



Natural Resources
Canada

Ressources naturelles
Canada

Standards for Pipeline Coatings

S. Papavinasam^a and R.W. Revie^b

CANMET Materials Technology Laboratory

Ottawa, Ontario, Canada K1A 0G1

Fax: 613-992-8735

^aPhone: 613-947-3603, Email: spapavin@nrcan.gc.ca

^bPhone: 613-992-1703, Email: wrevie@nrcan.gc.ca




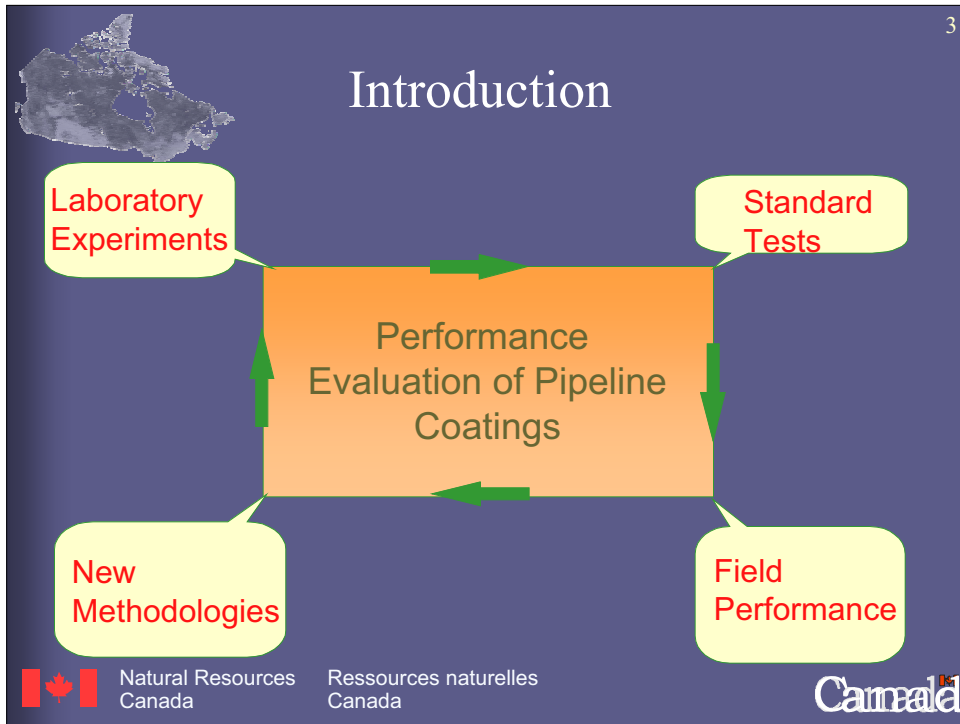
2

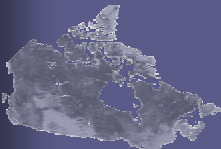



Outline

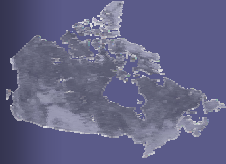
- Introduction
- Historical Perspective
- Standards for Coating Evaluation
- Summary

Natural Resources Canada / Ressources naturelles Canada





- 4
- 
- ## Historical Perspective
- Procedures to Select Pipeline Coatings
 - ◆ Pipeline operating conditions and physical properties of the coating are identified
 - ◆ Tests or behavior of materials
 - Several coatings short listed
 - ◆ Compromise of factors, including cost and facilities
 - Most appropriate coating(s) selected
-  Natural Resources Canada
 Ressources naturelles Canada
 Camalg



Historical Perspective

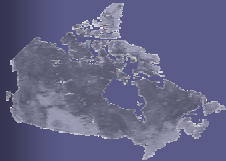
- 10-Year Study in 1950s
 - ◆ Develop and devise laboratory procedures
 - ◆ Correlate laboratory and field performance data
 - ◆ Test new materials



Natural Resources
Canada

Ressources naturelles
Canada

Camal



Historical Perspective

- 13 New ASTM Pipeline Coating Standards (1970s)
 - ◆ Physical and Mechanical Tests
 - ◆ Chemical and Atmospheric Exposure Tests
 - ◆ Electrical and Electrochemical Tests

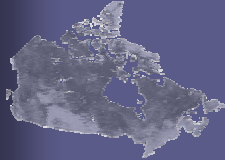


Natural Resources
Canada

Ressources naturelles
Canada

Camal



7

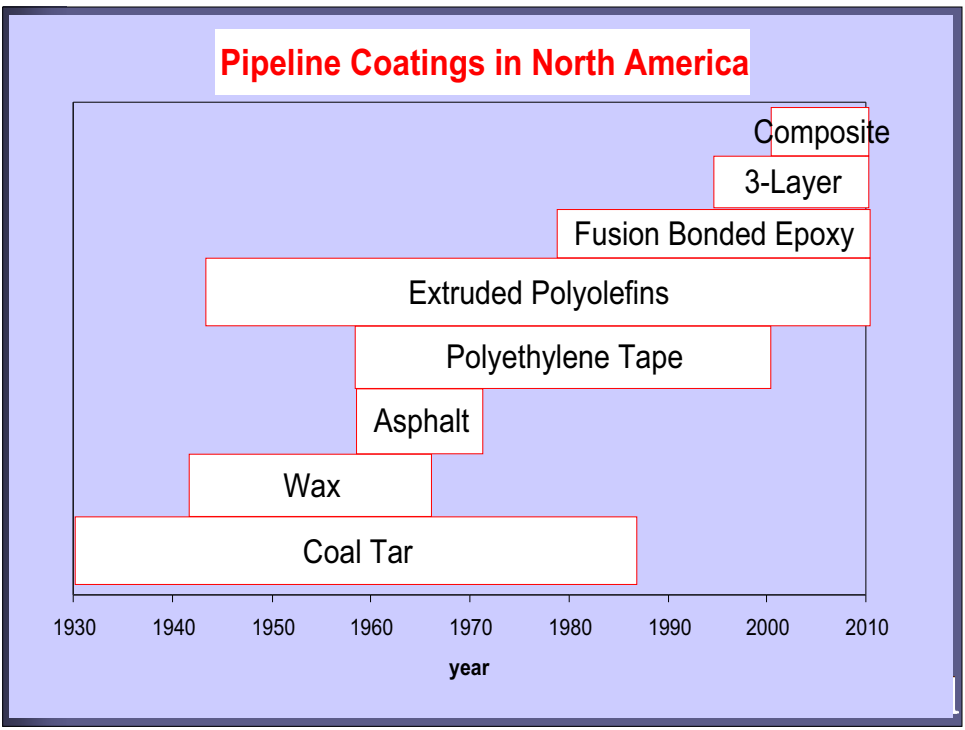


Historical Perspective

➤ **Industry Surveys**

- ◆ PRCI/GRI Survey (1992)
- ◆ PRCI/GRI/CANMET Survey (2002)
- ◆ Biloxi Coating Workshop (2004)

 Natural Resources Canada Ressources naturelles Canada
 





Standards for Pipeline Coatings

➤ General

- ◆ NACE RP0169, NACE RP0190, & CSA Z662

➤ Specific Coatings

- ◆ Coal Tar, Tape, FBE, Liquid Epoxy, Urethane, and Extruded Polyolefins

➤ Specific Properties

- ◆ Adhesion, Cathodic Disbondment, etc.



Natural Resources
Canada

Ressources naturelles
Canada

Camal



North American Standards-Making Organisations for Pipeline Coatings

➤ ASTM

- ◆ Specific Properties of Polymeric Coating

➤ AWWA

- ◆ Water Pipelines

➤ CSA

- ◆ Canadian Pipelines

➤ NACE

- ◆ Specific Coatings

➤ SSPC

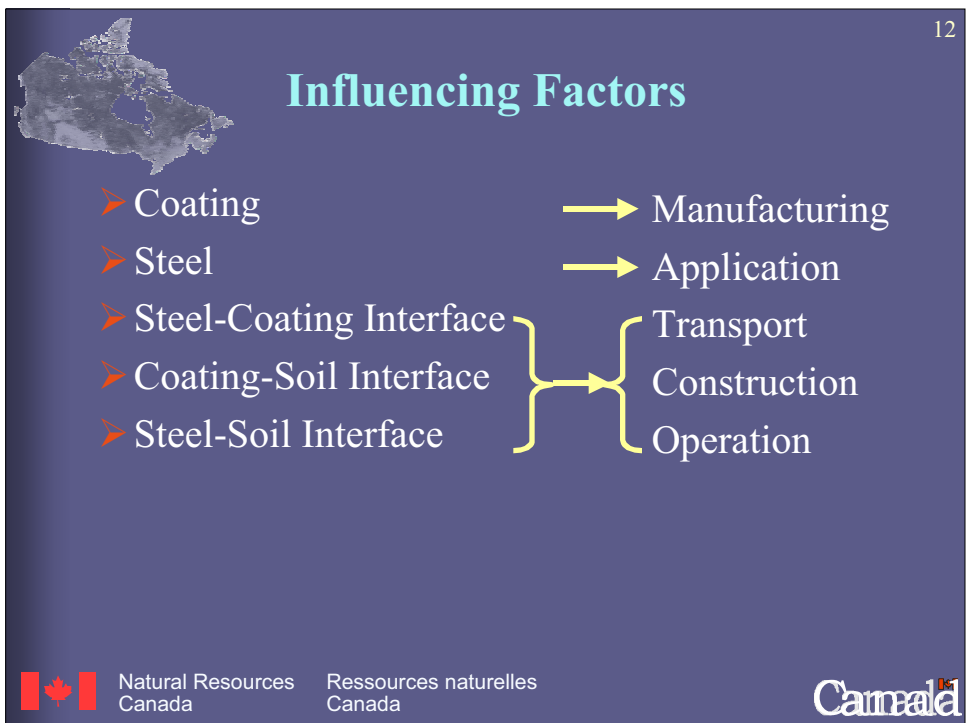
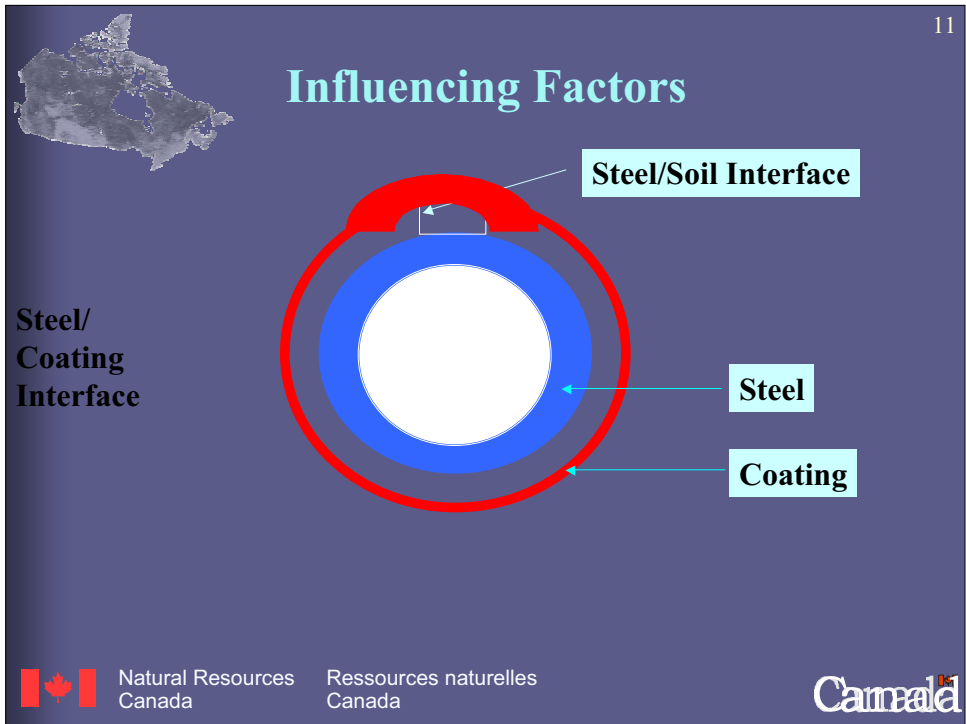
- ◆ Surface Preparation

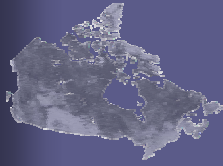


Natural Resources
Canada

Ressources naturelles
Canada

Camal





Standards: Steel

- ◆ Cleaning
- ◆ Surface profile
- ◆ Chemical contamination
 - Visible and Non-visible

**Standards agree with each other
with respect to the influence of steel**



Natural Resources
Canada

Ressources naturelles
Canada

Camald



Standards: Steel-Coating Interface

- ◆ Adhesion
 - Hot-Water Soak
 - Peel
 - Sheer
 - Pull-off
- ◆ Cathodic Disbondment
- ◆ Bendability/Flexibility

Harmonization of Standards by Various Organizations Useful



Natural Resources
Canada

Ressources naturelles
Canada

Camald



Standards: Coating (Common)

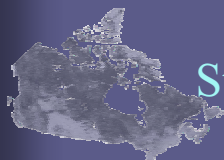
- Thermal Conductivity
- Dielectric Strengths
- Electrical Conductivity
- Hardness
- Penetration Resistance
- **Water Permeation**
- **Blistering**
- Chemical Resistance
- Weathering
- Cohesion
- Stress-Cracking Resistance
- Resistance to Oxidation
- Compressive Properties
- Thermal Expansion
- Brittleness Temperature
- Film Thickness

Harmonization of Standards from Various Organizations to Evaluate Water Permeation and Blistering will be useful.



Natural Resources
Canada

Ressources naturelles
Canada



Standards: Coating (Specific)

- ◆ Composition
- ◆ Gel Time (FBE)
- ◆ Particle Size
- ◆ Total Volatile Content
- ◆ Porosity
- ◆ Viscosity
- ◆ Flow
- ◆ Softening Point
- ◆ Shelf Life
- ◆ Filler Content
- ◆ Tear Strength
- ◆ Curing
- ◆ Tensile Strength
- ◆ Sag
- ◆ Low-Temperature Cracking Test
- ◆ Pliability
- ◆ Breaking Strength
- ◆ Insulation Resistance
- ◆ Density/Specific Gravity



Natural Resources
Canada

Ressources naturelles
Canada





Standards: Coating-Soil Interface

- ◆ Microbial Resistance
- ◆ Abrasion Resistance
- ◆ Impact Resistance
- ◆ Freeze-Thaw Stability
- ◆ Resistance to Elevated Temperature
- ◆ Compatibility and Repairability

Specifications included in the Coating-Standards



Natural Resources
Canada

Ressources naturelles
Canada



Standards: Steel-Soil Interface

- ◆ Detection of Holidays and Disbondments
 - Cathodic Protection Current
 - DC Potential (Soil) Gradient
 - Close Interval Survey
 - Coating Conductance
 - AC Voltage Gradient
 - Inline Inspection
 - Bellhole Inspection

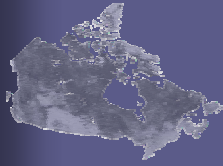
Development of standards required



Natural Resources
Canada

Ressources naturelles
Canada





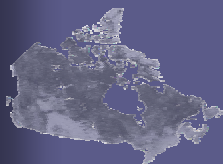
Summary

- Good Understanding of Coating Properties
- Several Standards Available
- Several Standards have Similar Requirements
- Some Standards have Different Requirements
 - ◆ Cathodic Disbondment and Adhesion



Natural Resources
Canada

Ressources naturelles
Canada



Moving On

- Harmonization of Some Standards
- Correlation between Laboratory and Field Data
- Common Industry Database
- Capability to Predict Long-Term Coating Performance using Short-Term Experiments Based on Standards

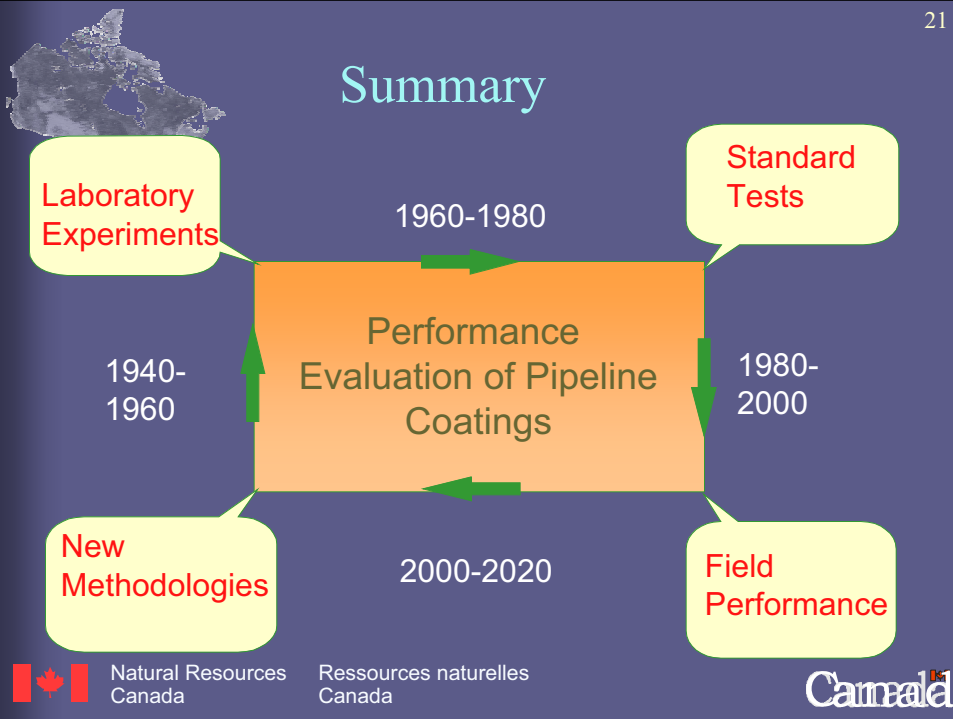


Natural Resources
Canada

Ressources naturelles
Canada



Summary



Natural Resources
Canada

Ressources naturelles
Canada

