

Pipeline Operational Risk Management

August 20, 2014 – Camisea 10 years conference



Who is Enbridge?



- North American leader in energy delivery, with over 80,000 km of pipeline and distribution networks
 - Liquids gathering and transport: 24,700 km
 - Natural gas gathering and transport: 23,000 km
 - Natural gas distribution: 33,000 km
- Owner/operator of world's longest liquids pipeline system
- Over 160 years of gas distribution experience and over 60 years of pipeline transmission experience
- Over CAD\$57 billion in assets, market capitalization of ~CAD\$40 billion
- Credit ratings: A- (S&P), Baa1 (Moody's), and A (Low) DBRS
- 2013 revenues of CAD\$33 billion
- Employs more than 11,000 people

**Enbridge has over
60 years of pipeline
operating experience**



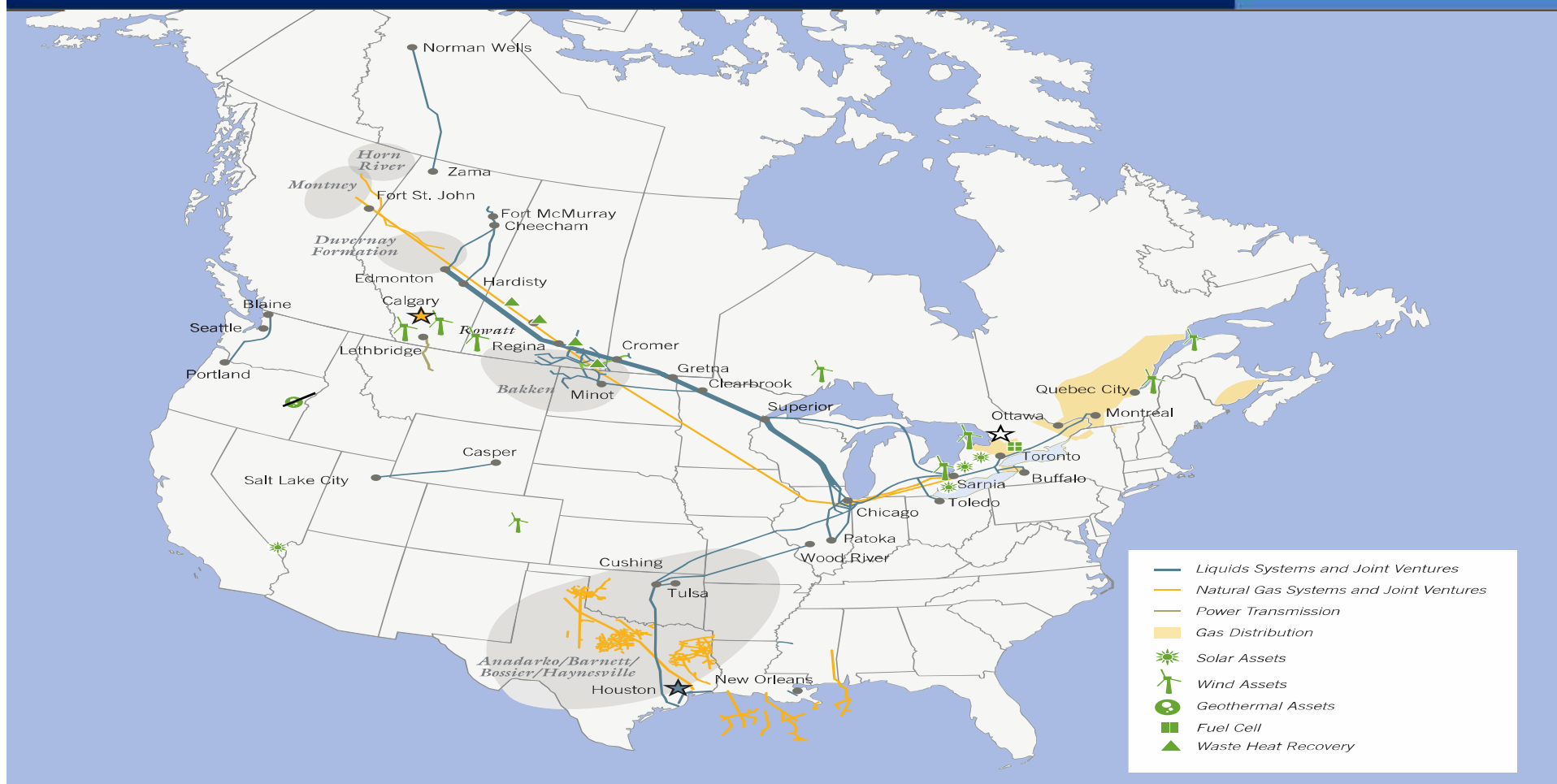
Awards and Recognition



- Recognized global leader in the energy sector, including:
 - Alberta's Top 60 Employers – 2011, 2012, 2013
 - Canada's Greenest Employers – 2010, 2011, 2012
 - Canada's Top 100 Employers – 2011, 2012, 2013
 - Corporate Knights Best 50 Corporate Citizens in Canada – 2011, 2012, 2013
 - Corporate Knights Global 100 Most Sustainable Large Corporations in the World – 2011, 2012, 2013
 - Dow Jones Sustainability Index (World and North America) – 2012, 2013
 - *Forbes* 100 Most Trustworthy Companies in America (Enbridge Energy Partners) – 2010, 2012, 2013
 - FTSE4Good Index – 2010, 2012, 2013



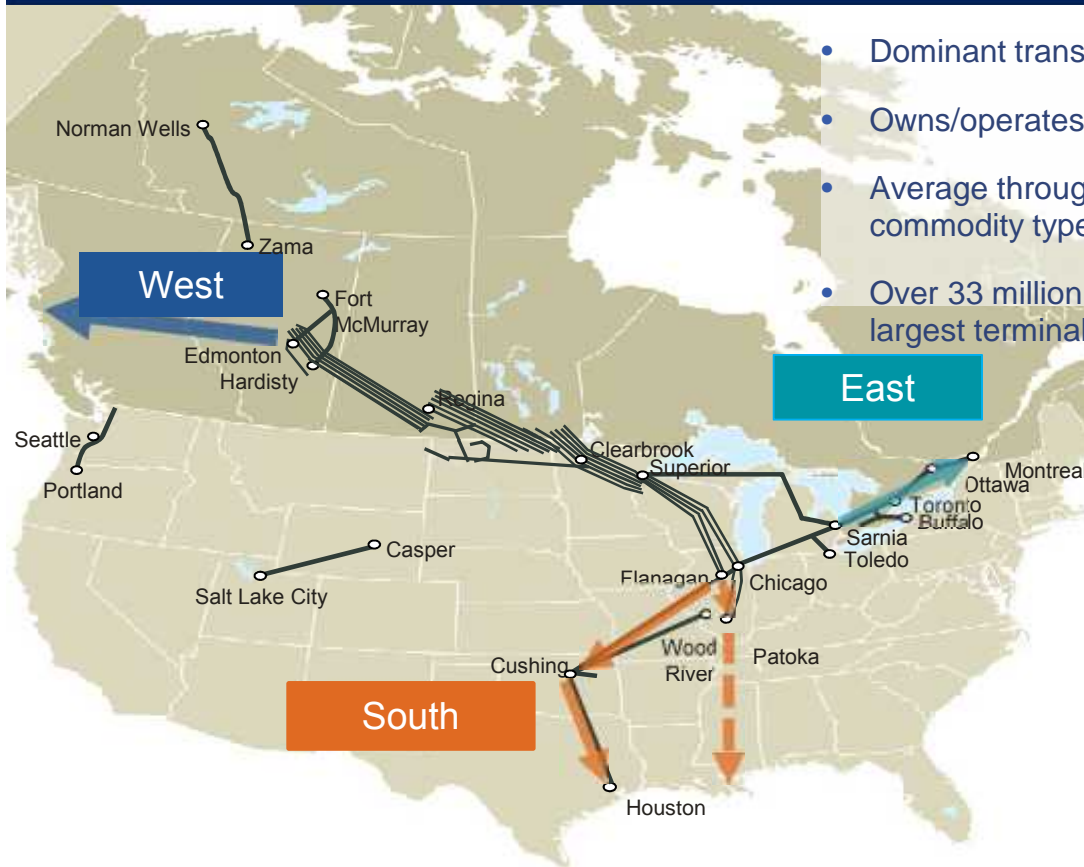
Core Business Segments



Liquids Pipelines



- Dominant transporter of Canadian crude oil to the US
- Owns/operates approximately 24,700 km of liquids pipelines
- Average throughput of ~2.2 million bbl/d, with close to 100 different commodity types
- Over 33 million bbl of crude oil/liquids storage capacity, including the largest terminal facility in Cushing, OK



North America Market Extensions

Western Extension:

- Northern Gateway Pipeline
- In Service 2018+
- 500 kbpd crude line
- 180 kbpd condensate line
- Potential ~\$3B (ENB 50% of \$6B)

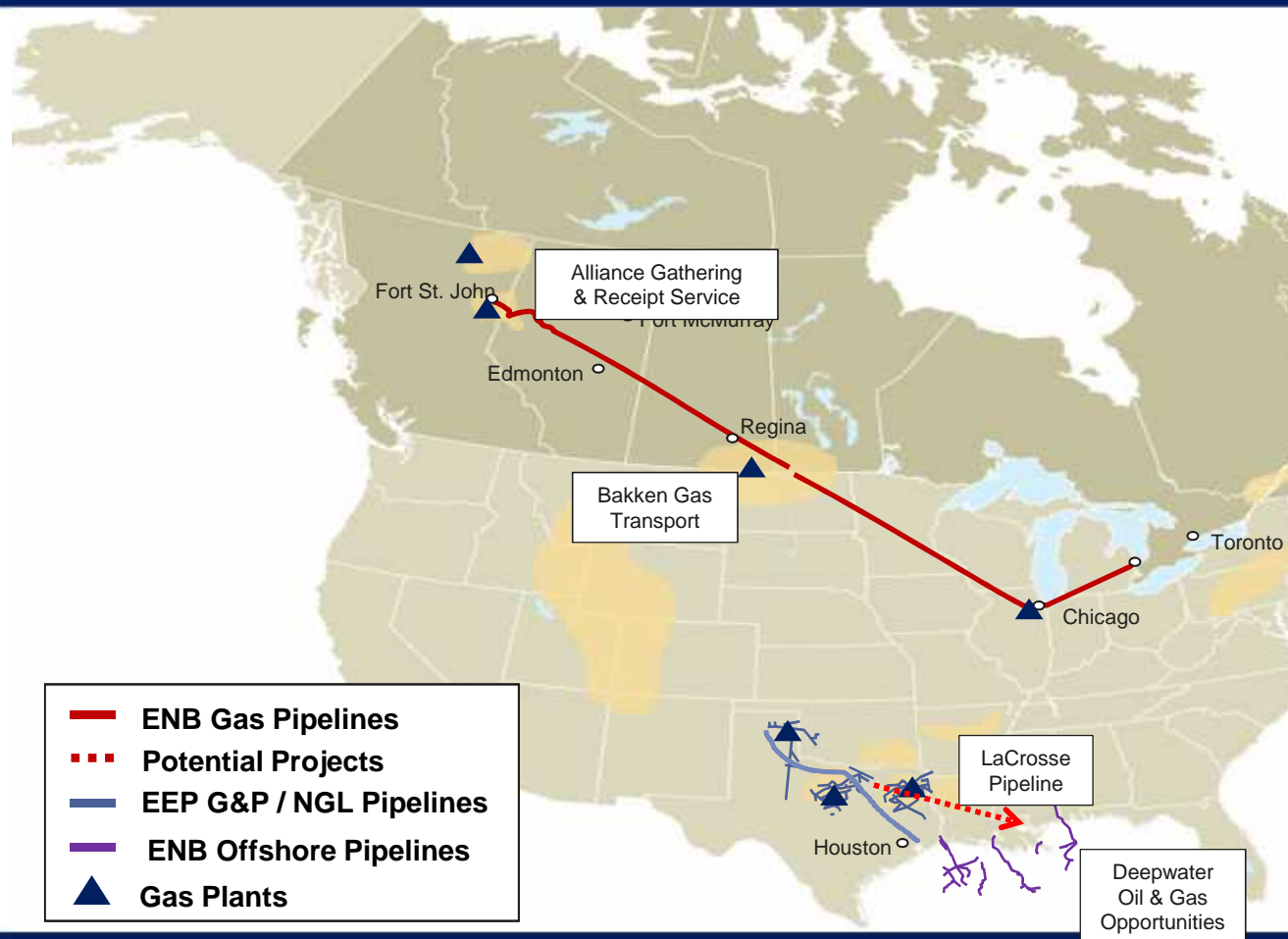
Eastern Extension:

- Toledo spur expansion: 2013
- Line 9 reversal to Mtl: 2014
- Potential ~\$1.0 Billion

US Gulf Coast Access:

- Flanagan South: 2014 (\$2.8B)
- Seaway Twin + Lateral 2014 (\$1.1B)

Natural Gas Pipelines



Alliance Pipeline

- 50% ownership
- 3,717 km, 36 & 42" dia., 1.33 Bcfd capacity

Vector Pipeline

- 60% ownership
- 560 km, 42" dia.
- 1.3 Bcfd capacity

Offshore Assets

- Over 2,500 km of offshore pipelines
- Average of ~3 Bcf/d transported
- ~40% of deepwater USGC gas production

EEP Midstream System

- 16,320 km of pipelines
- Average daily volumes of 2.5 Bcfd

Enbridge Gas Distribution



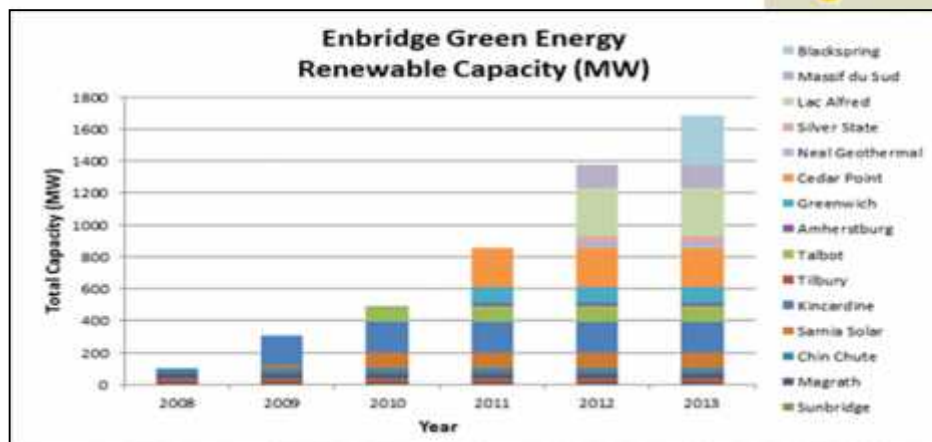
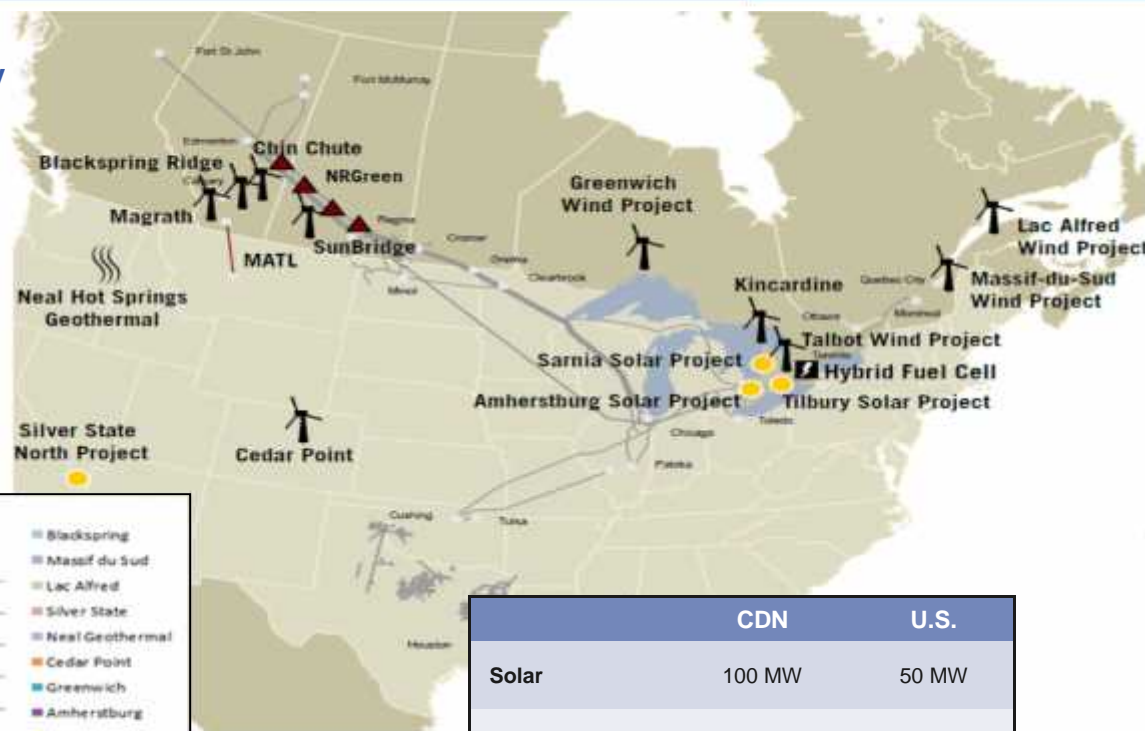
- Distributes an average of 1.0 Bcf/d gas
- More than 33,000 km of pipeline in network
- 103 Bcf reservoir gas storage
- Over 160 years of operational experience
- 2.0 million customers, Canada's largest gas distribution company
- Adds 30,000 – 50,000 new customers each year



Growing Green Energy Footprint



- Includes wind, solar and geothermal energy
 - Canada's #1 generator of solar and #2 generator of wind energy
- Business model focus:
 - Advanced stage projects
 - Long-term PPAs
 - Available transmission
 - Proven technology



	CDN	U.S.
Solar	100 MW	50 MW
Wind	1,302 MW	250 MW
Geothermal	-	23 MW
Waste Heat	30 MW	-

Proven Capital Project Execution Track Record



- Delivered 30 major projects valued at CAD\$18 billion between 2009 and 2013
- Over 90% of recent projects were on time and on budget
- Reliable cost estimates and schedules
- Disciplined control: cost, schedule and quality
- Rigorous risk identification and mitigation
- CAD\$42 billion of commercially secured current/future projects



Leveraging International Experience



- Colombia – OCENSA pipeline
 - Active in Colombia from 1995, held a 24.7% interest in and operated the OCENSA pipeline until 2009
- Spain – CLH system
 - From 2002 until 2008, Enbridge held a 25% interest in CLH, a refined products pipeline system
- Venezuela – Jose terminal
 - Operated from 1999 to 2003, included 3.5 mmbbl storage capacity and onshore/offshore facilities
- Oman – National Gas Transportation System
 - Operated 335 mmcf/d system from 2002 until 2006
- Enbridge remains committed to international growth



Enbridge Experience in Peru



- Through consulting company, Enbridge Technology Inc (ETI) we have been involved in the Camisea gas projects, with various entities, since 2004 and continue to be involved.



Camisea Pipeline Project (2004)



Technical Training Program

- Via the Canadian Petroleum Institute, ETI delivered an 8-week web-based, self-study training program, followed by a 3-week instructor-led program in Canada:
 - The knowledge based, self-study topics included fundamentals of natural gas and liquid pipeline operations, and
 - The instructor-led program focused on skills in relation to professional and analytical pipeline operations.



Integrity Management Program Framework

- Over an 4-month period, ETI completed the following:
 - On-site pipeline system review and gap analysis,
 - Development of the integrity management program framework, and
 - Development of the Integrity Management Program Manual.



NGL Safety Audit

- ETI completed an onsite assessment of the Camisea pipeline system, followed by a final report that included recommendations for improvement of procedures and practices in the following areas:
 - Health and safety management system,
 - Emergency preparedness and response, and
 - Operations and maintenance.



NGL Operations & Maintenance Training Program

- Phase 1: Over a 5-week period, ETI delivered knowledge-based, self-study via its online learning system in preparation for skills-based training in Canada.
- Phase 2: Over a 4-week period, ETI provided classroom-based, instructor led sessions and skills qualification in Canada in relation to normal and abnormal operating conditions and related checklists for O&M of natural gas pipelines.



NGL Safety and Emergency Response Training

- Over a 1-week period, ETI delivered a technical program that included the following topics:
 - NGL awareness – review of properties and characteristics
 - NGL plume development;
 - Incident command system overview;
 - NGL emergency response; and,
 - NGL ignition guidelines and training.



NGL Operations & Maintenance Procedures Gap Analysis

- Over a 4-week period, ETI completed an assessment to achieve key objectives as follows:
 - Review of COGA's NGL O&M practices;
 - Review of COGAS NGL O&M procedures; and
 - Prepare a report with finding and recommendations to enhance current procedures to international standards.



Virtual Web Service Hosting and Content License

- Via ETI's learning and content management system, Operations Performance Support System (OPSS), 34 operations-based technical training modules were licensed to 20 users



Contugas (2013-present)

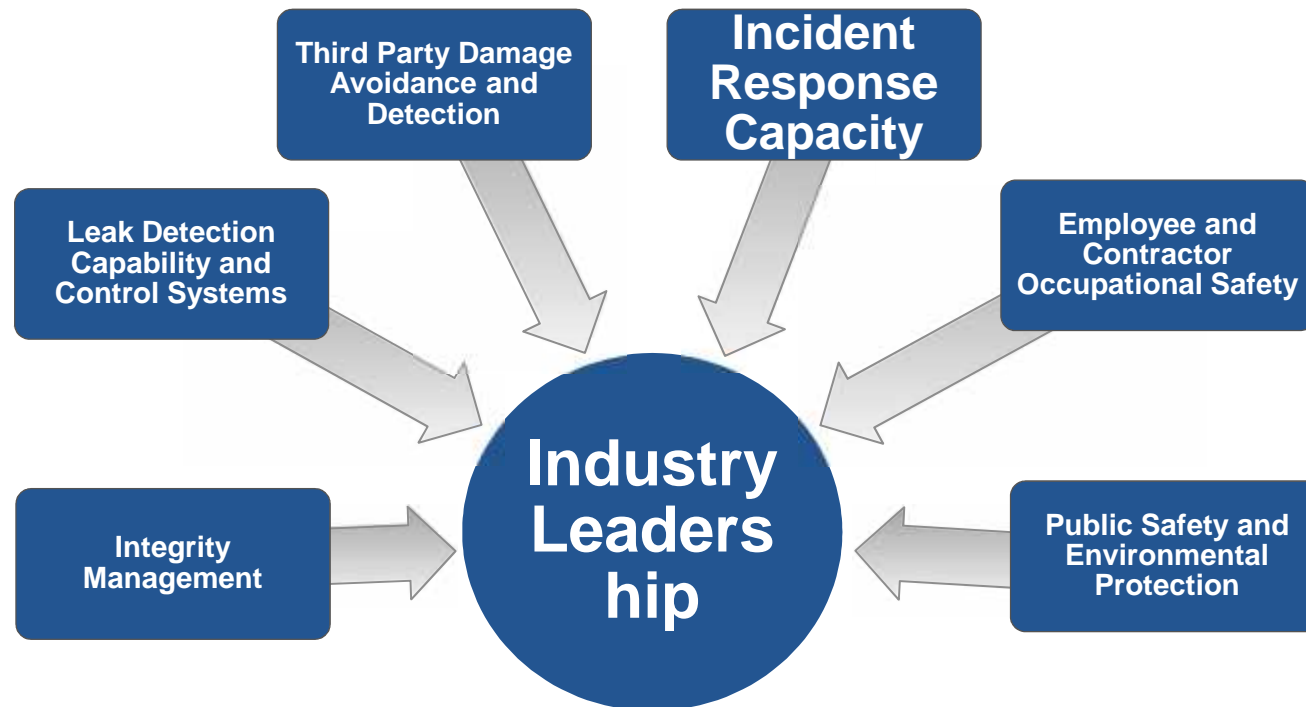


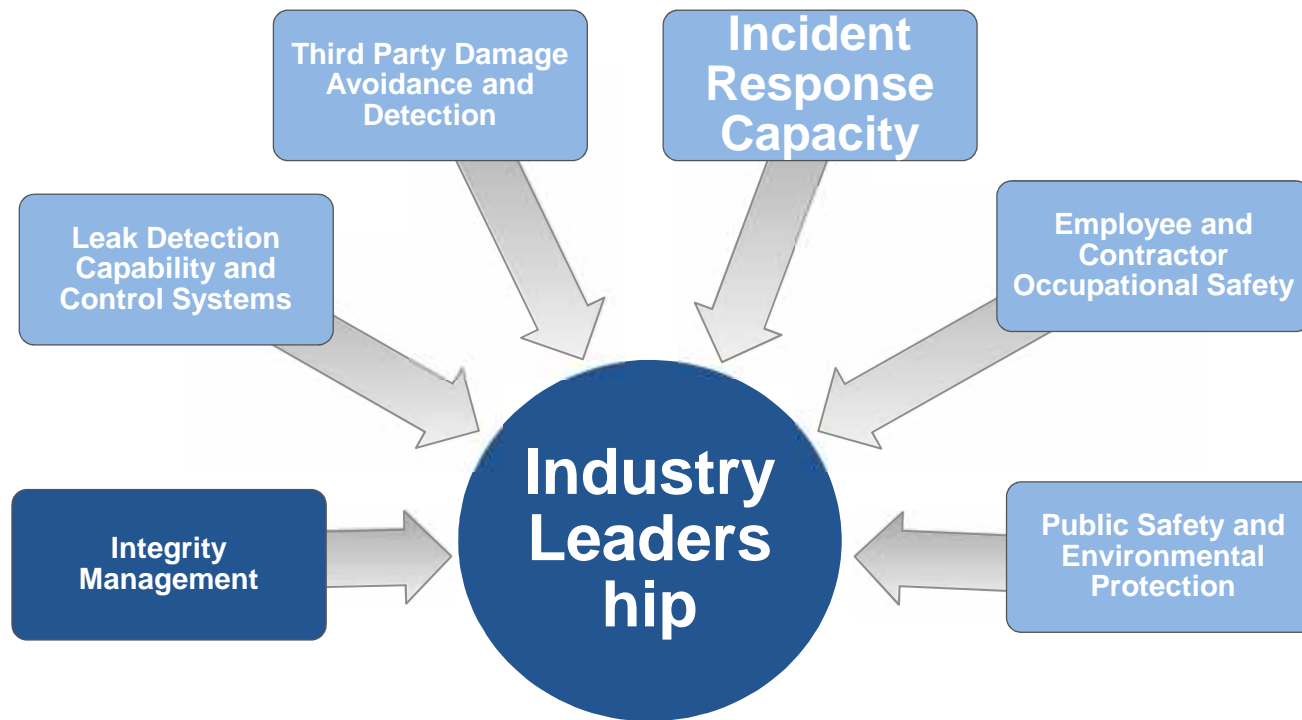
- Review and Inspection of Pipeline Design/Construction
 - SOW: new gas pipeline distribution system (20" x 200 km, 14" x 40 km, 6" x 50 km) and related facilities/gate stations
 - Phase 1 work commenced in January 2013, with 5 Enbridge Specialists completing the site visit to the Chinchá Gate Station
 - Phase 2 work commenced in Q2 2013
 - Phase 3 work to be completed in Q4 2014



- **Why Operational Risk Management?**

- One of the ways that we are transforming our operations to “be the best”
- Reduces safety, integrity and operational incidents
- Improves efficiencies
- Reduces delays and cost overruns, and loss of earnings
- Ensures that the high priority risks are aggressively and cost-effectively managed

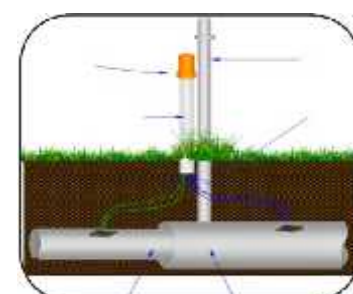
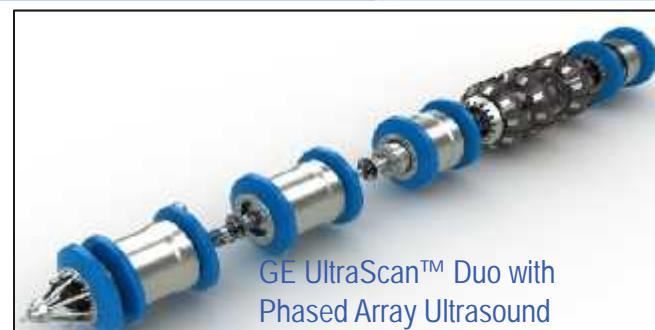




Pipeline Safety - Integrity Monitoring



- **Inline inspection (ILI)**
16,000 km inspected in 2011/2012
More than 4,000 pipe joints examined
Medical imaging technology – scan every 3 mm
- **Hydro testing**
Pipe manufacture, pipeline commissioning,
ILI verification study per regulator
- **On-line sensors**
Pressures/cycling, pipe movement, external & internal corrosion, vibration
- **Surveys**
Pipe depth, river crossing and geotechnical conditions,
corrosion control, 3rd party activity
- **Non-destructive testing**
Targeted investigation sites
- **Equipment checks**
Seals, sumps, rotating equipment



Pipeline Safety – Integrity Remediation



- Pressure reduction as a temporary measure
- Reinforcement, cut-out repair or pipe segment replacement
- Pipe support or strain relief
- Facility equipment replace or refurbish parts



Pipeline Safety - Emerging Technologies & Methods

Prevention

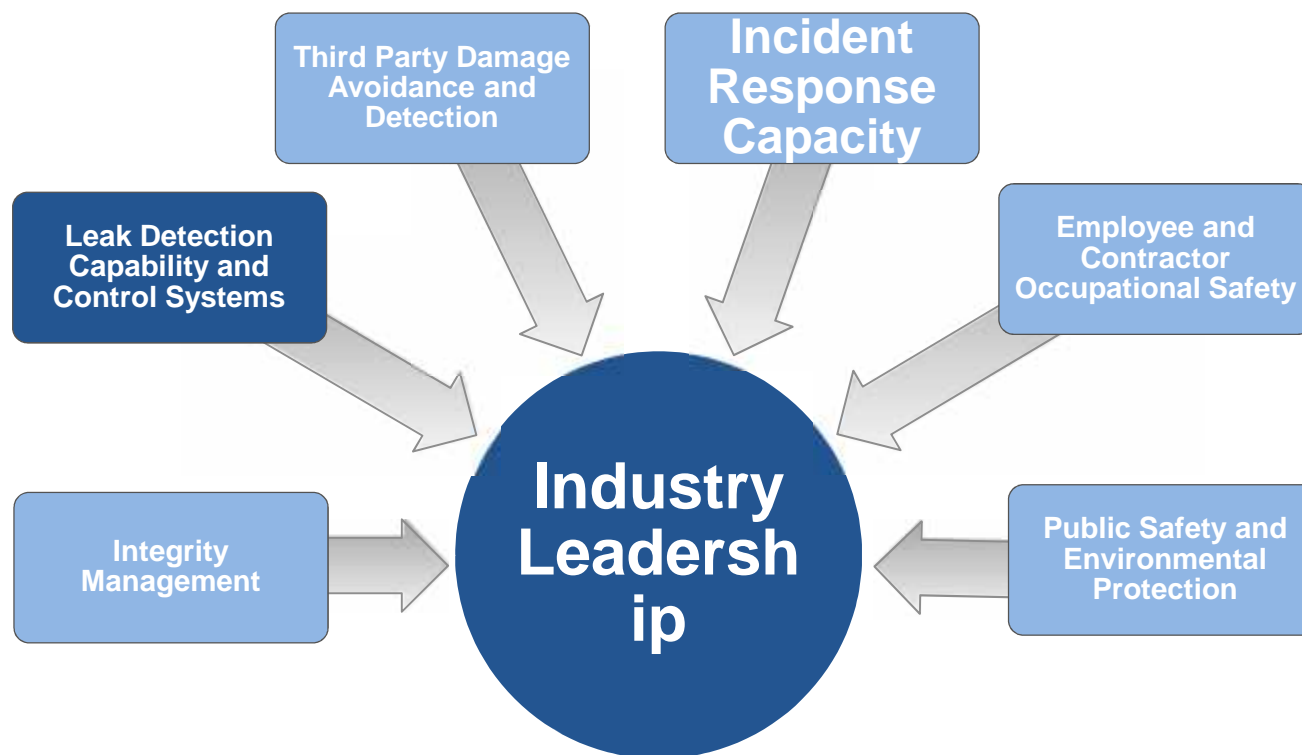


Monitoring



Mitigation





Pipeline Safety – Control Centre



- **Dedicated VP Pipeline Control**
- **“State of the Art” Control Centre**
- **Onsite 24/7 Technical Support**
- **Operator Training**
 - Technical – Hydraulics
 - Human Factors – Teams
- **Control Centre Procedures**
 - Management Escalation
 - Regulatory Compliance
 - “Golden Rules”



CCO Specific Golden Rules



SAFE OPERATING

Only operate pipeline/terminal facilities when not under the effect of excessive fatigue, alcohol or any substances that cause impairment.



WHEN IN DOUBT - SHUTDOWN

Always shutdown and bring the system to a safe state if a potential safety related anomaly or situation cannot be explained within specified time limits (i.e. 10 minute rule) and request support when needed.



EMERGENCY PROCEDURES

Always follow Emergency Procedures.

- **Overlapping Leak Detection**

- Computational Pipeline Monitoring (CPM)
- Line balance calculations
- Operator monitoring
- Visual surveillance

- **Detection Improvements**

- Monitoring System Tuning
- State of the art instrumentation
- Dynamic Alarm Thresholds



Multipath Ultrasonic Flow Meter

Pipeline Safety - Leak Detection Technology Tests



- Acoustic/Pressure Wave System

- Potential to reduce detection time
- Evaluation of external leak detection technology
- DTS, Vapor Tube and Hydrocarbon Cables



- Spectral sensing and video analytics

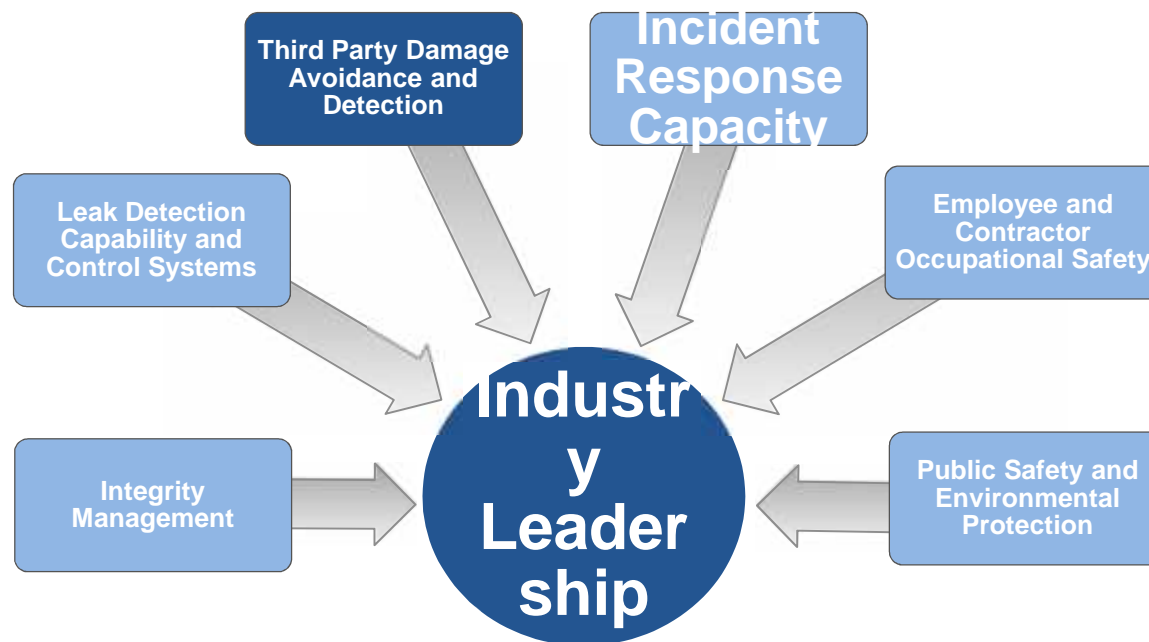
- Conducting international vendor assessment



- Acoustic Sensing and Acoustic Ball

- “Listens” for leak signatures
- Extremely low leak sensitivity





Pipeline Safety – Third Party Awareness

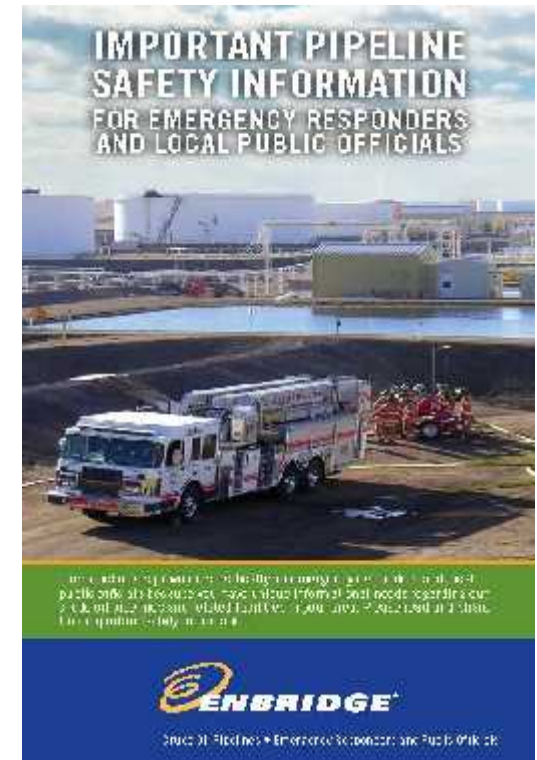


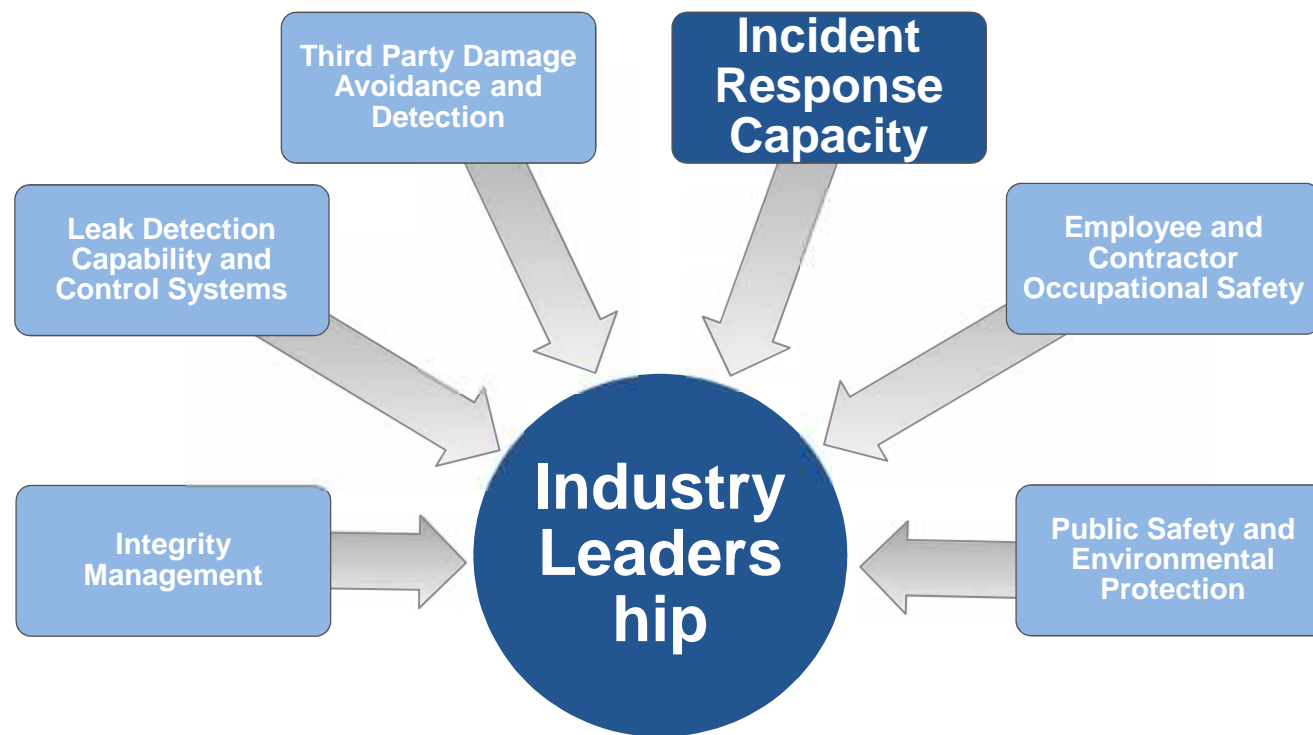
- **Emergency Responder Education Program**

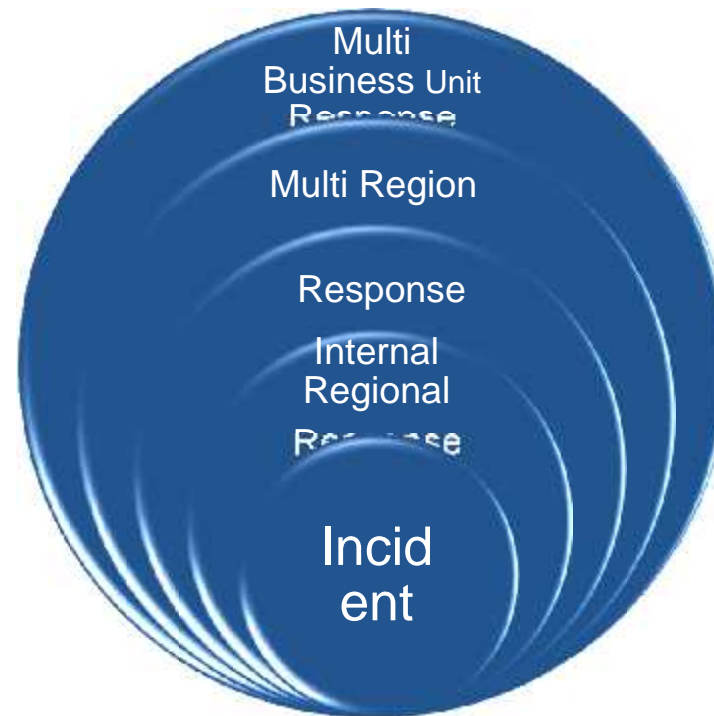
- Free access to pipeline emergencies training program
- (www.enbridge.protraining.com/index.cfm)

- **Priority outreach**

- 911 dispatch centers and fire departments

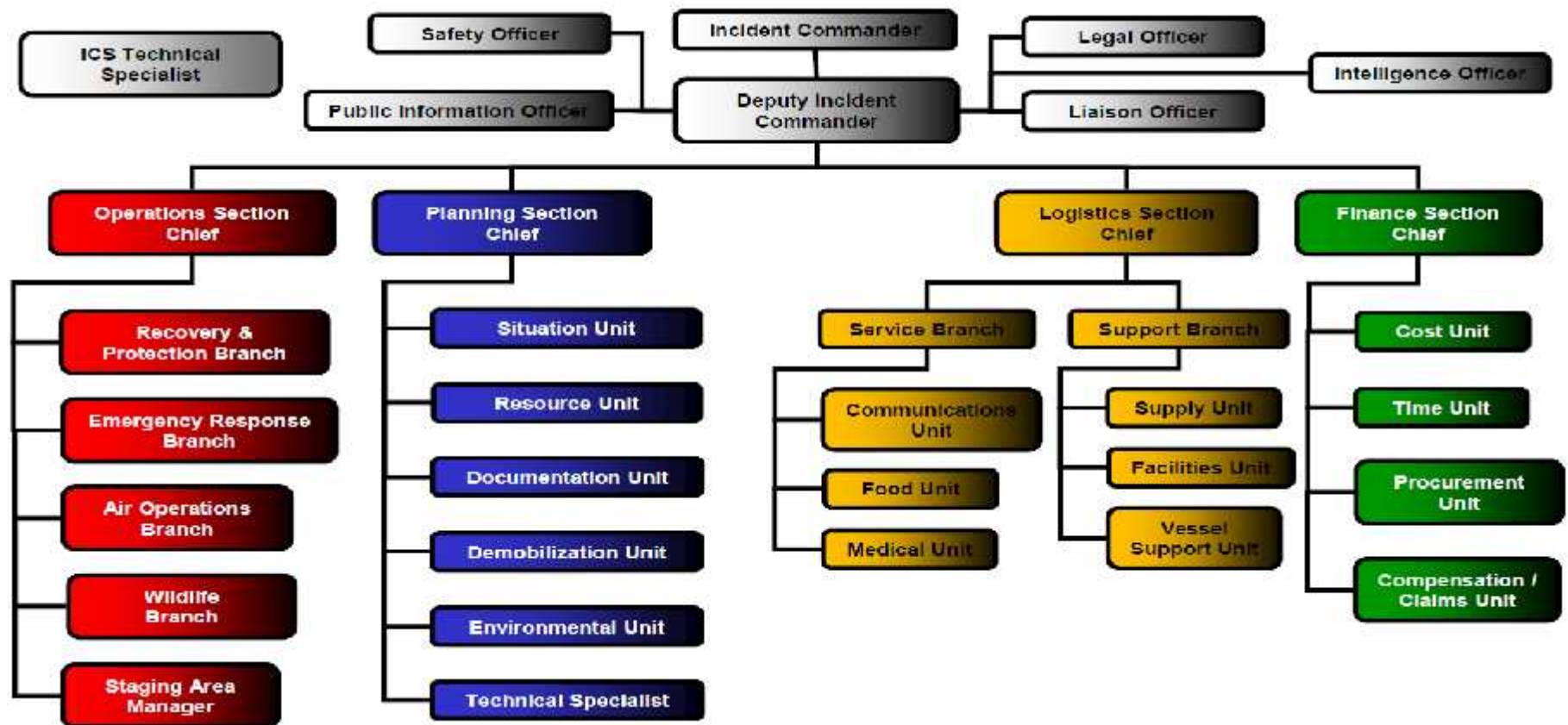


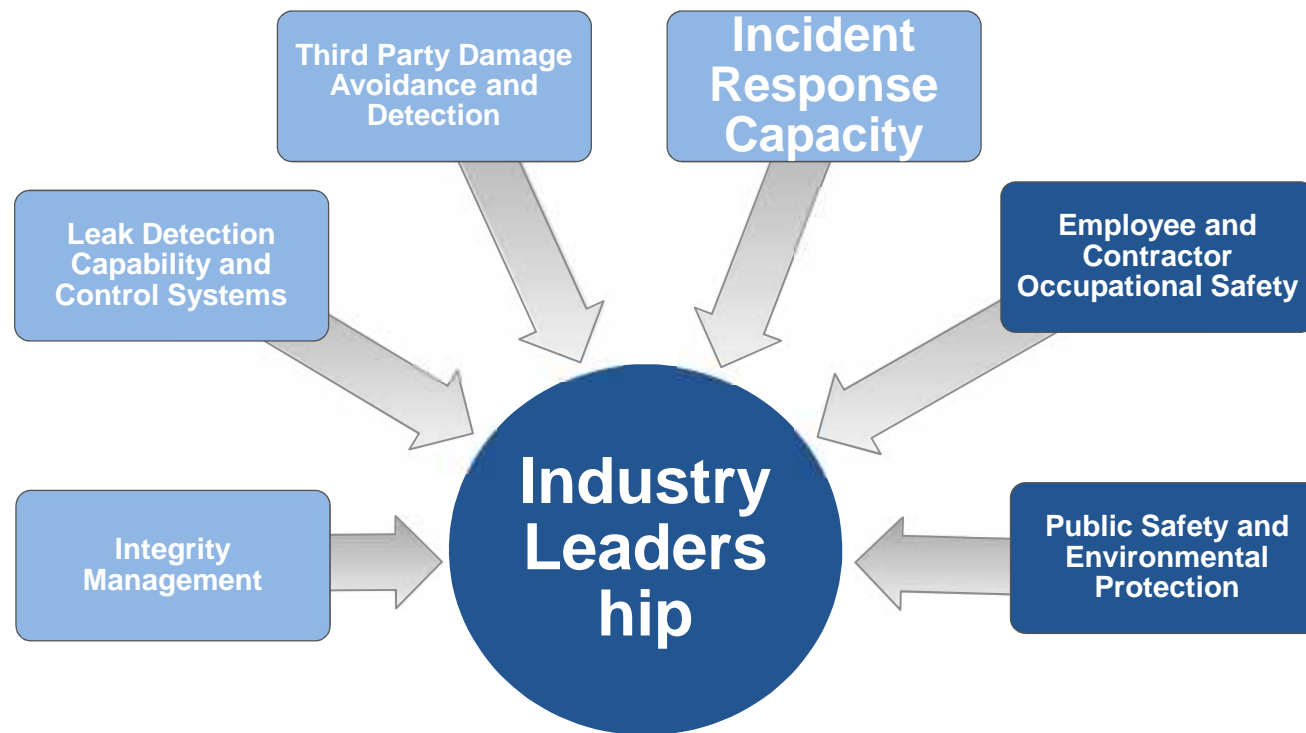




Tiered Response - Regional to Enterprise-Wide Teams

Pipeline Safety - Incident Command System Organization





- Integrity
- Safety
- Respect
- Communities
- Environment



Reputation - The Game Has Changed



- Energy transportation companies are coming under increasing levels of public scrutiny; this is an irreversible trend
- Corporate reputations are being impacted today by a complex interplay of many stakeholders including the media
- Incidents and operational reliability are the focus of public attention
- Reputational demands on Enbridge and other pipelines will continue to escalate; stakeholders want more transparency

Enbridge Top 5 Priorities



Our ability to attract, retain and develop a workforce that is capable to meet our priorities and challenges

Our ability to optimize all aspects of the customer experience, including development, contracting and service delivery

Our ability to continually grow and expand the infrastructure footprint



Our ability to safely, reliably and efficiently operate and maintain our pipeline network

Our ability to effectively manage the operation of our expanding asset base to maximize shareholder return

- **Society needs a safe, secure and reliable supply of energy**
 - Pipelines are the safest, most secure and reliable way of delivering the quantities of energy and fuel that people rely on every day
- **A supply of affordable energy to heat, light and power our world**
- **A source of energy that is delivered with great responsibility towards our environment, our communities and our people**

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