

SPACE WEATHER SERVICE FOR PIPELINE OPERATIONS

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EFFECTS OF SPACE WEATHER ON PIPELINE PERFORMANCE

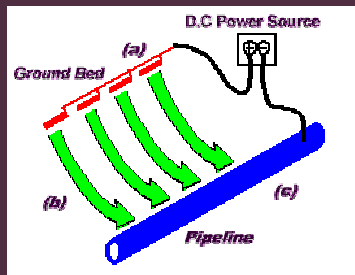
1. Geomagnetic disturbances during cathodic protection surveys
2. Corruption of survey data
3. Reduction of expected lifetime

CATHODIC PROTECTION

CORROSION REACTION



Corrosion control system= coating + cathodic protection



Industry standards

Potential of -0.850V to

-1.350 V at the pipe

steel/earth interface

$$-1.35 < \text{PSP} < -0.85\text{ V}$$

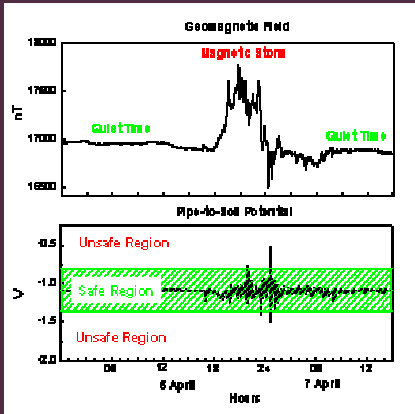
TELLURIC CURRENTS

PRODUCED BY INTERACTION OF

1. GEOMAGNETIC FIELD + 2. EARTH + 3. PIPELINE

PSP variations occurred where telluric currents are going in and out of cathodically protected pipeline

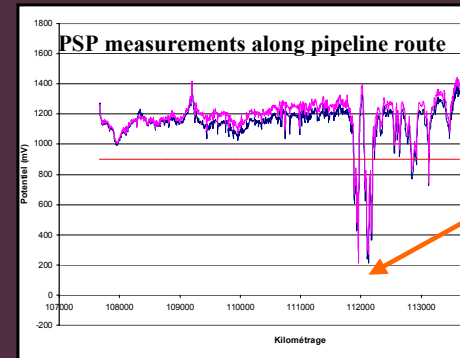
1. GEOMAGNETIC FIELD VARIATIONS EFFECTS ON PIPELINE PERFORMANCE



Henriksen et al., study on cathodically protected pipeline in Norway, 1971

“telluric current corrosion in auroral zones has about the same magnitude as the normal corrosion in soil where telluric corrosion is lacking”

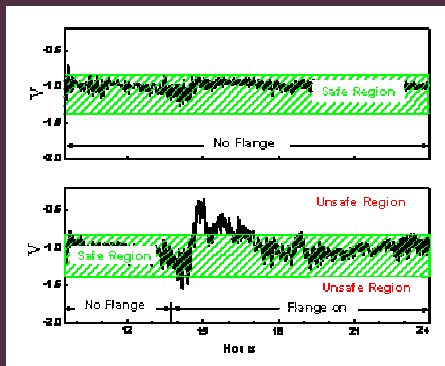
2. EARTH CONDUCTIVITY EFFECTS ON PIPELINE PERFORMANCE



Location of low resistivity formation

TQM pipeline, installed in 1998 1.5 mm pit found in 2001
R. Gummow, presentation at ESPRIT, 2002

3. PIPELINE STRUCTURE EFFECTS OF INSULATING JOINTS/FLANGES ON PIPELINE PERFORMANCE



SPACE WEATHER SERVICE FOR PIPELINE OPERATIONS

1. Prediction of disturbances during cathodic protection (CP) surveys
2. Interpretation of CP survey data
3. Estimation of expected lifetime

<http://www.spaceweather.gc.ca>

Regional Geomagnetic Conditions Real-Time Reports and Forecasts

Français	Contact us	Help	Search	Canada Site
Home	Current Space Weather Data	Effects on Geomagnetism	Effects on Technology	NRCan CSA

Current Space Weather
Regional Geomagnetic Conditions
Real-Time Reports and Forecasts

- Eastern North America
- Southern prairies
- Southwestern Canada
- Northern prairies
- Eastern auroral region
- Central auroral region
- Western auroral region
- Summary Plot from Canadian Magnetic Observatories

Short Term Magnetic Forecasts

- Tabular - Three Zone
- Map - Three Zone
- Graph - Three Zone
- Graph - Multi -Station
- Text version

Long Term Magnetic Forecasts

- Forecasts
- Review of past activity

Indices

Forecast of Energetic Electron Fluence

CANOPUS Real-Time Auroral Oval

SuperDARN

More SpaceWeather Information

- SOHO Images
- Maps of Coronal Holes
- ACE plots

Solar 10.7 cm Radio Flux, Penticton, Canada

- Latest Solar Radio Flux Report

Regional Geomagnetic Conditions Sample: Eastern North America

Natural Resources Canada / Ressources naturelles Canada

Current Regional Geomagnetic Conditions for Eastern North America issued at 15:42 UT 10:42 EST

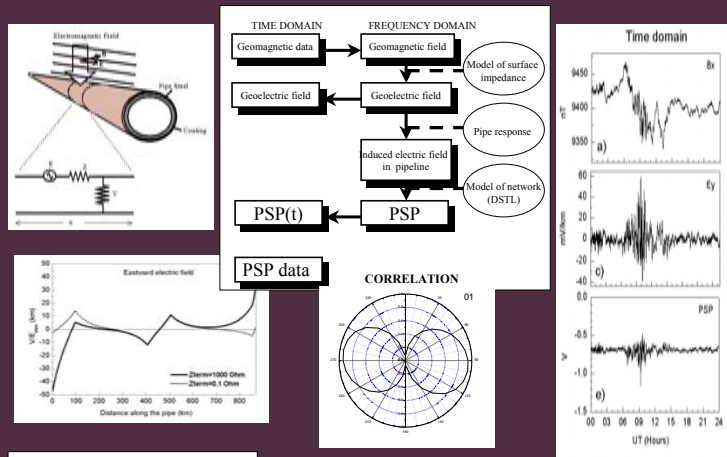
Explanation

Kr	Status last hour	Forecast 0 - 3 hours	Forecast 3 - 6 hours
5	major storm		
4	major storm		
3	major storm		
2	stormy		
1	stormy		
0	active		
0	unsettled		
0	quiet		
0	quiet		
0	quiet		

Major storm watch in effect during next 0 to 3 hours
Kr is approximately equivalent to the K index but is based on a one hour interval

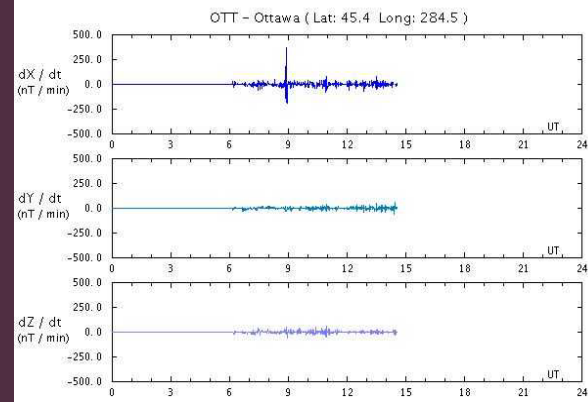
2003-05-02 [Important notices](#)

Interpretation of CP surveys: Modeling different pipelines



Real time interpretation of CP surveys Real Time dB/dt as proxy indicator for PSP

One Minute Rate of Change of Geomagnetic Field - OCT 29 2003
Geological Survey of Canada (GSC)



<http://www.....currently under construction>

Future

- Real time geo-electric field
- Improved real time models
- Adjustments for modern pipeline materials
- Estimate expected lifetime of pipelines