MP 608 – Marshall, Michigan Incident
NTSB/PHMSA Information Request Number 404

404 **Reference:** NTSB email request of April 3, 2012 by Matt Nicholson

Preamble:

Request: Provide Enbridge actions following the Marshall incident to address the issues identified by the Company related to the accident. This should address the following areas – control center training, control center procedures, organizational changes (control center, integrity management, risk, etc…), instrumentation changes or upgrades, MBS changes, SCADA changes, integrity management personnel changes, procedure changes, regional offices changes, facility response plan changes as well as any other areas that were addressed by Enbridge. All substantiated information will be included in the post-accident section of the factual report. This information may have been provided in previous Information requests but does not exist collectively in a single document. Please provide a narrative with supporting documentation or references to existing IR's that summarizes the changes implemented.

Required by- April 9, 2012

Response: Enbridge has undertaken various initiatives to improve its systems since the Marshall incident. Some of these initiatives were started prior to Marshall, but have continued and been modified where appropriate to reflect learnings related to the accident. Other initiatives have been commenced since the accident that do not appear to be directly tied to the direct or contributing causes to the accident. For this response, Enbridge has provided the most relevant information relating to initiatives commenced prior to or since the accident that may affect direct or contributing causes.

<u>Integrated Management System</u>

1. Enbridge Liquids Pipelines had initiated an Integrated Management System ("IMS") initiative prior to the accident. The purpose of the IMS is to align all management systems within Enbridge Liquids Pipelines to allow Enbridge to effectively manage the performance of its business and to continually monitor and improve the various management systems to achieve greater compliance and business results.

2. Established an Integrated Management System Executive Committee.

3. Drafted an Integrated Management System Framework which includes components on Environmental Management System, Risk Management System, Compliance & Ethics Management System, Asset Management, Quality Management, etc.

4. Drafted revised Environmental Management System.

5. Drafted Compliance & Ethics Management System, which includes components relating to reporting & escalation, internal investigation/review of Compliance Events, Compliance Register, Compliance Representatives, etc.

Environment

1. Changes to all levels of Environment Organization Structure to better align, focus and manage span of control. Specifically;
    a. Introduction of Manager of Environment US
    b. Split Supervision into 2 units, Supervision of Programs and a separate Supervisor for Regional Support
    c. New Emergency Preparedness position
    d. Environment Emergency Preparedness position is part of Emergency Response Advisory Team

2. Procedures/Program Enhancement
    a. Enhancements to Environmental Management System ("EMS") and integration of EMS into overall Integrated Management System
    b. Incident Command System training for all environmental staff 100/200 and 300
    c. Enhancements to Book 7, specifically submerged oil plan and other areas of improvement such as Wildlife Management Plan, Shoreline Clean Up Assessment Techniques and Air Monitoring

3. Consulting and Contractor staff
    a. Engaged specific consultants to provide Emergency Response support, consultants with sufficient capacity to provide response support for significant incidents

Emergency Response

1. Enbridge has created, and began specialized training for, a cross-business unit response team, to respond to large-scale events anywhere in North America that would require more resources that a single region, or business unit, could provide. The response team will be conducting annual major training exercises involving all business units, Emergency Response ("ER") contractors and consultants, and federal, state/provincial and local emergency response agencies.

2. Enbridge has created a dedicated Emergency Response group in Operation Services (it was previously part of the Health and Safety group), to provide an increased level of support to the regions, related to emergency response preparedness and training. A newly appointed manager provides leadership to the group and a senior management steering committee provides direction and oversight.

3. A third-party ER preparedness assessment is being conducted to identify additional strategic equipment purchases (e.g. sorbent boom, containment boom, fire boom, skimmers. boats, bladders, etc.) that will enhance abilities to more rapidly respond and contain a significant release anywhere in the Enbridge system.

4. Additional Enbridge personnel are being added in each region to improve ER preparedness planning and coordination.

Safety Culture

1. Lifesaving Rules at Enbridge

    a. The Lifesaving Rules were implemented January 1, 2012. They are applicable to all employees and contractors, and are communicated, clarified and reinforced across all Business Units at Enbridge.
    b. The six Lifesaving Rules are: Hazard Management, Driving Safety, Confined Space Entry, Ground Disturbance, Isolation of Energized Systems, and Reporting of Safety Related Incidents.
    c. All employees and contractors must review a video message from Pat Daniel – CEO and an interactive training module and then acknowledge they have completed the training and understand the Lifesaving Rules.
    d. Additionally, Control Centre Operations is in the process of introducing three Lifesaving Rules that are designed to complement the Lifesaving Rules at Enbridge but are focused on key areas of control centre operation: Safe Operating, When in Doubt - Shutdown, and Emergency Procedures.

2. Process Improvement Teams

    a. A number of teams have been set-up or are in the process of being set-up to perform gap analysis and then develop action plans to reduce/eliminate the gaps.
    b. Examples of the teams are: Contractor Safety Management, Process Safety Management, Incident Investigation, Management of Change, Office and Off-the-Job Safety.
    c. Workplace Safety Improvement Initiatives are underway in: Western Region, Superior Region and Control Centre Operations.

3. Training Related to Safety Culture

a. Felt Leadership Training for LP Operations Senior Management – ½ day session
b. Leadership Engagement Workshop for entire LP Executive Management (Steve Wuori and all VPs) – 1 day session
c. Line Management Training initially focused on Operations and Engineering staff at VP, Director, General Manager, Manager and Supervisor levels – 2 days
    i. Approximately 6 sessions have been held in Canada and the US. More are planned for remainder of 2012.
    ii. Focus is on objectives, safety observations, accountability, and engagement.

4. Safety Perception Survey Workshops are in progress and intend to engage most, if not all employees and provisioned contractors. Workshops are near completion in Western Region, Superior Region and Control Centre Operations with follow-up required on Action Items.

Public Awareness

1. Revised Enbridge U.S. and Vector Pipeline Public Awareness Plan (March, 2012) – See IR 241

2. U.S. Public Awareness Committee (PAC): The PAC was formalized in May 2011 prior to a PHMSA audit of the Enbridge U.S. and Vector Pipeline Public Awareness Program. The committee consists of internal stakeholders, including field operations & management, ROW, Compliance, Integrity and Public Affairs, and meets four times annually. The committee, which is chaired by Public Affairs and co-sponsored by the General Manager, EPND and District Manager, North Texas, is tasked with:
    a. Maintaining effective communications with other stakeholders
    b. Preparing for successful regulatory inspections and audits
    c. Implementing standardization of companywide programs
    d. Annual review and sign-off of the Public Awareness Program
    e. Annual Review of the Public Awareness Performance Measures
    f. Reviewing Industry best practices
    g. Achieving full participation among the committee members
    h. Establishing accountability and consistency

3. In response to the PHMSA audit of the Public Awareness Program, in 2011, the PAC clarified and improved the process for the program's annual implementation review; we hope to have Enbridge's GT Internal Audit team test the process before its implementation in Q3, 2012. Additionally, the committee standardized the process to collect field metrics to assist with evaluation of the Program's effectiveness, and is currently working on a mobile documentation solution to improve and simplify the documentation process for employees.

    i. Public Awareness Documentation Database: An online documentation database, which is accessible by all Enbridge U.S. and Vector Pipeline employees, has

allowed us to better document supplemental Public Awareness contacts, which include face-to-face meetings, letters, emails, telephone calls, events, etc. The database rolled out (as previously planned) in Q4, 2010; subsequent improvements have been based on user experience and are focused on continuous improvement of our documentation process.

ii. Employee Training: Training is provided annually for field employees in each liquids region and gas district to help them better understand their role in the Public Awareness Program. In 2011, we provided training for more than 500 field employees. In Q4, 2012 we plan to roll-out online training that all employees, regardless of whether they work in a field location or in an office, will be required to complete.

iii. Baseline PAP Brochure Focus Group Research: Focus group testing of the Public Awareness brochures for all audiences was conducted in Q1, 2012. Based on the feedback received from participants, several changes were made to the 2012 brochures. Major changes include re-focusing emphasis placed on the emergency numbers and reducing non-emergency phone numbers to one toll-free number to improve clarity on which number to call in emergency vs. non-emergency situations. Although already planned and budgeted for 2012, the focus groups were also suggested during the 2011 PHMSA PAP audit.

iv. Affected Public Magnets: The entire Affected Public audience now receives a magnet with the annual brochure mailing which includes the appropriate emergency number for their area.

v. Emergency Responder Training: A program to provide in-person and online training for emergency responders is currently in development and will launch in Q4, 2012.

vi. Public Awareness Calendars: Affected Public within 200 feet of GT pipeline systems now receive an additional, supplemental contact through the annual Public Awareness calendar. This calendar has been provided to Affected Public on the liquids pipelines for several years.

vii. Public Official Outreach: Through the engagement of Enbridge's Government Affairs team, the public official mailing list has been improved to better target state and federal public officials. In addition, supplemental mailings have been sent to public officials to remind them of Enbridge's Public Awareness efforts, including 811 Day, National Safe Digging Month and the delivery of Public Awareness calendars to their constituents.

4. Increased Supplemental Activities: Enbridge is increasingly leveraging mass media to reach those who may live further away from our pipeline systems, but could potentially be impacted by an incident. For example, for National Safe Digging Month, as part of a

larger awareness campaign, Enbridge will be placing ads in regional newspapers and pitching letters to the editor signed by Enbridge management in each area.

Human Resources

1. Although the process to make regular organization changes commenced before the accident, there have been various organizational changes since that time. See IRs 125 and 205.

Pipeline Control Systems and Leak Detection (PCSLD)

1. Organization Structure Changes
    a. Creation of the Pipeline Control Systems and Leak Detection department in October, 2010 – Director led and reporting to Senior VP Pipeline Integrity & Engineering
    b. Single area of accountability in relation to leak detection capability, safe and reliable pipeline control systems and improved operator information systems.
    c. Incremental staff and contractor additions in 2010, 2011 and 2012 resulting in a doubling of the PCSLD workforce
    d. Creation of the Leak Detection department reporting to the Director, PCSLD. Department comprised of three teams: Maintenance and Integration, Assessment and Support, and Testing and Research.
    e. Creation of the Pipeline Control Systems department reporting to Director, PCSLD. Department comprised of three teams: SCADA Services, Control Systems CAN, and Control Systems USA
    f. Creation of Quality and Compliance department reporting to Director, PCSLD.

2. Process and Procedure Changes
    a. New Procedures - Four MBS Analyst procedures have been implemented since July 2010, these include the Leak detection escalation process, Shift change sheet, Alternate leak detection recommendation procedure and Analysis and Communication Procedure – See IR 329
    b. Efforts are underway to formalize existing practices through the identification and development of standard operating procedures
    c. Control Room Management - Procedures have been developed for the Control Room Management regulation, which have an implementation deadline of August 1st, 2012. – See IR 385
    d. Establishing a Quality Management System (QMS) which ensures effective execution of critical work activities meeting pre-defined quality objectives is underway

3. Training Changes – See IR 237
    a. The Leak Detection Analyst Training Program has been enhanced in several areas including On-The-Job training, Training Program Layout, Readiness Assessment, and Communications with CCO Personnel

4. Instrumentation Changes
    a. Assessments and planning of instrumentation additions and upgrades required to improve the performance of the leak detection system, and ensure it consistently meets or exceeds Enbridge internal performance targets has been completed
    b. A Leak Detection Instrumentation Improvement Program has been initiated that will add and upgrade instrumentation across the system based on the assessment results
    c. The establishment of a maintenance management program is underway. This program will further enhance the existing program by formalizing the inventory and management of critical leak detection equipment

5. MBS Changes
    a. Continuous improvement plans have been developed and are being implemented to tune the Material Balance System (MBS) leak detection system for optimal performance
    b. A leak detection equipment design standard has been developed to ensure leak detection performance standards will be met on new pipelines
    c. Various initiatives are underway to assess commercially available leak detection technologies and determine if there are complementary strategies to further enhance leak detection performance

6. SCADA / Pipeline Control System Changes
    a. Initiatives are underway to improve controller decision support systems. This includes active projects which will deliver tools to support the analysis of column separation as well as potential leak events, and implementation of expert systems to support alarm analysis
    b. Ongoing improvements to historical data storage and retrieval have been completed at most terminal and pump stations, resulting in the archiving of critical data at a resolution frequency of approximately one second.

    Evaluation of the current communication mechanisms, including RTU infrastructure and physical communication layers is in progress

<u>Pipeline Control (including CCO)</u>

1. Organizational Structure Changes - to better align, focus, manage span of control and workloads. (Reference IR-189 & 205).

    Specifically;
    a. Pipeline Control now reports to the Sr. VP, Operations versus the VP, Customer Services to realign with operating functions versus commercial function (Customer Service) in previous reporting structure.
    b. Introduction of dedicated VP, Pipeline Control – dedicated executive management
    c. Reclassification of one position to Director Level and creation of 3 new manager positions to split up the responsibility of the department into more manageable levels from a span of control perspective.

d. Re-classification of Shift Leads to Shift Supervisors in late 2011 with a change in role to providing supervision and people leadership
e. Introduction of on shift technical support in 2011 with the addition of 10 new - Sr. Technical Advisors to support abnormal operating conditions and on-going mentorship.
f. Augmentation of training staff to support more rigorous training plans by adding 1 new Supervisor Training and Compliance position in 2011.
g. Augmentation of engineering staff with an additional Control Center Engineer position in January 2012.
h. Augmentation of Control Center Operator staff with the addition of 7 operator positions in 2011 and to February of 2012 to accommodate growth & expansion, reassignments, workload balancing.

2. Key Procedures & Process Enhancements (Ref IR's 183, 184, 187, 217, 225, 231, 235, 329)
    a. Pipeline Startup Procedure – revised and enhanced
    b. Pipeline Shutdown Procedure – revised and enhanced
    c. MBS Alarm Procedures – procedures revised, enhanced and aligned between MBS Analyst and Control Centre procedures.
    d. Suspected Column Separation Procedure – procedure revised and enhanced
    e. Incident Investigation Process – revised and enhanced
    f. Shift Change Procedure – process formalized and enhanced
    g. Fatigue Management Handbook – development of processes and procedures
    h. MBS Alarm Communication Protocols – revised and enhanced
    i. Column Separation Analysis Form - developed and implemented
    j. List of common Column Separation Locations - developed
    k. Procedure Review and Revision Process - revised and enhanced
    l. Pipeline Control Admin On-call Handbook developed and implemented
    m. CCO Specific Life Saving Rules – developed and implemented in March, 2012

3. Control Room Management (CRM) – Code of Federal Regulations 195.446
    a. The Control Centers CRM Plan was developed and in place August 1, 2011. It consists of detailed processes and procedures to provide control room management in the following :
        i. Roles and Responsibilities
        ii. Provide Adequate Information – SCADA
        iii. Provide Adequate Information – Shift Change
        iv. Fatigue Mitigation
        v. Alarm Management
        vi. Change Management
        vii. Operator Experience
        viii. Training
        ix. Compliance Validation
        x. Compliance and Deviation

b. A number of the sections were implemented on October 1, 2011 with the remaining on track for implementation by August 1, 2012.

4. Training Development and Enhancements (Ref IR's 188, 220, 237)
    a. All pipeline operators received enhanced hydraulics training which included the following
        i. Re-emphasis on the need to think leak first and adhere to emergency procedures.
        ii. Overview of MBS system and procedures
        iii. Refresh training on 10 min rule and compliance to procedures
        iv. Clarification of roles and responsibilities between operators & shift lead as well as between operators/shift leads and MBS Analyst.
    b. Column Separation Analysis Training
    c. Incident Investigation (including SCAT) for all Managers, Technical Services, Engineers, Shift Leads and Training Staff.
    d. Introduction to Lifesaving Rules Training – to all Pipeline Control Staff
    e. Augmentation of Emergency Response Training in the control centre to include 2 full days in 2012.
    f. Fatigue Management Training - developed and implemented Q3/Q4, 2011.
    g. Mentor Selection Process and Training – revised and enhanced.
    h. MBS System Training and Formalized Communication Protocols
    i. Pipeline Control Admin staff on-call training developed and implemented

5. Other Related Changes and Enhancements:
    a. Control Center Safety Culture Enhancement Initiative (See attachment 2)
        i. Safety Culture Assessment and Perception Survey Completed mid-2012
        ii. Safety Culture Improvement Team in place late 2012
        iii. Corporate and CCO specific Life Saving Rules Developed and Implemented
        iv. Action Plans developed for the following improvement areas to be implemented through 2012:
            1. Safety Objectives and Safety Performance Metrics
            2. Safety Org Structure and Safety Management System
            3. Incident Investigation and Reporting
            4. Safety Observations and Audits
            5. Leadership Safety Training and Operator Awareness of Field Activities
            6. Process Safety Information
            7. Communication Processes
            8. Control Center Procedures
            9. Management of Change
    b. Control Center Human Factors
        i. Employee Engagement Plans developed and implemented
        ii. Key Performance Indicators – performance metrics developed and implemented
        iii. Relocation of the Control Center to a new state of the art facility in November, 2011 which provides:

1. Better operating environment for operators (eg. Sit/stand consoles)
2. Fatigue management facilities

iv. Operator objectives revised to ensure prioritization on core operating responsibilities and the safety of the pipeline system
v. Respectful Workplace and Communications Training conducted with Pipeline Control Staff in February, 2012.
vi. Recruitment Process Enhanced
    1. More HR recruiting support using professional recruiters in March 2012
    2. Better assessment tools being developed to assess job fit, medical and technical competencies.

Integrity

1. Organizational Structure:
IR 250 depicts changes to the Integrity Management Department following the Marshall incident. In 2010 the System Integrity group included Integrity Management, Risk Management, System Compliance and Facility Integrity. This was led by one Director and included five Manager areas. In early 2011, the Pipeline Integrity department was reorganized and is now led by a Vice President solely focused on Integrity Management for Pipeline and Facilities. The Risk Management and System Compliance areas now fall under their own separate area led by a Director reporting to the Senior Vice-President of Pipeline Integrity and Engineering. The Pipeline Integrity department is now structured into two Director areas, one focusing on Infrastructure Integrity and the other on Integrity Programs. Each of these Director areas has three Manager areas with specific accountabilities as detailed below:

2. Infrastructure Integrity:

a. Asset Integrity:

This group has been established to increase the focus and resources on three functional areas:

i. Operational Optimization, who work with Operations to ensure integrity activities, such as pressure restrictions are managed appropriately.
ii. Due Diligence is a support function to Engineering to ensure all integrity requirements are managed appropriately through the project life cycle.
iii. Integrity Projects who assist in determination of long term pipeline maintenance strategies including replacement versus repair analysis as well as carrying out project work that is driven from Integrity such as line pipe replacement.

b. Reliability:

While reliability science was being utilized by the Pipeline Integrity department prior to 2011, this new functional area significantly increases the focus and resources applied to the development and implementation of reliability tools into the integrity management program. In particular, the principles of reliability science will be applied in the areas of

ILI tool accuracy, integrity risk assessment, pipe strength modeling, and process innovations.

c. Facilities Integrity:

This group existed prior to 2011 but is now increased in size and continues to manage integrity for facilities on equipment such as tankage and line pipe laterals which are unpiggable. This group also leads the management of leak reduction initiatives.

3. Integrity Programs:

a. Integrity Services:

This group is accountable for three functional areas:

i. Quality Management: Accountable for the management of the Integrity Management System complete with continuous improvement.
ii. Information Management: A focus area developed to improve and manage all critical data and records and develop systems to ensure the use of this information is efficient and accurate.
iii. In Line Inspection (ILI) Technology: Dedicated to the technological advancement and exploitation of the ILI science.

b. Logistics:

This group is responsible for the design, execution and scoping of all In Line Inspections and the preparation of excavation packages for integrity digs. Another significant change in the organization has been the creation of the Main Line Projects group, which reports through the Engineering functional area and is responsible for the completion of all integrity excavations.

c. Planning:

This group is responsible for the planning and analysis of integrity assessment activities, and is similar to the structure that existed prior to 2011. Accountability is directed to the three focus areas of Corrosion, Crack and Pipe Deformation including Mechanical Damage and strain.

4. Procedural Changes

Enbridge has revised and improved numerous procedures within the Integrity Management program. The following table identifies the significant revisions to the procedures that support the crack management program. See IRs 250, 290 and 295.

Pre-Marshall Process	Post-Marshall Process
PI-37 Fitness-for-Purpose Calculations for Crack ILI	
The wall thickness used for FFP calculations must be the actual wall thickness as reported by the crack ILI tool unless un-available. Consider using wall	The wall thickness used for FFP calculations shall be the lower of the reported wall thickness from an ultrasonic wall measurement inspection tool or nominal wall thickness. If an ultrasonic wall

Pre-Marshall Process	Post-Marshall Process
thickness data from another ultrasonic ILI if it is more accurate than the data available from the crack ILI.	measurement inspection is not available, or if the quality of the inspection is in question, the lower of the reported wall thickness from the crack inspection tool or nominal wall thickness shall be used.
PI-38 Crack Excavation Selection Criteria	
Maximum bin depth and total length used, but no tolerance considered for FFP calculations for dig selection.	For feature selection, the FFP calculation shall include a *minimum of one tool tolerance* to the depth provided by the ILI vendor.
A selection of crack-field features and or metal loss features shall be determined based on: • Depth; • Length of feature; • Length of longest interacting indication; • Distance from discharge; • Width.	All CF indications with a reported Interlinked Length (IL) greater than 3 inches (76.2 mm) shall be selected for excavation.
Risk (or Deep Features) Features with a reported depth of more than 2 mm (0.080”) but with a predicted failure pressure above hydro test pressure shall be selected for excavation **Proximity to High Pressure Locations** When choosing between two or more similar features for validation, consideration should be given to location relative to station discharges and areas with large drops in elevation. The actual fluid pressure is likely higher in these locations even if the MOP does not change along the length of a segment.	**Risk Mitigation Consideration** The selection of features that meet the risk mitigation criteria should consider results from Mainline Risk Assessment and engineering judgment. The risk mitigation criteria apply to features that did not meet the criteria provided in section 5.1 and 5.2. **CF and CL at Pump Discharge** All CF and CL indications at discharge that are located at a distance less than 5 miles or 10% of the total length between two pump stations shall be considered for excavation. These features should be selected in the following order: • CF and CL features located within 3 inches from the long seam and with reported length greater than the leak rupture boundary. • CF and CL features located at a distance greater than 3 inches from the long seam and with reported length greater than the leak rupture boundary.

Pre-Marshall Process	Post-Marshall Process
	• CF and CL features located within 3 inches from the long seam and with reported length less or equal than the leak rupture boundary. • CF and CL features located at a distance greater than 3 inches from the long seam and with reported length less or equal than the leak rupture boundary.
While trending was completed and reviewed for possible ILI issues, tool performance was not explicitly calculated.	**Tool Performance Validation** The ILI Validation Criteria apply to all CF, CL, and NL reported features. It targets the minimum number of features required to provide statistical significance, in order to determine whether the inspection met the performance specifications. The ILI Validation Criteria is applied if the minimum number of features has not been achieved by applying the previous criteria (sections 5.1, 5.2, and 5.3). In order to determine the minimum number of features for a stated confidence a proportion based sample size calculation is used, this is provided by the following relationship: $$n = \frac{Np(1-p)}{(N-1)\frac{B^2}{z^2} + p(1-p)}$$ Where: n = sample size N = population of one feature depth range p = proportion of that feature depth range within the entire population B = bound error (suggested value 0.10) z = z value corresponding with a chosen confidence interval
While Enbridge experience has shown that crack ILI technology accurately characterizes the total penetration of cracking in metal loss; a formal approach to	**Cracks in Corrosion** Threat integration is completed upon the receipt of a new run by the Data Integration SML per PI-43.

Pre-Marshall Process	Post-Marshall Process
continuous validation has been included in the process.	The results shall be reviewed to assess possible coincident crack ILI features and metal loss ILI feature. Crack features ("cl", "nl", "cf") associated with metal loss features shall be considered within the selection criteria. In Enbridge experience, crack ILI typically accurately characterizes the total depth of such features. However, a selection of possible coincident features should be excavated in Phase 1, focusing on risk mitigation areas as described in Section 5.3.1….
PI-39 Crack ILI vs. Field NDE Trending – Under Development at the time of Marshall	
Since this procedure was under development at the time of the incident at Marshall, updates were rolled into the document during final development or since approval. POD, POI, and POS calculation and comparison to vendor specification has been implemented since the Marshall Incident.	<u>Determining POD, POI, POS</u> Where POD, POI, or POS does not meet the vendor specifications, the supervisor must be notified immediately and corrective actions initiated and documented through the IMS. All instances where POI is incorrect will be provided to the ILI vendor to facilitate improvements in defect classification models.
PI-40 Crack ILI Outlier Analysis	
Fitness-For-Purpose Outlier: Any feature that has an ILI predicted failure pressure above the hydro pressure but a field predicted failure pressure that falls below the hydro pressure.	Fitness-For-Purpose Outlier: Any feature with fitness-for-purpose calculated using ILI and field NDE dimensions that meets either of the following criteria: • $(FFP_{NDE} / MOP) < 1.05$; flaws of this severity must be documented within Appendix A and reported to the supervisor of the Materials Tech. Group immediately. • $(FFP_{NDE} / MOP) < (FFP_{ILI} / MOP - 0.05)$
Track and report progress of outlier analysis and action item generation and completion Note: More defined actions were included in the process documents post-Marshall. These activities were completed previous to Marshall, but were not documented as a formalized approach.	• Provide to the ILI vendor all instances where field NDE was not aligned with the identified feature type. • Identify immediately to Supervisor if depth or fitness for purpose outliers have been confirmed and identify any revisions to excavation programs are required (per PI-38)
Track and report progress of outlier	Results of discrete depth outlier or fitness for

Pre-Marshall Process	Post-Marshall Process
analysis and action item generation and completion Note: More defined actions were included in the process documents post-Marshall. These activities were completed previous to Marshall, but were not documented as a formalized approach.	purpose outliers must be integrated into the dig selection and may result in the necessity for additional integrity actions, such as pressure restrictions or additional excavations. Where analysis error is the cause, steps will be taken to ensure corrective action is identified and implemented. These actions may include changes to the analysis process or improvements to the Quality Assurance ("QA") process. Consideration will be given to the possibility of similar errors elsewhere in the same inspection (or other inspections if a process shortcoming is identified).
PI-41 Crack ILI Interval Determination (changed from PI-41 Condition Monitoring for Crack ILI Re-inspection in 2011)	
5.0 Condition Monitoring For Crack ILI Re-inspection	This Section was moved to its own process document, *PI-06 Pressure Cycle Monitoring*. No significant changes were made post-Marshall. PI-41 now has a focus on re-assessment interval determination methodology.
Historically, Enbridge has considered fatigue growth to be more conservative than SCC growth for re-assessment interval determination.	To ensure the most conservative scenario is applied, Enbridge now also considers SCC growth rates for re-assessment interval determination in addition to fatigue growth rates. SCC growth rate methodology is described in detail in *Section 5.0 Crack ILI Interval Determination*. The SCC growth rate is used to confirm the re-assessment interval is acceptable. Please see NTSB IR No. 282 for *PI-41 Crack ILI Interval Determination*.