from which the observation identifier originated. The value for this field shall be LN.

Note: See instructions for specific disease testing program for values of patient observations required by that program.

OBX.5 - Observation Value (VARIES) - Required

The Observation Value field will depend upon the type of observation being transmitted. This will be established on a test-by-test or program-by-program basis.

OBX.6 - Units (CNE) - Conditional

OBX.6 is a Conditional field - any OBX segment with a value of NM in OBX.2 shall have units associated with it. Units are to be supplied as a coded entry (CNE) data type. The default coding system consists of the ISO abbreviation for a single case unit (ISO 2955-83) plus extensions that do not collide with ISO abbreviations. We designate this coding system as ISO+. ¹⁴ The ISO+ abbreviations are the codes for the default coding system. Consequently, when ISO+ units are being used, only ISO+ abbreviations need to be sent. The Uniform Code for Units of Measure (UCUM) ¹⁵ system of units is rapidly overtaking ISO+ and may at some point replace it in the NAHLN standard.

HL7 Component Table – CNE Coded No Exceptions

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	R		Identifier	Units abbreviated in ISO or ANSI standard abbreviation or Uniform Code for Units of Measure (UCIM) code.
2	199	ST	RE		Text	Textual description
3	20	ID	R	0396	Name of Coding System	Either ISO for metric units or ANS+ for "English" units, or UCUM for more current units.

An example of OBX.6 is shown below:

```
<OBX.6>
  <CWE.1>G</CWE.1>
  <CWE.2>gram</CWE.2>
  <CWE.3>ISO</CWE.3>
</OBX.6>
```

OBX.11 - Observation Result Status (ID) - Required

As the observation result is assigned at the time the accession is received this observation status is always a final observation. The value is fixed as "F."

OBX-14 Date/Time of the Observation (DTM) - Required or Empty

This field represents the physiologically relevant date-time or the closest approximation to that date-time. In the case of observations about the specimen, it is the date when that assessment was made or applies.

OBSERVATION_REQUEST GROUP

The OBSERVATION_REQUEST group (OPL_O37.OBSERVATION_REQUEST) is used to contain the order itself. The OBSERVATION_REQUEST group shall be present and may repeat.

¹⁴ Both the ISO unit's abbreviations and the extensions are defined in the HL7 standard Section 7.4.2.6.2, "ISO and ANSI customary units abbreviations." HL7 Messaging Standard Version 2.5, 2003

¹⁵ <https://ucum.nlm.nih.gov/>

Common Order Segment (ORC)

The Common Order segment contains fields that are common to a large variety of orders. These usually relate to administrative data related to the “who, what and when” of orders rather than the specific order details. For new orders there aren’t many statuses to track.

SEQ	LEN	DT	OPT	RP/#	TBL#	ITEM#	ELEMENT NAME
1	2	ID	R		0119	00215	Order Control
4	22	EI	R			00218	Placer Group Number

An example ORC segment:

```
<ORC>
  <ORC.1>SC</ORC.1>
  <ORC.4>
    <EI.1>234454</EI.1>
    <EI.3>2.16.840.1.113883.3.5.8.1.2</EI.3>
    <EI.4>ISO</EI.4>
  </ORC.4>
</ORC>
```

ORC.1 Order Control (ID) - Required

This field determines the function of the order control segment. These may also be called “trigger events” or changes to the status of the order that result in the need to communicate via a message. The most obvious trigger event is the creation of a “New” order (control code NW). Additional events are listed in HL7 Table 0119 – Order control codes. As of this release of the NAHLN, only new results (NW - New) or replace order (RO – Replace Order) codes are supported for orders.

The RO value has special meaning. It instructs the receiving system to replace any "order" information. The placer assigned order number should remain the same to ensure update of the correct order.

An example ORC.1:

```
<ORC.1>NW</ORC.1>
```

ORC.4 Placer Group Number (EI) - Required or Empty

This field allows an order placing application to group sets of orders together and subsequently identify them. It is often captured by the laboratory as an external reference assigned by the placer to allow them to track their submissions using their own identifier. It is not and should not be the same as the placer order number. This would include identifiers such as FAD Investigation numbers. This field does not repeat so a single submission to the laboratory may only be assigned to a single placer group.

The component usage has two distinct but related patterns. In the original usage EI.1 is an identifier such as an FAD investigation number and EI.3 is an OID for the system of codes used in EI.1. For program testing, the referral number pattern is established by the program so EI.3 is the program OID. The second usage is for cases where no referral number has been assigned. These are grouped only by program. In this case EI.1 is omitted and the OID in EI.3 stands along as the identifier that groups the orders by program.

Program specific note:

The ORC.4/EI.3 OID has taken on a critical role as the number of tests using the NAHLN/LMS has grown. This is the key field for determining which secondary systems within the VS information technology infrastructure receive data from the tests under each order.

HL7 Component Table – EI Entity Identifier

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	199	ST	RE		Entity Identifier	The placer group number assigned to the order
3	199	ST	R		Universal ID	OID for the organization that assigned the entity identifier. For example, the OID for NVSL
4	6	ID	R	0301	Universal ID Type	The identifier type of the universal ID. This should be ISO (ISO OID)

Example using a NVSL FAD number as the placer group number:

```
<ORC.4>
  <EI.1>05CA0023</EI.1>
  <EI.3>2.16.840.1.113883.3.5.1.7 </EI.3>
  <EI.4>ISO</EI.4>
</ORC.4>
```

Program Specific Constraints

CSF: This field is required for the CSF program and contains the referral number provided on the CSF submission form. The maximum length for the value of this field is 32 characters

WS-AI: This field is required for the WS-AI program and contains the field assigned referral number provided on the submission form by the collector. The maximum length of the value of this field is 32 characters

For all other programs the program OID is required in EI.3 and "ISO" in EI.4

Observation Order Segment (OBR)

The Observation Order segment can be thought of as a header for a set of related tests or observations. If a set of tests or observations would logically be ordered and/or interpreted together, they should be contained in an ORDER group with a single OBR header.

SEQ	LEN	DT	OPT	RP/#	TBL#	ELEMENT NAME
2	427	EI	R			Placer Order Number
4	705	CWE	R		9999	Universal Service Identifier
23	504	MOC	RE			Charge to Practice

SEQ	LEN	DT	OPT	RP/#	TBL#	ELEMENT NAME
31	705	CWE	RE			Reason for Study

OBR.2 - Placer Order Number (EI) - Required

The Placer Order Number is used to link back to the ordering system when orders are sent to the fulfilling laboratory from the field. This field contains the unique number that was assigned to the test(s) by the originator of the order (either from the field or from another testing laboratory. When a specimen is sent to another laboratory for confirmatory testing, the specimen's original Filler Order Number becomes the new Placer Order Number. This is an entity identifier (EI) data type and is Required.

HL7 Component Table – Entity Identifier

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	199	ST	R		Entity Identifier	Order number assigned by the placer or requesting laboratory.
2	20	IS	RE	0363	Namespace ID	Name of the program or the premises id of facility that assigned the entity identifier - Preferred to be the Premises ID assigned by NAIS
3	199	ST	RE		Universal ID	OID for the organization that assigned the entity identifier. For example, the OID for CAHFS order number
4	6	ID	C	0301	Universal ID Type	The identifier type of the universal ID. This should be ISO (ISO OID)

An example of OBR.2 is shown below:

```
<OBR.2>
  <EI.1>42134213423</EI.1>
  <EI.3>2.16.840.1.113883.3.5.1.2</EI.3>
  <EI.4>ISO</EI.4>
</OBR.2>
```

OBR.4 - Universal Service Identifier (CWE) - Required

The Universal Service Identifier is the LOINC code defining the test or panel/battery name as ordered. This is a coded entry (CWE) and is Required. For new tests or panels that do not have an assigned LOINC Code, an alternative or local identifier may be used. If a local code is used it is strongly recommended that the Text field be valued with the laboratory's description of the test (not the local abbreviation).

LOINC has very good coverage of veterinary test *results* and is committed to supporting veterinary medicine with new codes as needed. It is much less complete on *order* codes especially for batteries where the precise sequence of observations is determined at the lab or follows a complex algorithm. As the NAHLN expands more of the *order* codes (Universal Service Identifiers) will be in the form of extension LOINC codes. These look just like ordinary LOINC codes but with a leading X. The check digit is calculated on the digits only.

Note that for LOINC, the text component *shall* be the LOINC long common name. The long common name is now the preferred text because it is somewhat more human readable. If a more recognizable name is to be sent, it should be in CWE.5 or CWE.9.

The conditionality of components in this field is the same as that described for most other CWE coded fields. The second set of components (CWE.4-CWE.6) may be used if the universal service ID is not represented in the NAHLN reference table. The original text description should also be sent in component 9 of the CWE data type. If neither the NAHLN reference tables nor the local laboratory Order Code list contains an adequate representation of the Order Code, then component 9 (original text) shall be sent.

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	RE		Identifier	The LOINC code for this order.
2	199	ST	RE		Text	The LOINC Long Common Name for the test or panel ordered.
3	20	ID	RE	0396	Name of Coding System	For the NAHLN, this will be LN for LOINC.
4	20	ST	CE		Alternate Identifier	Local code for universal service ID
5	199	ST	CE		Alternate Text	Local coding system text for universal service ID
6	20	ID	CE	0396	Name of Alternate Coding System	L for local code
9	199	ST	C		Original Text	Universal service ID description as recorded in source system.

Program specific implementation note:

WS-AI Program: The CWE.1 field for this program must be valued using one of the following LOINC codes:

44263-2 - Influenza virus A RNA [Units/volume] (viral load) in Unspecified specimen by Probe and target amplification method

44264-0 - Influenza virus A H5 RNA [Units/volume] (viral load) in Unspecified specimen by Probe and target amplification method

44266-5 - Influenza virus A H7 RNA [Units/volume] (viral load) in Unspecified specimen by Probe and target amplification method

CWE.3 must be populated with "LN".

CSF Program: The population of the CWE.1 field for this program is not required; however, the allowed LOINC Code(s) are documented in the specific program requirements.

CWE.3 must be populated with "LN".

An example of OBR.4 is shown below:

```
<OBR.4>
  <CWE.1>44263-2</CWE.1>
  <CWE.2>Influenza virus A RNA [Units/volume] (viral load) in Unspecified specimen by Probe
and target amplification method</CWE.2>
  <CWE.3>LN</CWE.3>
</OBR.4>
```

An example of OBR.4 with an extension LOINC code is shown below:

```
<OBR.4>
  <CWE.1>X0001-6</CWE.1>
  <CWE.2>IAV-S Surveillance Protocol</CWE.2>
  <CWE.3>LN</CWE.3>
</OBR.4>
```

An example of OBR.4 using a local coding system:

```
<OBR.4>
  <CWE.4>4183</CWE.4>
  <CWE.5>Locally-Developed Nose and Tail PCR</CWE.5>
  <CWE.6>L</CWE.6>
</OBR.4>
```

LOINC Order codes can be found at

http://vtsl.vetmed.vt.edu/nahln/main.cfm?page=subset&subset=universal_service_id

OBR.23 - Charge to Practice (MOC) - Required or Empty

This field allows for a coded charge code that can be used to hold the program or other account funding the test(s) in this order. It is used by NAHLN to differentiate NAHLN-paid results from others. It can also be used in lieu of a Guarantor to assign bill-to account for the order. Unlike Guarantor, this can be used to split an accession across more than one bill-to. One of either the GUARANTOR group or OBR.23 is Required (not schema enforceable).

An example of OBR.23 is shown below:

```

<OBR.23>200812061234-0800
  <MOC.2>
    <CWE.1>B123456</CWE.1>
    <CWE.2>Penny Payor</CWE.2>
    <CWE.3>2.16.840.1.113883.3.5.1.2</CWE.3>
  </MOC.2>
</OBR.23>

```

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	RE		Identifier	Billing Account Identifier.
2	199	ST	RE		Text	Optional Name of Account.
3	20	ID	RE	0396	OID of Coding System	Here we pre-adopt a version 3 usage and identify the code system with an OID

OBR.31 - Reason for Study (CWE) - Required or Empty

This field indicates the purpose that this test or battery was ordered. It replaces the observation on the visit from previous versions of the message structure. This has two advantages. First, it allows the Order Message to contain the same information in the same place as the result. Also, it allows different reasons for different orders on the same accession. The cost of this is that for accessions with multiple orders, the same information must be repeated. This is functionally CNE for NAHLN usage but is CWE to allow additional reasons in new test programs, lab-to-lab, etc.

The local coding system used by the NAHLN will likely expand from one to two or more character codes to handle more fine-grained reasons why a particular case was selected for sampling under a surveillance program.

HL7 Component Table – CWE Coded With Exceptions

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	RE		Identifier	The code for the reason this test is being ordered.
2	199	ST	RE		Text	Textual description of the reason.
3	20	ID	RE	0396	Name of Coding System	For the NAHLN, this will be L for Local code. "Local" in this case means local to the NAHLN rather than an internationally recognized code system.
4	20	ST	CE		Alternate Identifier	Alternate code for reason. For example if the LIMS has its own code.
5	199	ST	CE		Alternate Text	Alternate coding system text for the reason
6	20	ID	CE	0396	Name of Alternate Coding System	L for local code

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
9	199	ST	C		Original Text	May be used to convey the way the reason for testing was entered on submission forms or to provide finer-grained reason than available in the code system.

This is an example of OBR.31 using a local coding system established by the NAHLN:

```
<OBR.4>
  <CWE.1>N</CWE.1>
  <CWE.2>National Surveillance</CWE.2>
  <CWE.3>L</CWE.3>
</OBR.4>
```

Reason for study codes can be found at

http://vtsl.vetmed.vt.edu/nahtml/main.cfm?page=subset&subset=reason_submission

TIMING GROUP

The TIMING group (OPL_037.TIMING) is optional and consists of a single TQ1 segment. This segment is used to carry priority information.

HL7 Attribute Table – TQ1 – Timing/Quantity

SEQ	LEN	DT	OPT	RP/#	TBL#	ITEM#	ELEMENT NAME
9	250	CWE	R		0485	01635	Priority

This is an example of TIMING with TQ1 using a local coding system established by the NAHLN:

```
<OPL_037.TIMING>
  <TQ1.9>
    <CWE.1>49499008</CWE.1>
    <CWE.2>Stat (qualifier value)</CWE.2>
    <CWE.3>SCT</CWE.3>
    <CWE.9>Priority 1</CWE.9>
  </TQ1.9>
</OPL_037.TIMING>
```


Options for priorities in SNOMED

Text	SNOMED Code	FADDL Priority
As soon as possible (qualifier value)	709122007	2
Delayed priority (qualifier value)	441808003	
Elective (qualifier value)	103390000	
Emergency (qualifier value)	25876001	
High priority (qualifier value)	394849002	A
Immediate (qualifier value)	88694003	
Normal priority (qualifier value)	394848005	
Repeat elective (qualifier value)	64695001	
Repeat emergency (qualifier value)	21282002	
Rescheduled (qualifier value)	58334001	
Routine (qualifier value)	50811001	3
Scheduled - priority (qualifier value)	416774000	
Stat (qualifier value)	49499008	1
Urgency (qualifier value)	103391001	

HL7 Component Table – CWE Coded With Exceptions

SEQ	LEN	DT	OPT	TBL#	COMPONENT NAME	COMMENTS
1	20	ST	RE		Identifier	SNOMED code for priority
2	199	ST	RE		Text	Textual description priority.
3	20	ID	RE	0396	Name of Coding System	SCT
4	20	ST	CE		Alternate Identifier	Alternate code for priority.
5	199	ST	CE		Alternate Text	Alternate coding system text for priority
6	20	ID	CE	0396	Name of Alternate Coding System	L for local code or OID of code system.
9	199	ST	C		Original Text	Other priority or text mapped from.

Acknowledgment Message ACK_O38 or OPR_O38

The HL7 specification provides a message structure that is intended to communicate back to the user any errors that were encountered during processing. This message structure is of type OPR (Chapter 4, HL7 version 2.6) and has been customized for NAHLN. In original mode, a single application level acknowledgment message is returned to the sender to indicate successful receipt of the message or one of a small range of error conditions.

Message Acknowledgment has changed significantly with the implementation of clearinghouses and message routers. When messages pass through a clearinghouse or store-and-forward router, the router can only

acknowledge committing the message to its local storage. It cannot guarantee that the final recipient will be able to successfully process the contents. Thus, the system now supports Accept level (commit) Acknowledgment as well as both synchronous and asynchronous Application Acknowledgement.

In enhanced mode acknowledgement, the router or receiving system first returns a simple OPR_O38 Message with either commit accept (CA), commit fail (CR), or commit error (CE). The laboratory system later returns an application level OPR_O38 message with application accept (AA), application fail (AR), or application error (AE). Alternately the laboratory may return a more complete OPR_O38 acknowledgement. OPR error messages can be populated with specific information; in the specimen segment for example.

Note that ACK_O38 is exactly the same structure as OPR_O38 if the optional RESPONSE group is omitted.

In responding to a laboratory order message, the receiving system is not only verifying the message structure and content but also that the order makes sense and can be fulfilled by the recipient laboratory. Thus the more complete structure of the OPR message may be necessary. The OPR message may also be used to send status updates.

OPR Message Structure

<u>OPR^O38^OPR_O38</u>	<u>General Acknowledgment</u>	<u>Chapter</u>	<u>NAHLNS Usage</u>
MSH	Message Header	2	Required
MSA	Message Acknowledgment	2	Required
[{ ERR }]	Error	2	Used in case of errors
[RESPONSE group begin		
{	ORDER group begin		
NK1	Next of Kin	3	
[PID]	Patient Demographics	3	
[{	SPECIMEN group begin		
SPM	Specimen	7	
[{	OBSERVATION_REQUEST group		
ORC	Common Order	4	
OBR	Observation request	4	
}]	OBSERVATION_REQUEST end		
[{	TIMING group begin		
TQ1	Timing/Quantity	4	

<u>OPR^O38^OPR_O38</u>	<u>General Acknowledgment</u>	<u>Chapter</u>	<u>NAHLNS Usage</u>
}}	TIMING end		
}}	SPECIMEN end		
}}	ORDER end		
]	RESPONSE end		

Message Header Segment (MSH)

The structure of the Message Header is the same as the MSH in the OPU_R25 message. The following discussion addresses the relationship of each field to those in the original message.

See MSH Segment structure table in the OPU message section above.

MSH.1 and MSH.2 Field Separator and Encoding Characters

These can be copied directly from the incoming message as they are retained only for compatibility with the traditional “pipe” encoding method.

MSH.4 Sending Facility

The sending facility of the Acknowledgment message is the same as MSH.6 in the original message.

MSH.6 Receiving Facility

The receiving facility of the Acknowledgment message is the same as MSH.4 in the original message.

MSH.7 Date/Time of Message

This is the date/time of the Acknowledgment message. In most cases of connection-based messages, this will be within at most seconds of the date/time of the original message. In store and forward based systems, it may be significantly later.

MSH.9 Message Type

This field identifies the specific message type and structure. The response to the order message may be either ACK_O38 or OPR_O38. MSH.9 specifies which structure is used. It is assumed that initially only ACL_O38 will be used until details of reporting order changes, etc. are clarified.

```

<MSH.9>
  <MSG.1>ACK</MSG.1>
  <MSG.1>038</MSG.1>
  <MSG.3>ACK_038</MSG.3>
</MSH.9>

```

MSH.10 Message Control ID

This is the message control ID of the Acknowledgment message. It is a unique identifier generated by the receiving (NAHLN repository or NAHLN Message broker) system and used to uniquely identify the Acknowledgment itself.

MSH.11 Processing ID

The processing ID is the same as that of the original message and may be copied directly from MSH.11.

MSH.12 Version ID

The version ID of all messages covered by this guide will be 2.6. It can be copied directly from the original message's MSH.12 or defaulted.

Message Acknowledgment Segment (MSA)

The Message Acknowledgment segment contains the information needed by the sending facility to match up the acknowledgment to the original message in its system and to determine the result of the transmission.

SEQ	DT	OPT	RP/#	TBL#	ELEMENT NAME
1	ID	R		0008	Acknowledgment Code
2	ST	R			Message Control ID

MSA.1 Acknowledgment Code

This is a coded item for the HL7 Table with one of three codes: "AA" indicates successful acceptance of the message. "AR" indicates rejection of the message. Messages may be rejected either because they are a message type, structure or processing ID that the system does not accept or because of internal issues unrelated to message structure such as database failure. "AE" indicates an error in the message structure or content. Additional acknowledgement codes will be supported in the future if necessary.

HL7 Table 0008

AA	Original mode: Application Accept - Enhanced mode: Application acknowledgment: Accept
AE	Original mode: Application Error - Enhanced mode: Application acknowledgment: Error
AR	Original mode: Application Reject - Enhanced mode: Application acknowledgment: Reject
CA	Enhanced mode: Accept acknowledgment: Commit Accept
CE	Enhanced mode: Accept acknowledgment: Commit Error
CR	Enhanced mode: Accept acknowledgment: Commit Reject

MSA.2 Message Control ID

This is the Message Control ID from the message header of the original message. It is copied directly from MSH.10 of the incoming message. It is used by the original sending system to match the acknowledgment message to the original submission message.

Error Segment (ERR)

The error segment allows return of detailed error information to allow the sending facility to debug their application. It will occur in messages returning an “AE” or “CE” Acknowledgment Code and is used to convey the details of any errors detected. ERR segments may be used with “AA” Acknowledgment Codes to convey information that does not prevent processing but that senders need to address. Early implementations simply sent the output from validating XML parser or stack traces from databases. Future implementations may provide additional error diagnostic information.

SEQ	DT	OPT	RP/#	TBL#	ELEMENT NAME
3	CWE	R		0357	HL7 Error Code
4	ID	R		0516	Severity
7	TX	R			Diagnostic Information

ERR.3 HL7 Error Code

The type of error is provided as a coded entry with exceptions. The possible values are provided in HL7 Table 0357.

HL7 Table 0357 - Message error condition codes

Value	Description	Comment
0	Message accepted	Success. Optional, as the AA conveys success. Used for systems that must always return a status code.
100	Segment sequence error	Error: The message segments were not in the proper order, or required segments are missing.
101	Required field missing	Error: A required field is missing from a segment
102	Data type error	Error: The field contained data of the wrong data type, e.g. an NM field contained “FOO”.
103	Table value not found	Error: A field of data type ID or IS was compared against the corresponding table, and no match was found.
200	Unsupported message type	Rejection: The Message Type is not supported.
201	Unsupported event code	Rejection: The Event Code is not supported.
202	Unsupported processing id	Rejection: The Processing ID is not supported.
203	Unsupported version id	Rejection: The Version ID is not supported.
204	Unknown key identifier	Rejection: The ID of the patient, order, etc., was not found. Used for transactions <i>other than</i> additions, e.g. transfer of a non-existent patient.
205	Duplicate key identifier	Rejection: The ID of the patient, order, etc., already exists. Used in response to addition transactions (Admit, New Order, etc.).
206	Application record locked	Rejection: The transaction could not be performed at the application storage level, e.g., database locked.
207	Application internal error	Rejection: A catchall for internal errors not explicitly covered by other codes.

Because the NAHLN uses the v2.xml encoding, most of the possible errors will be detected by a validating XML parser using the schema definitions provided by the IT committee. The trick will be translating the error thrown by the parser into the correct HL7 format error. This is not simply an academic exercise. It will be important for sending facilities using commercial HL7 tools. However, for NAHLN it will be acceptable to return 207 “Application internal” as the error code, and include the diagnostic output of the XML parser as ERR.7 “Diagnostic Information.”

ERR.4 Severity

This coded value for HL7 table values is used to differentiate warnings from errors. Most errors use “E” for error. Warning and Information can be used with “AA” codes to carry information such as upcoming password expiration dates.

HL7 Table 0516 – Error severity

Value	Description	Comment
W	Warning	Transaction successful, but there may issues
I	Information	Transaction was successful but includes information e.g., inform patient
E	Error	Transaction was unsuccessful

ERR.7 Diagnostic Information

This is a text (TXT) field for application level information to help with diagnosis of the problem by the sending facility. For validating XML parsers that produce useful error descriptions, those descriptions will be returned in this field.

Experience has shown that XML parser output is inadequate for many laboratory users to find the cause of errors. Moving forward, it is best practice to include more human-readable description of the specific error(s) here.

RESPONSE GROUP

The rest of the message consists of a single optional OPR_O38.RESPONSE group. This group is a clone of the list of ORDER groups from the Order message. For the most part it consists of an echo of the submitted information. Two types of changes may be present. Order codes in OBR.4 may be substituted to show what will actually be run. Patient and Specimen may be modified to show what was actually submitted. If the specimen condition has deteriorated, for example, the condition in the Order message might be "excellent" while that in the response could be "poor."

The NAHLN IT Core Committee will need to address individual use cases as they arise in real-world application.

Appendix A: XML Encoding

As of the summer of 2003, the HL7 Version 2 XML Encoding Syntax has been an official standard. All messages, segment groups, segments, fields, components, and subcomponents are represented as XML elements. The data type is represented as a fixed attribute of each element (that is, it is derived from the DTD or schema file.) These elements form a natural hierarchy that follows the hierarchical message definition from the standard.

Tag names are automatically derived from the positional definition of each element in the original encoding format. This is less human-friendly but more likely to remain 100% compatible with the rest of HL7.

The basic NAHLN Order Message has been encoded in customized schemas to allow simple validation of message structure and some content. It is *highly* recommended that a validating XML editor be used when debugging any NAHLN messaging system. Interpretation of validation error messages will detect the vast majority of errors made by beginning message implementations. Once messaging is functioning well, validation may be superfluous and may be turned off.

The following is an example of an acknowledgment message showing acceptance of a submission message.

```
<?xml version="1.0" encoding="UTF-8"?>
<ACK_038>
  <MSH>
    <MSH.1>|</MSH.1>
    <MSH.2>^~\&amp;</MSH.2>
    <MSH.4>
      <HD.1>A432L56</HD.1>
      <HD.2>2.16.840.1.113883.3.5.1.8</HD.2>
      <HD.3>ISO</HD.3>
    </MSH.4>
    <MSH.6>
      <HD.1>0038w50</HD.1>
      <HD.2>2.16.840.1.113883.3.5.1.3</HD.2>
      <HD.3>ISO</HD.3>
    </MSH.6>
    <MSH.7>20050324123606-0500</MSH.7>
    <MSH.9>
      <MSG.1>ACK</MSG.1>
      <MSG.2>038</MSG.2>
      <MSG.3>ACK_038</MSG.3>
    </MSH.9>
    <MSH.10>2731</MSH.10>
    <MSH.11>
      <PT.1>P</PT.1>
    </MSH.11>
    <MSH.12>
      <VID.1>2.6</VID.1>
    </MSH.12>
  </MSH>
  <MSA>
    <MSA.1>AA</MSA.1>
    <MSA.2>7615</MSA.2>
  </MSA>
</ACK_038>
```

Note that data types appear in two forms, simple and complex. A simple data type can be represented as a single (#PCDATA) element. A complex data type contains, or can contain, more than one component. When a field contains a single instance of a simple data type such as ST, ID or IS, the value alone is provided as a text (#PCDATA) entry. If the field contains a complex element, even if that element has only the first component populated, the element is displayed as a tag with its contents. Compare MSH.10 with MSH.11 for example.

Note also fields MSH.1 and MSH.2. These are holdovers from the vertical bar delimited form of HL7 where these fields define the delimiters for the rest of the message. Because this XML is a literal translation from the archetypical pipe delimited form these are retained as vestigial message elements. The ampersand subcomponent separator is interesting in that it requires escaping as an XML entity “&” in the XML.

Validation

One of the great advantages of the XML encoding is that widely available tools for parsing and validating the syntax and structure (and some but not all content) of incoming messages may be used. Validation can be performed against either Document Type Definitions (DTDs) or Schemas (XSDs). The NAHLN uses only schemas. Information about the schema file used to create a particular message is to be included in the Profile ID field of the MSH segment (MSH.21).

To validate against Schemas, the schema location is either specified manually in the editor or other validating parser or associated with the namespace of the document in the root tag. Including an external link to the schema creates a small security weakness, so normally the receiving system assigns a local schema file for validation.

Location of Schemas

In most programming libraries, the schema location can be overridden in code to point to a local copy. The most recent schema will be available at:

<https://vtsl.vetmed.vt.edu/nahln/Documents/NAHLNMessageSchemas/NAHLNOrderBase.xsd>

Message validation may occur in two places in the data flow. The sending application may validate against schemas to check its work prior to sending. On the receiving end, the receiver may validate against schemas as part or all of its message integrity checking. Because the sending application cannot know for certain what type of validation the receiver is going to apply it should not specify the Schema in the transmission.

Namespaces

The NAHLN violates the HL7 XML encoding standard in one small way. The content of the NAHLN message is carried in the default namespace (noNamespace). It should really be in a namespace defined by HL7. Because this added complexity without immediate value, it was omitted. Note however that at some point in the future, there may be minor changes to the root element definition to include a namespace declaration. This will only affect the second line of the message.

Appendix B: Full Sample Message

The following is a sample of a message ordering a single test. Please note that the values provided in this message are for illustration purposes only.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<OPL_037>
```



```

<MSH>
  <MSH.1>|</MSH.1>
  <MSH.2>^~\& </MSH.2>
  <MSH.3>
    <HD.1>EMRS2</HD.1>
    <HD.2>2.16.840.1.113883.3.5.1.8.1</HD.2>
    <HD.3>ISO</HD.3>
  </MSH.3>
  <MSH.4>
    <HD.1>0034P2K</HD.1>
    <HD.2>2.16.840.1.113883.3.5.6.1.4</HD.2>
    <HD.3>ISO</HD.3>
  </MSH.4>
  <MSH.6>
    <HD.1>003EZUN</HD.1>
    <HD.2>2.16.840.1.113883.3.5.6.1.1</HD.2>
    <HD.3>ISO</HD.3>
  </MSH.6>
  <MSH.7>20171003082854-0400</MSH.7>
  <MSH.9>
    <MSG.1>OPL</MSG.1>
    <MSG.2>037</MSG.2>
    <MSG.3>OPL_037</MSG.3>
  </MSH.9>
  <MSH.10>0123456AE4EA</MSH.10>
  <MSH.11>
    <PT.1>P</PT.1>
  </MSH.11>
  <MSH.12>
    <VID.1>2.6</VID.1>
  </MSH.12>
  <MSH.21>
    <EI.1>NAHLNOrderBase_1_1</EI.1>
    <EI.3>2.16.840.1.113883.3.5.9</EI.3>
    <EI.4>ISO</EI.4>
  </MSH.21>
</MSH>
<!-- Minimum ROL with PIN -->
<ROL>
  <ROL.2>UC</ROL.2>
  <ROL.3>
    <CWE.1>PREM</CWE.1>
    <CWE.2>Source Premises</CWE.2>
    <CWE.3>HL70443</CWE.3>
  </ROL.3>
  <ROL.4>
    <XCN.2>
      <FN.1>NA</FN.1>
    </XCN.2>
  </ROL.4>
  <ROL.11>
    <XAD.3>SC</XAD.3>
  </ROL.11>
  <ROL.13>
    <PL.10>
      <EI.1>003EZUN</EI.1>
      <EI.3>2.16.840.1.113883.3.5.6.1.1</EI.3>
      <EI.4>ISO</EI.4>
    </PL.10>
  </ROL.13>
</ROL>
<ROL>
  <ROL.2>UC</ROL.2>
  <ROL.3>
    <CWE.1>SUB</CWE.1>
    <CWE.2>Submitting Party</CWE.2>
    <CWE.3>HL70443</CWE.3>
  </ROL.3>
  <ROL.4>
    <XCN.1>17435</XCN.1>
    <XCN.2>
      <FN.1>Jones</FN.1>
    </XCN.2>
    <XCN.3>James</XCN.3>
    <XCN.9>
      <HD.2>2.16.840.1.113883.3.5.1.9</HD.2>
      <HD.3>ISO</HD.3>
    </XCN.9>
  </ROL.4>
</ROL.11>

```

```

<XAD.1>
  <SAD.1>123 4th Ave</SAD.1>
</XAD.1>
<XAD.3>Columbia</XAD.3>
<XAD.4>SC</XAD.4>
<XAD.5>29223</XAD.5>
<XAD.9>RICHLAND</XAD.9>
</ROL.11>
<ROL.12>
  <XTN.2>WPN</XTN.2>
  <XTN.3>PH</XTN.3>
  <XTN.12>8035551212</XTN.12>
</ROL.12>
</ROL>
<OPL_037.ORDER>
  <NK1>
    <NK1.1>1</NK1.1>
  </NK1>
  <OPL_037.PATIENT>
    <PID>
      <!-- Patient ID is required -->
      <PID.3>
        <!-- Is this how swine PIN tags are recorded? -->
        <CX.1>003EZUN 1234</CX.1>
        <CX.4>
          <!-- Any ID following ADT official ID guidelines
            is a "NAIS" Animal ID -->
          <HD.2>2.16.840.1.113883.3.5.6.1.2</HD.2>
          <HD.3>ISO</HD.3>
        </CX.4>
      </PID.3>
      <PID.5>
        <XPN.1>
          <!-- Name doesn't really apply here.
            Required by standard. -->
          <FN.1>NA</FN.1>
        </XPN.1>
      </PID.5>
      <PID.30>N</PID.30>
      <PID.35>
        <CWE.1>78678003</CWE.1>
        <CWE.2>Sus scrofa (organism)</CWE.2>
        <CWE.3>SCT</CWE.3>
      </PID.35>
      <PID.38>
        <CWE.1>MT</CWE.1>
        <CWE.2>Meat</CWE.2>
        <CWE.3>HL70429</CWE.3>
      </PID.38>
    </PID>
    <OPL_037.PATIENT_OBSERVATION>
      <OBX>
        <OBX.2>CWE</OBX.2>
        <OBX.3>
          <CWE.1>46251-5</CWE.1>
          <CWE.2>Age Group</CWE.2>
          <CWE.3>LN</CWE.3>
        </OBX.3>
        <OBX.5>
          <CWE.1>28911000009108</CWE.1>
          <CWE.2>Suckling pig for meat production (organism)</CWE.2>
          <CWE.3>SCT</CWE.3>
        </OBX.5>
        <OBX.11>F</OBX.11>
        <!-- Effective date of observation -->
        <OBX.14>20171003</OBX.14>
      </OBX>
    </OPL_037.PATIENT_OBSERVATION>
    <OPL_037.PATIENT_OBSERVATION>
      <OBX>
        <OBX.2>ST</OBX.2>
        <OBX.3>
          <CWE.1>10164-2</CWE.1>
          <CWE.2>History of present illness Narrative</CWE.2>
          <CWE.3>LN</CWE.3>
        </OBX.3>
        <OBX.5>Flock has sudden increase in mortality </OBX.5>
        <OBX.11>F</OBX.11>
        <OBX.14>20171003</OBX.14>
      </OBX>

```

```

</OPL_037.PATIENT_OBSERVATION>
</OPL_037.PATIENT>
<OPL_037.SPECIMEN>
  <SPM>
    <SPM.2>
      <EIP.1>
        <!-- SECD program barcode with SECD program
              OID as assigner -->
        <EI.1>109368</EI.1>
        <EI.3>2.16.840.1.113883.3.5.8.7</EI.3>
        <EI.4>ISO</EI.4>
      </EIP.1>
    </SPM.2>
    <SPM.4>
      <CWE.1>119339001</CWE.1>
      <CWE.2>Stool specimen (specimen)</CWE.2>
      <CWE.3>SCT</CWE.3>
    </SPM.4>
    <SPM.11>
      <CWE.1>P</CWE.1>
      <CWE.2>Patient</CWE.2>
      <CWE.3>HL70369</CWE.3>
    </SPM.11>
    <SPM.17>
      <DR.1>20140301-0500</DR.1>
    </SPM.17>
  </SPM>
  <OPL_037.OBSERVATION_REQUEST>
    <ORC>
      <ORC.1>NW</ORC.1>
      <ORC.4>
        <!-- SECD Program assigned referral number, if any -->
        <EI.1>18SC01234</EI.1>
        <!-- SECD Program OID as testing program and assigner
              of above -->
        <EI.3>2.16.840.1.113883.3.5.8.7</EI.3>
        <EI.4>ISO</EI.4>
      </ORC.4>
    </ORC>
    <OBR>
      <!-- Order number created by the sending system. -->
      <OBR.2>
        <EI.1>195267</EI.1>
        <!-- Pretending this was created by EMRS -->
        <EI.3>2.16.840.1.113883.3.5.14.2</EI.3>
        <EI.4>ISO</EI.4>
      </OBR.2>
      <!-- Test or panel ordered.
            would more likely be an SECD panel. -->
      <OBR.4>
        <CWE.1>74752-7</CWE.1>
        <CWE.2>PEDV RNA XXX PCR-aCnc</CWE.2>
        <CWE.3>LN</CWE.3>
      </OBR.4>
      <!-- Bill To -->
      <OBR.23>
        <MOC.2>
          <!-- Account number to bill; pre-arranged -->
          <CWE.1>N12345</CWE.1>
          <CWE.2>NAHLN SECD Account</CWE.2>
          <CWE.3>L</CWE.3>
        </MOC.2>
      </OBR.23>
      <!-- Purpose of Test -->
      <OBR.31>
        <CWE.1>N</CWE.1>
        <CWE.2>National Surveillance</CWE.2>
        <CWE.3>L</CWE.3>
      </OBR.31>
    </OBR>
    <!-- This could also just be omitted for routine orders -->
    <OPL_037.TIMING>
      <TQ1>
        <TQ1.9>
          <CWE.1>50811001</CWE.1>
          <CWE.2>Routine (qualifier value)</CWE.2>
          <CWE.3>SCT</CWE.3>
          <CWE.9>Routine</CWE.9>
        </TQ1.9>
      </TQ1>
    </OPL_037.TIMING>
  </OPL_037.OBSERVATION_REQUEST>
</OPL_037.OBSERVATION>

```

```
        </OPL_037.TIMING>  
      </OPL_037.OBSERVATION_REQUEST>  
    </OPL_037.SPECIMEN>  
  </OPL_037.ORDER>  
</OPL_037>
```