Enbridge Reporting Profile Standard

Standard

Enbridge Analysis and Reporting Requirements

This document represents the "minimum" communication and reporting requirements essential to Enbridge Pipeline Integrity departments as furnished by all Inspection Service Providers herein referenced as "Vendor" for all ILI Technologies. This document is intended (formatted) to be used as a communication tool which includes a checklist. Although not deemed mandatory, Pipeline Integrity recommends the Service Provider complete and submits this checklist along with the report "deliverables" described within. This standard must be used as the Reporting "Criterion" to which the Service Provider must adhere.

Contract Number: W91002-13072-13

Line (Diam. In.): NPS 20 - Line 5

Segment Inspected: St. Ignace to Mackinaw-East

Tool Type: GEOPIG™ Caliper

Run Date: July 31, 2013

Issue Date: Oct 30, 2013

Issue Number: # 1

Lead Analyst / Certification Level: Harvy Lopez (Level II)

Checker Analyst / Certification Level: Vicky Chen (Level III)

Analysis and Reporting Check Date: Oct. 30, 2013.

The final report shall contain a **Project Personnel and Signature Page** that includes the following:

- Project Manager and all Analysts' names
  (Note: that due to data privacy regulations in some countries, an undisclosed list is provided that can be cross referenced to a particular individual if required).
- Project responsibilities
- Qualification level of each person who works on the project.

The final report shall contain references to personnel carrying out the QA/QC functions for all projects. Signature page shall also contain the following:

- Quality control personnel name
- Project responsibilities
- Qualification level
- Signature of individual(s) taking responsibility for quality assurance and compliance with contact requirements.

Note: In concurrence with the "Project Personnel and Signature Page" described above, the Vendors Quality Management Process, Analyst Certification and Training Process Document along with each Persons Proof of Certification shall be provided for each report. The Vendor shall include a notification of "Revisions" if and when any of these documents where changed from previous versions issued. See Page 20 "Deliverables" for more instruction.

GENERAL REQUIRMENTS

1. **COMPANY NAME AND ADDRESS** – Ensure that the correct company name is utilized

– CANADA **Enbridge Pipelines Inc.**
Enbridge Pipelines (Athabasca) Inc.
Enbridge Pipelines (NW) Inc.
Enbridge Pipelines (Saskatchewan) Inc.

– U.S.A. **Enbridge Energy Limited Partnership**
Enbridge Pipelines (Ozark) LLC.
Enbridge Pipelines (North Dakota) LLC.
Enbridge Pipelines (Toledo) Inc.
Enbridge Vector (USA) Inc.
Enbridge Pipelines (Spearhead) Inc.
Enbridge Pipelines (Southern Lights) LLC.

Shipping for both Canada and USA:

Attention:
Pipeline Integrity
Administrative Assistant
10201 Jasper Avenue
Edmonton, Alberta, T5J 3N7

Note: Vendor shall issue a "Report Delivery Acknowledgement Letter" to the Company immediately following the report issuance electronically or otherwise. Company shall sign and return the letter to acknowledge receipt and the date of delivery.

Link: Report Delivery Acknowledgement Letter Template

2. **RE ISSUE REPORTS** – By default, the original issue of a final report shall be called "Issue # 1". Consecutive re-issues of the same In-line Inspection data shall be clearly identified in consecutive numerical order; report "Issue # XX" and "Issue Date".

   Re-Issued reports must contain an executive summary clearly stating what revisions were required and the reason(s) for re-issue including technical, document editing or other.

3. **MEASUREMENT UNITS –** Ensure that the correct measurement units are utilized. If the segment inspected crosses the CAN-USA border, use the tool launch location (generally the trap location) to determine the measurement units to be used.

– CANADA - metric
– U.S.A - imperial

4. **DECIMAL PLACES** – Ensure the following decimal places are provided for each particular measurement:

	# of decimal places required				
	Rel. / Abs. Distance	Feature Length	Feature Width	Feature Depth*	Joint W.T.
meter	2				
millimeter		0	0	2	2
foot	2				
inch		2	2	3	3
mil				0	0
%				0**	

**Ultrasonic Crack Feature depths to be measured in mm or mil buckets with no decimal places.*
***Geometry / Caliper tool measures depth in percent; for geometry features report to minimum 1 decimal place.*

- **RPR's:** 3 decimal places.
- **Northing / Easting / Elevation (if reported):** 2 decimal places.
- **Latitude / Longitude (if reported):** 8 decimal places.

5. **GPS COORDINATES** – If an inertial tool is utilized for inspection, ensure the GPS coordinates are provided in all primary reports or listings which include the Pipeline Listing, Feature listing, Pipe book or tally, and AGM or marker listing. Coordinates shall include in both: UTM Zone XX, Northing (m) / Easting (m) / Elevation (m), and Latitude (deg) / Longitude (deg). Metric units will be used regardless of the inspection taking place in Canada or the U.S.A.

ABOVE GROUND MARKER (AGM), TIMER BOX (TB) OR MAGNET INFORMATION (ILI Service Provider specific) – Ensure the Marker List and the AGM list provided by the tracking service provider are correlated in the ILI results. Ensure the MilePost and/or AGM ID is included in the report. If the Above Ground Marker (timer box, magnet, etc.) information is missing, i.e. the timer box appears in the third party tracking report, but not in the maglogger, add a comment to the Marker List cover page in the report capturing the reason data was missed or not captured. **Tabulate the comments as shown in the table below:**

Box ID (Line Marker #)	Location	Mile Post	Reason for Omission
9	Pine Central Road	1113.57	Trigger not useable
20	FR 244	1135.34	Data not provided by Contractor
40	Highway # 122	1179.46	Did not trigger
44	State Line Road	1189.21	Blocked Access

Note: Tracking Service Providers must provide supplemental reporting as defined within the "Enbridge Standards and Guidelines for Tool Tracking and GPS, Section 5" [Standards and guidelines Tool Tracking and GPS] and the "Procedures and Practices Tool Tracking, Section 5" [Procedures and Practices Tool Tracking]

6. **ABSOLUTE DISTANCES** - Check that there are no absolute distances missing in the listing and tally (i.e. flanges and comments), and that they are provided in ascending consecutive order.

7. **PIPE TALLY** – All In-line Inspection (ILI) vendors and Enbridge employees must follow the appropriate Girth Weld (GW) numbering convention for all lines and sections of pipe within the Enbridge system as described below. It is important that a consistent GW number convention is used. The Company must maintain its ability to identify a specific piece of pipe or pipe joints within consecutive ILI run reports. In addition to GW, the report shall contain joint lengths, nominal wall thickness, and long seam orientation.

For additional information pertaining to girth weld numbering relative to in-line inspection and historical baselines, see attached link to "Girth Weld Numbering" procedure.

8. **Weld Orientation** – Where possible the orientation of each longitudinal weld shall be listed and reported to the Company within the Pipe tally and/or feature listing.

REPORTING REQUIREMENTS AND TIMES

1. Ensure all listings and Reports contain the following information:
   - Line # (Diameter in inches),
   - Segment (trap to trap),
   - Run Date,
   - Issue Date,
   - Issue Number.

2. Ensure the electronic files contain no macros, formulas or truncated text

3. Reported Features (and subsequent re issues) shall have the same QA/QC in a Priority Notifications (if required) and in the Final Report. The target is to have full compatibility from Preliminary to Final Report.

4. Any changes from a Priority Notification (if required) MUST BE HIGHLIGHTED IN THE EXECUTIVE SUMMARY of the final report.

5. A REPORT CHANGE SUMMARY – Ensure that a "Report Change Summary" is completed and up to date. Report Change Summary shall be maintained on file or included in report revision.

PRIORITY NOTIFICATION

For each and every feature meeting the Priority Notification Criteria, Vendor shall carry out the following:

Communicate Priority Notification – confirm verbally and in writing as per Integrity Management System Guideline PI-29. A repeated effort should be made to ensure contact has been made with company representative(s) within 48 hours of threat discovery.

1.) For formal notification in writing, use the template
Priority Notification Template 06/15/12

Please Note

2) For verbal communication, contact Enbridge Personnel based on the following order (in the event personnel cannot be contacted):
   1. Project Manager
   2. Programs Supervisors (Execution, Crack, Corrosion, Deformation)
   3. Specialist In-Line Inspection
   4. Manager of Program Logistics
   5. Pipeline Integrity Manager
   6. System Integrity Director

As part of the immediate reporting requirements for all technologies, the Priority Notification shall include but is not limited to the following information about feature(s) of interest:

1. Girth weld numbers
2. Absolute distance and distance relative to upstream girth weld
3. Orientation of the feature(s)
4. Depth, length and Remaining Strength Calculation i.e. RPR of the feature(s)
5. Distance to the nearest upstream and downstream above-ground marker(s)
6. A screen shot of the feature(s) from the ILI data
7. Joint length and long seam weld orientation for the joint in question as well as for five (5) joints immediately upstream and downstream.

SCHEDULE REQUIREMENTS

Contractual due dates for report delivery to start after the data is received at the vendor's facilities and no later than 7 days from the tools receipt in the trap date. And will comply with the following schedule by technology:

GEOMETRY:

Please Note

Priority Notification: Enbridge is to be notified immediately upon the discovery of each or any dents greater than 5% or upon detection of features meeting or exceeding the criteria for priority notification as identified in the work order or as stated within the Enbridge Reporting Profile Standard. "Caliper Field Report" is to be issued within 2 days (48 hrs) of receipt of tool. In concurrence with the notification, Vendor will ensure a lead analyst is assigned to the effort and will be made available to work directly with the project manager on report details.

Final Report: As per Vendor Standard Reporting, all restrictions greater than or equal to 2% are to be reported in the Final Report unless documented otherwise in the Work Order. All deformation that meet the criteria of "Dents in Close Proximity" or contain multiple apexes, as defined in the Listings Format section below, are to be reported including deformations greater than or equal to 1% in depth. If the Caliper tool is ran in conjunction with another technology, (i.e. Corrosion/Crack) the delivery date will be that of the Higher Order Technology. If the Caliper run is a standalone run, the report is to be delivered within 30 calendar days from receipt of inspection data at the vendor facilities.

Please Note

If the vendor is unable to achieve the 30 day delivery timeline based on pipeline length / feature volume, the vendor shall notify Enbridge with the plausible delivery date in writing not to exceed 90 calendar days.

Note: For Enbridge's tracking purposes, a maximum of 7 days will be added to the inspection end run date, to account for transfer of data from the inspection site to the vendor's facility.

CORROSION ULTRASONICS:

Please Note

Priority Notification: Enbridge is to be notified immediately upon the discovery of each or any metal loss features greater than or equal to 75% metal loss, that have an RPR less than or equal to 0.85 unless otherwise documented in the project work order Scope of Work re: Line 3 / 6B, the RPR shall be ≤0.80, or upon detection of features meeting or exceeding the criteria for priority notification as identified in the work order or the Enbridge Reporting Profile Standard. Clustering is to be 6Tx6T. In concurrence with the notification, Vendor will ensure a lead analyst is assigned to the effort. Analyst will be made available to work directly with the project manager on report details.

Final Report: As per Vendor Standard Reporting the Final Report to be delivered within 90 calendar days from receipt of inspection data at the vendor facilities for 200km or less, 30 additional calendar days for every additional 100km or fraction thereof.

Please Note

If the vendor is unable to achieve the 150 day delivery timeline based on pipeline length / feature volume, the vendor shall notify Enbridge with the plausible delivery date in writing.

Note: For Enbridge's tracking purposes, a maximum of 7 days will be added to the inspection end run date, to account for transfer of data from the inspection site to the vendor's facility.

MAGNETIC FLUX LEAKAGE (MFL):

Priority Notification: Enbridge is to be notified immediately upon the discovery of each or any metal loss features greater than or equal to 75% metal loss, that have an RPR less than or equal to 0.85, unless otherwise documented in the project work order Scope of Work re: Line 3 / 6B, the RPR shall be ≤0.80, or upon detection of features meeting or exceeding the criteria for priority notification as identified in the work order or the Enbridge Reporting Profile Standard. Clustering is to be 6Tx6T. In concurrence with the notification, Vendor will ensure a lead analyst is assigned to the effort. Analyst will be made available to work directly with the project manager on report details.

Final Report: As per Vendor Standard Reporting, the Final Report to be delivered within 90 calendar days from receipt of inspection data at the vendor facilities for 200km or less, 30 additional calendar days for every additional 100km or fraction thereof.

Please Note

If the vendor is unable to achieve the 150 day delivery timeline based on pipeline length / feature volume, the vendor shall notify Enbridge with the plausible delivery date in writing.

Note: For Enbridge's tracking purposes, a maximum of 7 days will be added to the inspection end run date, to account for transfer of data from the inspection site to the vendor's facility.

CRACK ULTRASONICS:

Please Note

Priority Notification: Enbridge is to be notified immediately upon the discovery of any features greater than or equal to 3mm in depth, or upon detection of features meeting or exceeding the criteria for priority notification as identified in the work order or the Enbridge Reporting Profile Standard. In concurrence with the notification, Vendor will ensure a lead analyst is assigned to the effort. Analyst will be made available to work directly with the project manager on report details. Additional reporting requirements such as Coarse Evaluation (Step 1) may be required and indicated in the Work Order specific to each inspection.

Final Report: As per Vendor Standard Reporting in aggregate with Vendor contractual performance specifications, the base reporting criteria of 30mm length x 1mm depth will be used on all projects unless expressly stated otherwise within the project work order Scope of Work.

Note: The Crack Reporting Criteria is dependent upon the tool speed. All crack features shall be reported using the best achievable criteria up to a maximum of 60 mm in length x 1 mm in depth. The Project Manager shall be contacted to validate / confirm the overall criteria obtainable (based on run conditions) prior to the complete data analysis.

The Final Report is to be delivered within 120 calendar days from receipt of inspection data at the vendor facilities for 200km or less, 30 additional calendar days for every additional 100km or fraction thereof to a maximum of 180 calendar days from receipt of inspection data at the vendor facilities.

Note: For Enbridge's tracking purposes, a maximum of 7 days will be added to the inspection end run date, to account for transfer of data from the inspection site to the vendor's facility.

Please Note

If the vendor is unable to achieve the 180 day delivery timeline based on pipeline length/ feature volume, the vendor shall notify Enbridge with the plausible delivery date in writing.

LISTINGS FORMAT

The following describes the **required data fields** for all standard electronic (MS Excel and Comma Delimited CSV) reports including those required for Metal Loss, Geometry / Dent and Cracking. Electronic reporting includes not only the full Pipeline Listing but the various supplementary reports commonly provided as MS Excel Spreadsheets. A list of required "Report Deliverables" is provided on page 20.

Please Note

Individual reports shall be provided for the specific Technology used on the project unless otherwise stated in the work order. For example, a "metal loss" inspection based on MFL or USWM shall produce a Metal Loss report. If a Caliper tool was run prior to the metal loss inspection, a stand-alone Caliper or Geometry report will be produced. Furthermore, if a "Combo" Technology is used to inspect a pipeline, Pipeline Integrity requires individual reports for the metal loss deliverable and the Caliper or Geometry deliverable in the case of a Metal Loss/ Caliper Combo tool. At their discretion, the Service Provider may provide a supplementary report combining or correlating the two technologies in addition to the technology specific reports,

Please Note

Note: To assist Pipeline Integrity with the import of ILI data into the ISAS Database, all Full Feature Lists and Pipe Tally Reports listed above are required in a "controlled" electronic file format. **The Report Listings shall be provided in both a Comma Delimited (CSV) file format as per the "Data Formats for the Enbridge Information Management System" requirements described on Page 24 of this document and in MS Excel format.** All listings provided electronically (CSV and Excel) shall reflect the same records. **All listings shown above shall include complete lists with the CSV file containing the same list of features /records provided in the Excel files.** For example, if a feature listing provided in Excel format includes welds, features, valves, agms, etc; the CSV file shall also include these same records. This requirement is further defined within the "Data Formats for **the Enbridge Information Management** System" (see page 24).

The following fields shall be reported as typical deliverables in all electronic reports or listings. The text shown in [ ] brackets denotes which inspection technology the field is applicable to.

a. **0.85 DL RPR –** Rupture pressure ratio (RPR) value, according to 0.85 DL pressure sentencing. A 0.85DL RPR shall be provided for both individual defects (individual boxed data) and the overall clustered defects (the overall defect based on the interaction of individual defects or boxed data) [Metal Loss]

b. **Absolute Distance (ft / m)** - the absolute distance along the pipeline which corresponds to the upstream edge of the feature, to the centre of the boxed feature for dents and other geometry features, measured from the start of the run. [All Technologies]

c. **Axial Length (in/m)** – the length of the dent/geometry feature reported as the distance between point of zero radial deflection from original wall profile in the axial direction, excluding the effects of ovality. [Dent / Geometry]

d. **Circumferential Width (in/m)** – the width of the dent/geometry feature reported as the distance between points of zero radial deflection from original wall profile in the circumferential profile, excluding the effects of ovality. [Dent / Geometry]

e. **Data Degradation – (Yes / No)** Denotes loss of reflected signal or loss of overall signal based on all Inspection Principles. [Metal Loss]

f. **Deformation Associated with** – Indicates whether the deformation associated with a geometric feature (dent, wrinkle or buckle) ~~feature~~ is associated with metal loss (ML), as well as the association of such ~~dent~~ deformation with girth weld (GW) or seam weld (SW). Ensure each "category" is identified individually. [Metal Loss]

g. **Deformation Associated with Weld (Y/N) –** Denotes whether or not the detectable limit of deformation of a ~~deformation (dent) or other~~ geometry feature is located at or crosses a girth weld or seam weld. [Dent / Geometry]

h. **Deformation in Close Proximity (Y/N) –** Denotes whether or not a ~~deformation~~ geometry feature ~~(dent)~~ is a singular occurrence or located in close proximity to another ~~deformation~~ geometry feature ~~(dents)~~. Close proximity is defined as any ~~deformation~~ geometry feature ~~(dent)~~ that the MSP is located within 3m (10 ft.) of the MSP of any other separate ~~deformation (dent)~~ geometry feature and is to be reported for all geometry features ~~deformation~~ meeting these criteria, including ~~dents~~features with depths greater than or equal to 1%. [Dent / Geometry and Metal Loss]

i. **Deformation Depth –** Depth of deformation ~~(dent)~~ of a geometry feature at the MSP, excluding the effects of ovality. Report the measured depth and depth as %OD in separate columns. [Dent / Geometry]

> Note: For non-geometry related inspections such as metal loss or crack, those features interpreted as possible dents or another geometry related feature but with uncertainty should ~~not be included in the report unless the feature is associated with another reportable item such as metal loss, weld, etc~~be reported as "geometry" features unless feature characterization has been confrimed by caliper ILI or other means. When appropriate a Geometry or Caliper inspection will be used to supplement other inspections to obtain definitive ~~results~~characterization and confirm the presence of dent, wrinkle or buckle features. ~~For metal loss or crack inspections, only report those geometry features with a high probability of correctness.~~

j. **Deformation Oriented off Axis (Y/N) –** Denotes whether or not the longitudinal axis of a geometry feature varies more than 15 degrees from the longitudinal or transverse axis of the pipeline. [Dent / Geometry]

k. **Echo Loss – (Yes / No)** Denotes loss of reflected signal based on Ultrasonic Inspection Principles only. [Metal Loss, Crack]

l. **Effective Area RPR –** RPR value, according to a "river bottom profile" assessment. An effective area RPR shall be provided for both individual defects (individual boxed data) and the overall clustered defects (the overall defect based on the interaction of individual defects or boxed data) [Metal Loss]

Please Note

> Note: Rupture Pressure Ratios shall be determined based on calculated hoop stress level at failure divided by Specified Minimum Yield Stress (Not the Design Pressure)

m. **Effective Depth (in / mm)** – the mean profile depth of the profile subsection, calculated by effective area / effective length. [Metal Loss]

Please Note

> Note: *Effective depth* is the mean profile depth of that subsection, calculated by effective area / effective length

n. **Effective Length (in / mm) –** Effective axial extent of the profile subsection. [Metal Loss]

Please Note

> Note: Effective length, *effective area* and *effective depth* are results of the iterative assessment of the aligned river-bottom profile of the defect. Every possible subsection of the profile is assessed for pressure severity according to ASME RSTRENG, using the length and the metal loss area of that profile subsection. *Effective length* and *effective area* are the attributes of the profile subsection with the lowest assessed pressure

o. **Feature Code –** as defined or described by In-Line Inspection vendor, (see also Feature code table below, Pages 33). [All Technologies]

p. **Feature ID / Area Number** – Unique identifier of the feature within the ILI report. This feature number will be used to tie-in the field results. [All Technologies]

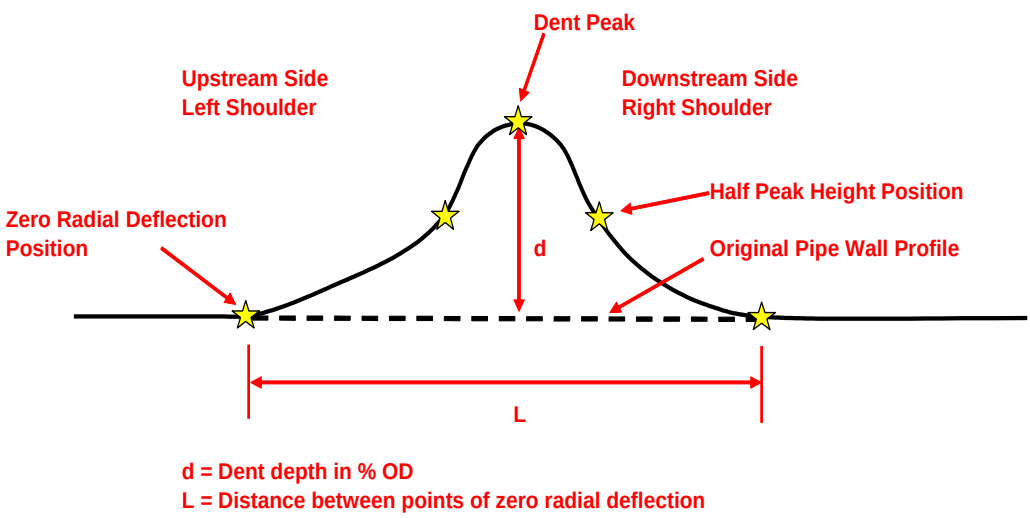
q. **Feature Length (in / mm)** – the length of the feature box. [Metal Loss and Crack]

r. **Feature Width (in / mm)** – the width of the feature box. [Metal Loss and Crack]

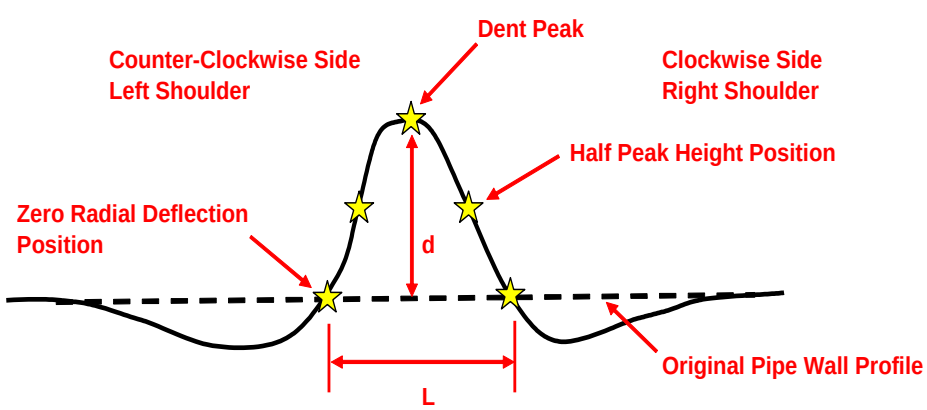
s. **Feature Orientation** - indicates the circumferential position (orientation) of the most significant point (MSP) of the feature, to the centre of the boxed feature for dents and other geometry features. [All Technologies]

t. **Feature Type –** as defined or described by In-line Inspection vendor, (see also Feature code table below, Pages 33). [All Technologies]

u. **Half Peak Height Position (in/m)** – the distance from the boxed edge of a dent feature to the position of half the peak depth of the feature reported for each of four shoulders of the feature. [Dent / Geometry] See Figure 1a and 1b below.



(a)



(b)

Figure 1: General Description of Dent Profile Parameters based upon (a) the Axial Orientation Profile and (b) the Circumferential Profile

v. **Joint Length (ft / m)** – Length of joint in which the feature is located. [All Technologies]

w. **Local Wall Thickness (in / mm / mils)** – an additional column for "actual measured local wall thickness" in the vicinity of the feature shall be included for all inspections based on ultrasonic technology. [Metal Loss and Crack]

x. **Longseam Orientation (deg)** – Orientation of the seam weld of the joint in which the feature is located, when detectable. [Metal Loss and Crack]
Special cases:

- For spiral weld where possible, indicate the orientation of the weld 30cm (12") d/s of the upstream joint and 30cm (12") u/s of the end of the joint (e.g. 350-75). If not detectable, indicate "SW" (for spiral weld);
- When longseam is not detectable, indicate "ND" or leave blank.

y. **Minimum ID** – minimum inside diameter measured by the ILI tool. [Dent / Geometry]

z. **Most Significant Point (MSP) distance (ft / m)** – the relative distance along the pipeline which corresponds to the most significant / deepest point of the feature, to the upstream girth weld. [All Technologies]

aa. **Most Significant Point (MSP) Orientation –** indicates the circumferential position (orientation) of the MSP of a ~~deformation (dent) or other~~ geometry feature. [Dent / Geometry]

bb. **Multi-Apex Deformation – (Yes/No)** – Denotes whether or not the ~~geometry of a deformation (dent)~~ geometric shape of a dent has a singular or multiple apex points, and is to be reported for all dents meeting this criteria, including dents with depths greater than or equal to 1%. [Dent / Geometry]

cc. **Nominal Wall thickness (in / mm / mils)** – Nominal wall thickness of the pipe, to be used in depth calculations. [Metal Loss and Crack]. For instances where the wall thickness for appurtenances such as valves, tee pieces or other installations is not clear, the vendor may report the estimated value or leave the wall thickness blank (Null value). Text will be rejected as invalid values in the ISAS ready (CSV) file.

dd. **Ovality (%OD)** – report at dent/geometry feature locations, or where measured ovality exceeds 5%. Ovality is calculated based on $(D_{max}-D_{min})/D_{nom}$. [Dent / Geometry]

ee. **Peak Depth (in / mm) –** Absolute measured depth of wall loss or crack related feature, or the combination of both. [Metal Loss and Crack]

ff. **Peak Depth (%)** – Depth of the feature as a percentage of nominal wall thickness of the pipe. Maintain record as a real number between 0 and 100. Depths relative to the actual or measured wall thickness may be required and agreed upon between the In-line Inspection vendor and Enbridge. [Metal Loss and Crack]

Please Note

Note: Feature Depth calculations shall be executed as follows:

- Peak Depth (in / mm) = Local WT – Remaining WT
- Peak Depth % (locWT) = Peak Depth ÷ Local WT × 100
- Peak Depth % (nomWT) = (Nom WT – Remaining WT) ÷ Nom WT × 100

gg. **Radial Position –** Indicates whether the feature is in the internal or external surface of the pipe; indicate "ND" (not decidable) when not possible to discriminate between internal and external. [Metal Loss and Crack]

hh. **Relative Distance** – the relative distance along the pipeline which corresponds to the upstream edge of the feature to the upstream girth weld; Relative Distance for Geometry is to the centre of the feature. [All Technologies]

ii. **Relative Postion –** Relative position of feature, from a weld (seam weld or girth weld). Mostly used to address features from an Ultrasonic Crack Detection inspection. [Crack Inspection]

- In longitudinal weld;
- Adjoining weld: Within 20 mm from the centreline of the weld;
- In Base Metal: More than 20 mm from the centreline of the weld;

- Not decidable: all other cases.

jj. **Remaining Wall Thickness (in / mm / mils)** - In addition to the nominal wall thickness, an additional column for "actual measured remaining wall thickness" in the vicinity of the feature shall be included for all inspections based on ultrasonic technology. [Metal Loss and Crack]

kk. **Top / Bottom Deformation –** Top of pipe deformation (dents) are those located between 8:00 o'clock and 4:00 o'clock (primarily top of pipe). [Dent / Geometry and Metal Loss]

ll. **Upstream Girth Weld** – The number of the upstream girth weld of the joint in which the feature is located. [All Technologies]

mm. **Weld Type** – Indicates the longitudinal weld type if detected and identified, e.g. SAW, DSAW, ERW, FW, Seamless. [Metal Loss and Crack]

nn. **Comment –** Additional comments describing the feature. [All Technologies]

Recommended Standard / General Comments

a. Repaired
   i. Under sleeve
   ii. Under Patch
   iii. Other

b. Degraded Data
   i. Sensor Liftoff
   ii. Debris
   iii. Sensor Failure
   iv. Echo Loss

c. Possible Weld Defect
d. Rock Shield
e. UTM Zone
f. Road
g. Bend
   i. Over
   ii. Field Bend
   iii. Under
   iv. Hot
   v. Cold
   vi. Right
   vii. Left

h. Bend Radius
i. Installation
j. Inclusion
k. Receiver
l. Launcher
m. Deformation associated with

If in the Vendor's opinion the definitions above do not adequately describe any one data field listed sufficiently, it is recommended the Vendor provide **for all reports** an enhanced "Description of Measurements" within the Report summary or definitions. A description or definition on the criteria used for each data field within the listings will provide the company with necessary details on how the data was analyzed and reported.

An example of how the vendor might describe or define vendor reporting criteria for each field is provided below:

Ultrasonic Crack features

- Location of Feature orientation is to the middle of the area, not to the Most Significant Point (MSP)
- Relative and Absolute distance of the feature is to the most upstream edge of the area.

Ultrasonic Metal Loss features

- Feature orientation is to the MSP, start and end of the area (based on width)
- MSP is also measured relative to long seam
- Relative and Absolute distance of the feature is to the most upstream edge of the area, MSP and to the end of the area
- Depth is measured in mm or mil, the percent wall loss is calculated using both the nominal (as provided by the company) and measured wall thickness from the ultrasonic sensors.

MFL features

- Feature orientation is to the centre of the area
- Relative and Absolute distance of the feature is to the most upstream edge of the area
- Depth is measured in percent relative to the nominal (as provided by the company) and measured wall thickness, if available from other sources.

Geometry / Caliper features

- Feature orientation is to the centre of the feature
- Relative and Absolute distance of the feature is to the centre of the feature
- Depth is measured as percent of the outside diameter
- Where directed by the Project Manager, bend radius shall be provided in "Comments". Alternatively, bend radius information shall be collected and retained by vendor for future reference.

Note: When in question, the Vendor shall contact the Company prior to all inspections to confirm all fields / data required, in addition to the above standards for reporting.

<u>The following tables are provided as examples of typical reports only; they are not intended as actual deliverables.</u>

SAMPLE TABLE # 1: Ultrasonic Crack Measurement LISTING

Technology: UltraScan CD
Line (Diam): 5 (34")
Segment: Launch to Receive
Run Date: 15-Jul-06

Client: Enbridge Pipelines Inc.
Project No.: 106-005
Issue No.: 2
Issue Date: 21-Dec-06

IN LINE INSPECTION DATA

UPSTREAM GIRTH WELD	JOINT LENGTH (ft)	LSO (deg)	WELD TYPE	NWT (in)	AWT (in)	FEATURE I.D. / AREA NUMBER	ABSOLUTE DISTANCE (ft)	RELATIVE DISTANCE (ft)	FEATURE TYPE	RADIAL POSITION (INT / EXT / ND)	RELATIVE POSITION	FEATURE ORIENT. (DEG)	FEATURE LENGTH (in)	FEATURE WIDTH (in)	FEATURE DEPTH (in)	FEATURE DEPTH (%)	DEGRADED DATA (Y/N)	COMMENT
3780	39.74	72	ERW/FW	0.281			17162.85	39.73	Girth Weld									
3790	39.58	323	ERW/FW	0.281			17202.59	39.74	Girth Weld									
3800	39.70	67	ERW/FW	0.281			17242.16	39.58	Girth Weld									
3810	39.70	323	ERW/FW	0.281			17281.86	39.70	Girth Weld									
3820	39.64	38	ERW/FW	0.281			17321.56	39.70	Girth Weld									
3820	39.64	38		0.281		004 - 05837	17347.48	25.92	Crack-Like	EXT	In Base Mat.	175	2.40	1.60	< 1 mm			surface-breaking lamination
3820	39.64	38		0.281		004 - 05952	17358.39	36.84	Crack-Like	EXT	In Base Mat.	273	11.70	1.90	1 - 2 mm			surface-breaking lamination
3820	39.64	38		0.281		004 - 11533	17359.50	37.94	Crack-Like	EXT	In Base Mat.	215	2.90	1.20	< 1 mm			surface-breaking lamination
3820	39.64	38		0.281		004 - 11271	17360.14	38.59	Crack-Like	EXT	In Base Mat.	218	2.60	1.10	< 1 mm			near GW - surface-breaking lamination
3830	39.79	346	ERW/FW	0.281			17361.19	39.64	Girth Weld									
3840	39.75	31	ERW/FW	0.281			17400.99	39.79	Girth Weld									
3850	39.67	339	ERW/FW	0.281			17440.73	39.75	Girth Weld									
3850	39.67	339		0.281		004 - 11423	17441.31	0.58	Notch-Like	EXT	In Base Mat.	190	4.60	1.10	< 1 mm			near GW
3850	39.67	339		0.281		004 - 06299	17453.35	12.62	Notch-Like	EXT	In Base Mat.	189	28.90	1.90	< 1 mm			
3860	39.75	70	ERW/FW	0.281			17480.40	39.67	Girth Weld									
3870	39.71	345	ERW/FW	0.281			17520.14	39.75	Girth Weld									
3880	39.62	85	ERW/FW	0.281			17559.85	39.71	Girth Weld									
3890	39.61	306	ERW/FW	0.281			17599.47	39.62	Girth Weld									
3900	39.53	99	ERW/FW	0.281			17639.08	39.61	Girth Weld									
3900	39.53	99		0.281		004 - 06682	17649.78	10.70	Notch-Like	EXT	In Base Mat.	310	8.90	1.10	< 1 mm			
3900	39.53	99		0.281		004 - 06681	17650.09	11.01	Notch-Like	EXT	In Base Mat.	282	10.80	1.40	< 1 mm			
3900	39.53	99		0.281		004 - 06699	17654.84	15.77	Notch-Like	EXT	In Base Mat.	268	34.00	3.60	1 - 2 mm			

SAMPLE TABLE # 2: Ultrasonic Wall Measurement LISTING

Technology: UltraScan WM
Line (Diam): 5 (34")
Segment: Launch to Receive
Run Date: 15-Jul-06

Client: Enbridge Pipelines Inc.
Project No.: 106-005
Issue No.: 2
Issue Date: 21-Dec-06

IN LINE INSPECTION DATA

GIRTH WELD	JOINT LENGTH (ft)	LSO (deg)	WELD TYPE	NWT (in)	AWT (in)	FEATURE I.D. / AREA NUMBER	ABS. DIST. (ft)	RELAT. DIST. (ft)	MSP (ft)	FEATURE TYPE	RADIAL POSITION (INT / EXT / ND)	FEATURE ORIENT. (DEG)	FEATURE LENGTH (in)	FEATURE WIDTH (in)	FEATURE DEPTH (in)	FEATURE DEPTH (%)	0.85 DL RPR	EFFECT. AREA RPR	CLUSTER ID	DENT ASSOC.	DENT DEPTH (%)	ECHO LOSS PRESENT (Y/N)	DEGRADED DATA (Y/N)	COMMENT
3780	39.74	72	DSAW	0.281			17162.85	39.73	39.73	Girth Weld														
3790	39.58	323	DSAW	0.281			17202.59	39.74	39.74	Girth Weld														
3800	39.70	67	DSAW	0.281			17242.16	39.58	39.58	Girth Weld														
3810	39.70	323	DSAW	0.281			17281.86	39.70	39.70	Girth Weld														
3820	39.64	38	DSAW	0.281			17321.56	39.70	39.70	Girth Weld														
3820	39.64	38		0.281		004 - 05837	17347.48	25.92	25.92	Metal Loss	EXT	175	2.40	1.60	0.271	15	1.070	1.180	CLS-104					
3820	39.64	38		0.281		004 - 05952	17358.39	36.84	36.84	Metal Loss	EXT	273	11.70	1.90	0.269	20	1.040	1.180	CLS-105				Y	Sensor lift off
3820	39.64	38		0.281		004 - 11533	17359.50	37.94	37.94	Metal Loss	EXT	215	2.90	1.20	0.153	45	0.954	1.100	CLS-105				Y	Sensor lift off
3820	39.64	38		0.281		004 - 11271	17360.14	38.59	38.59	Metal Loss	EXT	218	2.60	1.10	0.273	10	1.180	1.180	CLS-105				Y	Sensor lift off
3830	39.79	346	ERW/FW	0.281			17361.19	39.64	39.64	Girth Weld														
3840	39.75	31	ERW/FW	0.281			17400.99	39.79	39.79	Girth Weld														
3850	39.67	339	ERW/FW	0.281			17440.73	39.75	39.75	Girth Weld														
3850	39.67	339		0.281		004 - 11423	17441.31	0.58	0.58	Metal Loss	EXT	190	4.60	1.10	0.269	20	1.180	1.180	CLS-106					
3850	39.67	339		0.281		004 - 06299	17453.35	12.62	12.62	Dent	EXT	189	3.00	1.90						ML	2.1			
3860	39.75	70	ERW/FW	0.281			17480.40	39.67	39.67	Girth Weld														
3870	39.71	345	ERW/FW	0.281			17520.14	39.75	39.75	Girth Weld														
3880	39.62	85	ERW/FW	0.281			17559.85	39.71	39.71	Girth Weld														
3890	39.61	306	ERW/FW	0.281			17599.47	39.62	39.62	Girth Weld														
3900	39.53	99	ERW/FW	0.281			17639.08	39.61	39.61	Girth Weld	70													
3900	39.53	99		0.281		004 - 06682	17649.78	10.70	10.70	Mfg	EXT	310	8.90	1.10		10								

SAMPLE TABLE #3: Dent/Geometry LISTING

Technology Client:
Line (Diam): Project No.:
Segment: Issue No.:
Run Date: Isue Date:

Absolute Distance to MSP (feet)	Upstream Girth Weld	Relative Distance (feet)	Feature Orientation (degrees)	Minimum ID (in)	Ovality %OD	Dent Depth (excluding ovality) (in)	Dent Depth (excluding ovality) (%OD)	MSP Position (in)	MSP Orientation (in)	Dent Axial Length (in)	Dent Circ. Width (in)	Half Peak Height Position				Multi-Apex (Y/N)	Dent Oriented off Axis (Y/N)	Assoc. Girth Weld (Y/N)	Dent in Close Proximity (Y/N)	Comments
												U/S Shoulder (in)	D/S Shoulder (in)	Circ. Start Shoulder (in)	Circ. End Shoulder (in)					

Note: If achievable, Pipeline Integrity would prefer that the Final Reports (feature listings) represent the data columns and corresponding information as per the above sample.

SAMPLE TABLE # 4: PIPEBOOK

Technology **MFL** Client: **Enbridge Pipelines Inc.**
Issue No.: **1** Project No **107648_18A**
Issue Date: **15-Jan-08** Run Date: **3-Oct-07**
Line (Diam): **13 (18")** Segment: **Gretna to Clearbrook**

PIPEBOOK

Upstream Girth Weld	Joint Length	LSO (deg)	WT (in)	Absolute Distance (feet)	Northing WGS84 UTM (metres)	Easting WGS84 UTM (metres)	Elevation (m)
21550	39.86	345	0.281	85527.41	5,411,479.76	623,503.72	242.09
21560	37.52	82	0.281	85567.27	5,411,470.92	623,512.02	242.06
21570	39.88	322	0.281	85604.79	5,411,462.61	623,519.82	241.90
21580	39.87	52	0.281	85644.67	5,411,453.70	623,528.04	241.87
21590	39.90	345	0.281	85684.53	5,411,444.84	623,536.31	242.11
21600	39.88	75	0.281	85724.43	5,411,436.05	623,544.68	242.19
21610	39.91	375	0.281	85764.31	5,411,427.20	623,552.96	242.35
21620	39.86	60	0.281	85804.22	5,411,418.32	623,561.22	242.68
21630	39.90	330	0.281	85844.09	5,411,409.49	623,569.53	242.92
21640	39.82	67	0.281	85883.99	5,411,400.68	623,577.86	243.16
21650	39.90	352	0.281	85923.81	5,411,391.84	623,586.14	243.31
21660	37.59	67	0.281	85963.70	5,411,382.94	623,594.37	243.44
21670	39.93	352	0.281	86001.29	5,411,374.59	623,602.19	243.51
21680	39.91	45	0.281	86041.22	5,411,365.73	623,610.48	243.56
21690	39.94	322	0.281	86081.13	5,411,356.89	623,618.80	243.68
21700	39.97	52	0.281	86121.07	5,411,348.06	623,627.14	243.82
21710	39.89	337	0.281	86161.04	5,411,339.24	623,635.50	244.02
21720	39.91	52	0.281	86200.93	5,411,330.44	623,643.83	244.26
21730	39.87	345	0.281	86240.84	5,411,321.59	623,652.14	244.44

DELIVERABLES

The following is the minimum required deliverables for all electronic reporting including those for Metal Loss, Geometry / Dent, and Cracking. Specific reports include:

Note: For AGM / Tracking report deliverables, see "Standards and Guidelines Tool Tracking and GPS, Section 5" and "Procedures and Practices Tool Tracking, Section 5".

Report

- **Executive Summary –** Electronic Format only (PDF)
- **Severity Listing –**Electronic Format only (PDF). These documents illustrate the most significant or severe features in the report. The vendor shall report some or all of the following as part of their standard deliverables. For guidance, Enbridge recommends the following report standards:
    - Corrosion Reports – Shall provide the most significant 15 to 20 features based on Depth and Effective Area RPR.
    - Geometry Reports – List of all dents with a depth greater than 2%
    - Crack Reports – List of crack-like, notch-like and crack-field features with a depth equal to or greater than 2mm.

Note: The extent of the above reporting shall be subjected to the overall density of features reported. The objective of this reporting is to provide an overview of the most significant features documented.

Listings

- **Pipebook / Pipe Tally–** Electronic Format only (Excel). This document contains a list of all girth welds, with associated starting and end distance, length, longseam orientation (when detectable) and nominal wall thickness.
- **Pipeline Listing –** Electronic Format only (Excel). This document lists all girth welds, features, fittings, sleeves and any other relevant information. Refer to the **Listing Formats** in the previous section, for required fields.
- **Feature Listing –** Electronic Format only (Excel). This is a list of only the features present in the joints. It is a filtered version of the pipeline listing.
- **Marker List or Reference Point Listing –**Electronic Format only (Excel).
- **Data Management (Database) files –** Electronic Format only (CSV) - Refer to Data Format for Data Management System on page 24 for required fields.

Note: The Comma Delimited Files or listings (CSV) shall contain the same records or features as those reported in the "listings" delivered in Microsoft Excel format. For example, if welds, valves, AGMs, etc. are provided within the excel "feature listing", these same records shall be included in the database tables delivered in CSV format.

- **Nominal wall thickness listing** – Electronic Format (Excel).
- **Dent Listing** – Electronic Format (Excel).
- **Lamination Listing** – Electronic Format (Excel).
- **Repair Listing** – Electronic Format (Excel).
- **Wall Thickness Listing** – Electronic Format (Excel).
- **Metal Object Listing** (Metal objects in close proximity to pipe) – Electronic Format (Excel).
- **Eccentric Casing Listing** – Electronic Format (Excel).
- **Temperature Profile & Listing** – When available in Electronic Format (Excel)
- **Pressure Profile & Listing** - When available in Electronic Format (Excel)

Tool Performance

The Vendor shall consider the excavation information provided by the Company and take into consideration the excavation findings. When considered in relation to Vendor reports, the Vendor shall derive a "Tool Performance and Accuracy" summary based on API 1163 Guideline - Exhibit E as a proposed method. Documentation shall be in standard electronic formats (MS Excel and Comma Delimited CSV) and shall include those required for Metal Loss, Geometry / Dent and Cracks.

Quality

The purpose of the quality system is to ensure consistent products and services are delivered. The following quality system standards are adopted from both API 1163 and/or the Pipeline Operators Forum, latest versions (June 2012). All activities involved in the design, testing, field operations, data analysis, and support services for conducting an in-line inspection fall under the scope of this system.

- **Quality Management Process Document(s) –** Electronic Format only (PDF). Documentation shall provide an overall summary of the Vendor's Quality Management Process as it relates to Data Acquisition, Analysis and Reporting. Shall include procedures for all levels of Data Analysis.
- **Procedure Document(s)** – Electronic Format only (PDF). Documentation shall provide guidance on the design, testing, contracting, field operations, data reduction and analysis processes; written procedures for all activities and services necessary to complete a successful in-line inspection. All written procedures and records shall be maintained by each organization, according to their area of responsibility, and must be made available to the Pipeline Operator upon request.
- **Personnel Certification and Training Process Document(s) –** Electronic Format only (PDF). A list of personnel that will be deployed for the ILI tool run, data analysis and final report review shall be submitted within the report.

  (Note: that due to data privacy regulations in some countries, an undisclosed list is provided that can be cross referenced to a particular individual if required).

  Documentation shall provide a detailed overview of Company Personnel Certification and Training Methodologies and Processes in the areas of Data Acquisition, Analysis and Reporting.
- **Proof of Employee Training and Certification Document(s)** – Electronic Format only (PDF). A document or record of training and certification shall be provided for all individuals involved in the analysis and reporting process as per those identified on the report signature page.

  (Note: that due to data privacy regulations in some countries, an undisclosed list is provided that can be cross referenced to a particular individual if required).

  Records of qualification requirements shall be in accordance with ASNT ILI-PQ2005, and shall be maintained by the individual performing the task. The organization employing the individual shall keep a copy of the qualification record on file and make available to the Pipeline Operator upon request.
- **Tool Performance Specification -** Electronic Format only (PDF). Vendor shall provide a Defect Detection Specification or Performance and Operating Specification stating the minimum detection and sizing accuracy specific to the project and/or technology used. See API 1163 - Section 7 for guidance. The equipment used in the in-line inspection shall be uniquely identified, and the records maintained so that traceability of the equipment is possible.

- **Tool Calibration** - Electronic Format only (PDF). The Vendor shall provide information regarding the calibration procedure and latest calibration record of the tool. The procedure should give insight in, but not limited to: used calibration features, line pipe material, wall thickness and manufacturing process, tool velocity, date and frequency of calibration. For magnetic tools the calibration information will include the tool speed and the measured magnetic field strength value with the position where it was measured. In addition the Vendor shall supply a definition of which sizing model and revision was used. It can be considered that, for specific applications, specifications and/or defect geometries, dedicated tool calibration can be performed (e.g. with spare project pipes), followed by a modified interpretation/sizing model.
- **Management of Change Notification / Documented "Revision" Summary –** Electronic Format only (PDF). A summary shall be provided at the front of the re-issued report identifying any revisions to the above quality documents based on prior releases issued in earlier reports. Understanding what changes have occurred to these documents between reports will allow Pipeline Integrity personnel to ascertain what process changes take place that may affect the reporting.
- **Record Keeping** – All documentation and information should be maintained such that the inspection can be recreated; easy to access and organized so there is no confusion about the content. Records shall be retained for the time period specified in the contract.

LABELING REQUIREMENTS

For Electronic Reporting

DATA CD'S, DVD'S, and HARD DRIVES

Disc Contents
Pipe Diameter
Start and End Trap Information
Line Number
Run Date
Issue Date
Issue Number
Re-Issue date (if applicable)
Project I.D. Number
Disc Number
Vendor Information
Tool Type

SPREADSHEETS, WORD DOCUMENTS, OTHER ELECTRONIC FILES

Line Number
Start and End Trap Information
Pipe Diameter
Tool Type
Run Date
Issue Number
Issue Date
Re-Issue Date (If Applicable)
Project I.D. Number

EXAMPLE:
Client Data
30 inch Crude Oil Pipeline
Superior to Iron River
Line 5
Run Date: April 1, 2005
Issue #1
Project Number: 123456_78A
Disk 1 of 1
Enbridge Pipelines (Lakehead) L.L.C.

EXAMPLE:
Superior to Iron River
30 inch Crude Oil Pipeline (762mm)
Enbridge Pipelines (Lakehead) L.L.C.
Line 5
MFL Pipeline Inspection Report
Project Number: 123456_78A
Run Date: April 1, 2005
July 10, 2005
Issue #1

Reporting Standard Checklist

Task	Report reference	Name	Initials upon completion	Date (m/d/y)
Basic ILI run details / info	✓	Harry Lopez	HL	Oct 30/13
Signature Page present and signed	✓	" "	HL	" "
Proper report numbering	✓	" "	HL	" "
If report is a re-issue, ensure an Executive Summary highlighting all changes is included at the front of the report	na	" "	HL	" "
Correct units of measure, and consistent throughout report	✓	" "	HL	" "
Correct decimal places	✓	" "	HL	" "
Listing of GPS coordinates in proper format	✓	" "	HL	" "
Correlation of AGM list and Marker List; includes Milepost and/or AGM ID	✓	" "	HL	" "
Check that all absolute distances are listed, and are in ascending order	✓	" "	HL	" "
Ensure no macros, formulas, or truncated text in any electronic files	✓	" "	HL	" "
Any and all Immediate Notification / Priority Reporting features were made known to Enbridge within 48 hrs. of discovery	na	" "	HL	" "
Final Report (electronic format) delivered on time (see standard for specific delivery times according to technology utilized)	✓	" "	HL	" "
Report Deliverables				
• Executive Summary	✓	" "	HL	Oct 30/13
• Severity Listing	na	" "	HL	" "
• Pipebook / Pipe Tally	✓	" "	HL	" "
• Pipeline Listing	✓	" "	HL	" "
• Feature Listing	✓	" "	HL	" "
• Marker Listing	na	" "	HL	" "
• MFL to MFL Run Comparison	na	" "	HL	" "
• MFL Manual Assessment	na	" "	HL	" "
• NEAC Analysis	na	" "	HL	" "
• ISAS Files	✓	" "	HL	" "
• Nominal wall thickness listing	✓	" "	HL	" "
• Wall Thickness Listing	✓	" "	HL	" "
• Metal Object Listing	na	" "	HL	" "
• Eccentric Casing Listing	na	" "	HL	" "
• Temperature Profile & Listing	na	" "	HL	" "
• Pressure Profile & Listing	na	" "	HL	" "
• Repair Listing	na	" "	HL	" "
• Lamination Listing	na	" "	HL	" "
• Dent Listing	✓	" "	HL	" "
Tool Performance				
• Specification	✓	Harry Lopez	HL	Oct 30/13

• Calibration	na	Harvy Lopez	H/3	Oct 30/13
• Quality Management	✓	Harvy Lopez	H/2	Oct 30/13
• Procedures	✓	" "	H/2	" "
• Personnel Certification and Training	✓	" "	H/2	" "
• Management of Change	na	" "	H/2	" "
• Records	na	" "	H/2	" "
• Labeling	✓	" "	H/2	" "
• Data Formats	✓	" "	H/2	" "
• Data Management System Tables	na	" "	H/2	" "

Data Formats for the Enbridge Information Management System

All database tables defined below are to be provided in a "Comma Delimited" file (csv) format and shall be prepared in addition to the standard reporting presently being delivered at the completion of each individual inspection program. This electronic file is required as part of the overall reporting. Variations to or additional requirements may be acknowledged within the standard Enbridge Work Order issued prior to the work being performed.

This additional report request should not significantly impact vendor workload because the information is already being collected as part of the present standard reporting. The request for electronic file in csv format facilitates capturing the data in one location and in a platform that is readily imported and used within our data management system.

The following multiple spreadsheets represent each new standard for all inspection technologies as well as the feature code and sub type listing. The various spreadsheets are intended to communicate a list of required field (column) headings, data type, units and comments for each inspection type. The final spreadsheet provides a feature code list and sub-type list based on the new database revisions. Once again the final report must be provided in comma delimited format (csv) for each spreadsheet or technology.

Metal Loss

Metal Loss Inspection - Required ILI Vendor Fields	Data Type	Unit	Description
AREA_ID	String (20)		Vendor assigned feature identifier
CLUSTERNO	Integer		Vendor assigned cluster number
CLUSTERRPR	Double		The calculated RPR based on clustering criteria
DEEPESTPOINT DEGREES	Integer	Degrees	The orientation of the most severe point in degrees, as viewed in the direction of flow.
DEEPESTPOINTHHMM	Integer	Time (HHMM)	The orientation of the most severe point in HHMM, as viewed in the direction of flow (no colon).
DEPTHMM	Double	Millimeters	The peak depth of the feature in millimeters
EFFECTIVE_DEPTHMM	Double	Millimeters	The the mean profile depth of the profile subsection, calculated by effective area / effective length
DEPTHPERCENT	Integer	% (Real # between 0-100	The peak depth of the feature in % of nominal wall thickness
DATA_DEGRADATION	String (20)		Yes / No - Specification if signal loss is present on this feature based on any Inspection Principle
ECHO_LOSS	String (20)		Yes / No - Specification if echo loss is present on this feature based on Ultrasonic Principles
ENDDEGREE	Integer	Degrees	The orientation of the end point, as viewed in the direction of flow.
ENDDISTANCE	Double	Meters	The absolute distance along the pipeline to the downstream edge of the feature
FEATURECODE	Integer		**Feature Code for Database, see sheet "Feature Codes and Sub Types"**
GWNUMBER	Integer		Pipe joint number
EFFECTIVE_AREA_RPR	Double	kPa	The calculated failure Pressure based on effective area calculation (Rstreng)
JT_LENGTH	Double	Meters	Length of joint in which the feature is located
LENGTH	Double	Millimeters	The axial length of the feature
EFFECTIVE_LENGTH	Double	Millimeters	Effective axial extent of the profile subsection
LI_LENGTH	Double	Millimeters	Length of Longest Indication (box) within a group or cluster
LONGSEAM ORIENTATION START	Integer	Degrees	Starting orientation of the seam weld of the joint in which the feature is located, when detectable. Note: For spiral weld, where possible indicate the orientation of the weld 30cm (12”) d/s of the upstream joint If not detectable, indicate “SW” (for spiral weld) When longseam is not detectable, indicate “ND” or leave blank.

Metal Loss Inspection - Required ILI Vendor Fields	Data Type	Unit	Description
LONGSEAM ORIENTATION END	Integer	Degrees	Ending orientation of the seam weld of the joint in which the feature is located, when detectable. Note: For spiral weld, where possible indicate the orientation of the weld 30cm (12") u/s of the end of the joint If not detectable, indicate "SW" (for spiral weld) When longseam is not detectable, indicate "ND" or leave blank.
STARTDEGREE	Integer	Degrees	The orientation of the start point, as viewed in the direction of flow.
MSPDISTANCE	Double	Meters	Relative distance along the pipeline to the deepest point of the feature from the previous (upstream) girth weld.
MSP_REL_TO_LSW	Double	Degrees	The orientation of the most severe point minus the orientation of the seam weld in degrees
NORTHING	Double (8 decimal places)	Meters	Y coordinate
EASTING	Double (8 decimal places)	Meters	X coordinate
ELEVATION	Double	Meters	Z coordinate, Height above Sea-Level in meters
PITRPR	Double		The calculated river bottom profile (Rstreng) RPR based on pit or individual feature criteria
RAD_POS	String (20)	I, E, M, ND (see Description)	Radial position of defect. i.e. external, internal, mid-wall, non-decidable, etc.
REL_POS	String (20)		Relative position of defect in pipe. I.e. base metal, adjoining weld, longitudinal weld, etc.
RELDISTANCE	Double	Meters	Relative distance along the pipeline to the upstream edge of the feature from the previous (upstream) girth weld.
REMARKS	String (255)		Comments
REMWT	Double	Millimeters	Remaining local wall thickness as measured in millimeters
CUSTOMRPR	Double		The calculated custom RPR for the feature (ILI vendor may have a customized river bottom profile calculation i.e. LAPA)
RSTRENGRPR	Double		The calculated RStreng (river bottom profile) RPR for each feature
RUNDISTANCE	Double	Meters	The absolute distance along the pipeline to the upstream edge of the feature
SUBTYPECD	Integer		**Feature Code for Database, see sheet "Feature Codes and Sub Types"**
LOC_WALLTHICKNESS	Double	Millimeters	Local wall thickness actually measured in the vicinity of the feature
Nom_WALLTHICKNESS	Double	Millimeters	Nominal wall thickness in the vicinity of the feature
WIDTH	Double	Millimeters	The circumferential width of the feature

Cracking

Crack Detection ILI Vendor Fields	Data Type	Unit	Description
FEATURECODE	Integer		**Feature Code for Database, see sheet "Feature Codes and Sub Types"**
SUBTYPECD	Integer		**Feature Code for Database, see sheet "Feature Codes and Sub Types"**
GWNUMBER	Integer		Pipe joint number
REMARKS	String (255)		Comments
RELDISTANCE	Double	Meters	Relative distance along the pipeline to the upstream edge of the feature from the previous (upstream) girth weld.
ENDDISTANCE	Double	Meters	The absolute distance along the pipeline to the downstream edge of the feature
RUNDISTANCE	Double	Meters	The absolute distance along the pipeline to the upstream edge of the feature
DEPTHMM	Double	Millimeters	The peak depth of the feature in millimeters
DEPTHPERCENT	Integer	%	The peak depth of the feature in % local wall thickness
DEEPESTPOINTHHMM	Integer	Time (HHMM)	The orientation of the most severe point in HHMM, as viewed in the direction of flow (no colon).
DEEPESTPOINT DEGREES	Integer	Degrees	The orientation of the most severe point in degrees, as viewed in the direction of flow.
STARTDEGREE	Integer	Degrees	The orientation of the start point, as viewed in the direction of flow.
ENDDEGREE	Double	Degrees	The orientation of the end point, as viewed in the direction of flow.
JT_LENGTH	Double	Meters	Length of joint in which the feature is located
LENGTH	Double	Millimeters	The axial length of the feature
WIDTH	Double	Millimeters	The circumferential width of the feature
LONGSEAM ORIENTATION START	Integer	Degrees	Starting orientation of the seam weld of the joint in which the feature is located, when detectable. Note: For spiral weld, where possible indicate the orientation of the weld 30cm (12”) d/s of the upstream joint If not detectable, indicate “SW” (for spiral weld) When longseam is not detectable, indicate “ND” or leave blank.
LONGSEAM ORIENTATION END	Integer	Degrees	Ending orientation of the seam weld of the joint in which the feature is located, when detectable. Note: For spiral weld, where possible indicate the orientation of the weld 30cm (12”) u/s of the end of the joint If not detectable, indicate “SW” (for spiral weld) When longseam is not detectable, indicate “ND” or leave blank.

Crack Detection ILI Vendor Fields	Data Type	Unit	Description
WALLTHICKNESS	Double (2 decimal places)	Millimeters	Local wall thickness in the vicinity of the feature
LI_LENGTH	Double	Millimeters	Length of Longest Indication
REL_POS	String (20)		Relative position of defect in pipe. i.e. base metal, adjoining weld, longitudinal weld, etc.
RAD_POS	String (20)		Radial position of defect. i.e. external, internal, mid-wall, non-decidable etc.
AREA_ID	String (255)		Vendor assigned feature identifier
DEPTHCATEGORY	String (20)	%	The depth range for features.
DEFECTFAILUREPRESSURE	Double	kPa	The calculated failure pressure of the defect
NORTHING	Double (8 decimal places)	Meters	Y coordinate
EASTING	Double (8 decimal places)	Meters	X coordinate
ELEVATION	Double	Meters	Z coordinate, Height above Sea-Level in meters

Geometry / Denting

Geometry Tool Inspection - Required ILI Vendor Fields	Data Type	Unit	Description
FEATURECODE	Integer		**Feature Code for Database, see sheet "Feature Codes and Sub Types"**
SUBTYPECD	Integer		**Feature Code for Database, see sheet "Feature Codes and Sub Types"**
GWNUMBER	Integer		Pipe joint number
REMARKS	String (255)		Comments
RELDISTANCE	Double	Meters	Relative distance along the pipeline to the upstream edge of the feature from the previous (upstream) girth weld.
ENDDISTANCE	Double	Meters	The absolute distance along the pipeline to the downstream edge of the feature
RUNDISTANCE	Double	Meters	The absolute distance along the pipeline to the upstream edge of the feature
DEPTHMM	Double	Millimeters	The peak depth of the feature in millimetres not including ovality.
HALFPEAKUS	Double	Millimeters	The distance from the upstream edge of a dent to the half peak height position
HALFPEAKDS	Double	Millimeters	The distance from the downstream edge of a dent to the half peak height position
HALFPEAKCS	Double	Millimeters	The distance from the circumferential starting edge of a dent to the half peak height position
HALFPEAKCE	Double	Millimeters	The distance from the circumferential ending edge of a dent to the half peak height position
MULTIAPEX	Integer	Yes/No	Denotes whether or not the geometry of a dent has a singular or multiple apex points.
OFFAXIS	Integer	Yes/No	Denotes whether or not the longitudinal axis of a dent is more than 15 degrees from the longitudinal or transverse axis of the pipeline.
ASSOCGW	Integer	Yes/No	Denotes whether or not a geometry feature is interacting with a girth weld.
PROXIMITY	Integer	Yes/No	Denotes whether a dent is singular or the MSP is within 3 m (10') of another dent feature MSP.
DEPTHPERCENT	Double (1 decimal place)	%	The peak depth of the feature in % nominal diameter not including ovality
DEEPESTPOINTHHMM	Integer	Time (HHMM)	The orientation of the most severe point in HHMM, as viewed in the direction of flow (no colon).
DEEPESTPOINT DEGREES	Integer	Degrees	The orientation of the most severe point in degrees, as viewed in the direction of flow.
STARTDEGREE	Integer	Degrees	The orientation of the start point, as viewed in the direction of flow.
ENDDEGREE	Double	Degrees	The orientation of the end point, as viewed in the direction of flow.
JT_LENGTH	Double	Meters	Length of joint in which the feature is located
LENGTH	Double	Millimeters	The axial length of the feature
WIDTH	Double	Millimeters	The circumferential width of the feature
LONGSEAM ORIENTATION	Integer	Degrees	The seam weld orientation, as viewed in the direction of flow.
WALLTHICKNESS	Double (2 decimal places)	Millimeters	Local wall thickness in the vicinity of the feature
VENDORFEATUREID	String (255)		Vendor assigned feature identifier
BENDANGLE	Double	Degrees	The bend angle
BENDDIRECTION	String (10)		The bend direction (up, down, right, or left turn)

Geometry Tool Inspection - Required ILI Vendor Fields	**Data Type**	**Unit**	**Description**
BENDRADIUS	Double	Multiples of pipe Dia. D	(Ex. 7.0D, 10.0D -> 7, 10)
OVALITYMINID	Double	Millimeters	The minimum inner diameter of the pipe at the location of an ovality
NORTHING	Double (8 decimal places)	Meters	Y coordinate
EASTING	Double (8 decimal places)	Meters	X coordinate
ELEVATION	Double	Meters	Z coordinate, Height above Sea-Level in meters

Above Ground Markers

AGR Inspection - Required Vendor Fields	Data Type	Unit	Description
REMARKS	String (255)		Comments
ALTREFERENCE	String (50)		Secondary Reference
CHAINAGESOURCE	String (50)		Where the chainages were derived from
LOCATION NAME	String (50)		The name for the reference (Ex. 3-V-2 Hardisty Terminal, E/W Gravel Rd)
LOCATION MP	Double	Miles	The mile post for the reference
LOCATION KP	Double	Kilometres	The kilometer post for the reference
OFFSET	Double	Meters	The offset between the timer box and the reference
REFERENCE	String (50)		The type of reference (Ex. Centreline Road, Fence Line, or Valve)
RUNDISTANCE	Double	Meters	The absolute distance along the pipeline to the “marker” (AGM / AGR)
SUBTYPECD	Integer		**Feature Code for Database, see sheet "Feature Codes and Sub Types"**
NORTHING	Double	Meters	Y coordinate
EASTING	Double	Meters	X coordinate
ELEVATION	Double	Meters	Z coordinate, Height above Sea-Level in meters
ILIRUNID	String (50)		The identifier for the ILI run (Ex. L3_YPKB_2006_WM_01)
AGR_ID	Integer		Vendor assigned reference identifier
CHAINAGE	Double	Meters	The distance along the ground to the reference
ALTOFFSET	Double	Meters	The offset between the timer box and the secondary reference
GWNUMBER	Integer		Pipe joint number
NORTHING	Double (2 decimal places)	Meters	UTM Northing Coordinate
EASTING	Double (2 decimal places)	Meters	UTM Easting Coordinate
LAT_DEGREE	Double (8 decimal places)	Decimal Degrees	The latitude of the reference
LONG_DEGREE	Double (8 decimal places)	Decimal Degrees	The longitude of the reference
UTMZONE	String (50)		The UTM Zone used for the GPS coordinates
DATUM	String (50)		The Datum / Projection used for the GPS coordinates
DEPTHOFCOVER	Double	Meters	The depth of cover
GPSACCURACY	String (50)	Meters	The accuracy of the GPS coordinates for this reference typically stated as Sub-Centimeter, Sub-Decimeter or Sub-Meter
SOURCE	String (50)		The source for the GPS for this reference
TRACKINGDATE	String (50)	Date	The date the tool tracking took place

Please Note

Note: Above Ground Marker / Control Point final reports are typically provided by Tracking Company once vetted and approved by the Inspection Company. In-Line Inspection Reporting – Database Feature Codes

FEATURE CODE	FEATURE DESCRIPTION	Uptime Subtype
1	G.W. WELD	
3	C.P. POINT	
4	ATTACHMENT	
10	BEND - HOT PULLED	Geometry-Related::2
11	BEND - COLD	Geometry-Related::2
13	BEND - MITRE	Geometry-Related::2
14	BEND - FORGED	Geometry-Related::2
15	BEND	Geometry-Related::2
20	WALL THICKNESS (Transition)	
21	SPIRAL WELD (Transition)	
22	LONGITUDINAL SUB ARC WELD (Transition)	
23	SEAMLESS (Transition)	
24	E.R. WELD (Transition)	
30	CASING	
36	CASING - ECCENTRIC START	
37	CASING - ECCENTRIC END	
40	OFFTAKE - FORGED	
41	OFFTAKE - WELDOLET	
44	OFFTAKE - STOPPLE	
45	OFFTAKE - WELDED	
50	VALVE	
51	BALL VALVE	
52	GATE VALVE	
53	CHECK VALVE	
63	REPAIR SHELL / SLEEVE	-
66	REPAIR - PATCH	
69	REPAIR - OTHER	
70	METAL LOSS - External	Metal Loss::2
73	CORROSION / METAL LOSS	Metal Loss::3
74	DENT	Geometry-Related::1
75	CRACK-RELATED	Crack-Related::Various
76	INCOMPLETE WELD	Material Defects::3
77	GIRTH WELD ANOMALY	Material Defects::3

Common Alias

Uptime "Sub-Type" Codes for ILI Import	
Crack-Related	
Crack Field	4
Crack Like	5
Notch Like	6
Metal loss	7
Non-decidable	8
Inclusion-Like	9
Geometry-related	10
Metal Loss	
Int / Internal	1
Ext / External	2
Unknown	3
Internal - 0t (Unclustered)	4
External - 0t (Unclustered)	5
Material Defects / Anomaly	
Laminations	1
Inclusions	2
Material Defect	3
Geometry-Related	
Dents	1
Bends	2
Buckles	3
Mechanical Damage	4
Ovality	5

FEATURE CODE	FEATURE DESCRIPTION	Uptime Subtype	Common Alias	Uptime "Sub-Type" Codes for ILI Import	
78	CASING - ECCENTRIC MID				
79	METAL LOSS - Internal	Metal Loss::1			
80	JOINT - FLANGED				
81	JOINT - INSULATED			**Markers**	
82	JOINT - PROCHIND			Milepost	1
90	MAGNET			Aerial Marker	2
91	LINE MARKER			Monument	3
92	REF PT - MAP			Survey Point	4
93	ANODE			Pig Signal	5
94	VERT SUPPORT MEMBER				
96	GROUND ANCHOR			_	
97	SWAMP WEIGHT		River Weight		
98	BUCKLE ARRESTER			**Above Ground Markers (AGR)**	
99	SUPPORT			AGR Timer Box	1
100	UNKNOWN FEATURE			AGR Valve	2
101	FULL CIRC FITTING				
102	TEXT COMMENT				
103	MILL FAULT	Material Defects::3	Manufacturing Defect		
104	MATERIAL ANOMALY	Material Defects::Various			
110	METAL OBJECT				
137	Long Weld Anomaly	Material Defects::3			
139	Sensor Failure (Degraded Data)				
140	Debris (Degraded Data)				
143	Ovality	Geometry-Related::5			
144	Gouge	Geometry-Related::4			
200	UNKNOWN APPERTENANCE				

Enbridge Reporting Profile Standard – Revision Request Form

Please Note

Analysis and Reporting Requirements are subject to Vendor and Company Operations Committee review and updated on an annual basis. For any changes stemming from the annual review or as required on an as needed basis, changes shall be processed using the following "Formal change request" form. Request approvals are required from both company and vendor representatives to ensure contract commitments are met.

Change Request Form

Request No:	7.0	Request Date:	June 1, 2012
Request Title:	Reporting Criteria Edits & Enhanced Definitions	Status:	Final Draft
Originator's Name:	Garry Sommer	Phone/Email:	Garry.Sommer@enbridge.com
Sponsor's Name:		Priority:	high
Assigned To:		Response Date: 30/06/12	

Request Description

- Criteria change for all Technology Reporting Schedules
- Revision to incorporate “Priority Notification” Name change
- Additional clarification / definitions for feature listing
- Addition of Dent / Geometry fields to feature listing. Includes illustrations.
- Addition of sample dent table
- Updated fields (Dent / Geometry related) in Database Files
- Addition of default reporting as per contract
- Addition of statement on tool performance

Justification

Requested by Analysis Group and Programs Group for improved reporting and to eliminate miscommunication in conjunction with new Contracts

Alternative Solutions

1.

2.

3.

Impact Assessment

Impacts	Option 1	Option 2	Option 3
Functional Scope	Within Vendors ability to report		
Schedule	May impact reporting timelines		
Effort	Minimal change from present		
Cost	Increased Vendor cost for software dev.		

Recommendation

Issued as Final

Authorization

Action: Authorized By: Date: