Using Earned Value Management on Ontario MNR’s Mid-Canada Line Radar Site Remediation Project

Presented by: Chris Ludwig, M.Eng., P.Eng., PMP
Project Summary

- Proponent: Ontario Ministry of Natural Resources
- $85 M project to clean up 16 former DND radar sites over 6 years
- Issues: derelict buildings, radar towers, fuel tanks, metal drums, equipment, debris and contaminated soils.
- Provides training and job opportunities to First Nations people and businesses during the cleanup.
- MNR Just finished Year 3 Season
Potential Source of Project Variances

- Remoteness of sites
- Work in Polar Bear Provincial Park – Wilderness class park
- Limited weather window for work
- Critical relations with First Nations along coast and other stakeholders.
- Uncertainty around contaminated soil volumes
- Changing regulatory standards
FRANZ Study Objectives

• How to keep the Project within budget ($85 million) by identifying:
  – high financial risk components of the Project
  – likelihood of the Ministry incurring risk, and
  – Components that could be deleted or reduced in scope to keep within budget.

• Update the project risk assessment and risk management plan.
  ➢ Implemented Earned Value Analysis to assess project “health” and to predict future project performance
What’s Earned Value Management?

Measurement of Cost and Schedule variances are built on three metrics:

Earned Value (EV) = value of completed work at time $t$, expressed in terms of approved budget assigned to that work

Planned Value (PV) = original authorized budget assigned to scheduled work at time $t$

Actual Cost (AC) = the actual cost incurred and recorded in accomplishing work at time $t$
Example of EVM

(after PMBOK® Guide, 2000 edition, Figure 10.2)

At Month 1 in a project:

- Actual work completed is $250K of planned work → EV = $250K

- Budget says $500K of planned work should have been completed → PV = $500K

- Contractor/consultants invoice for $750K → AC = $750K
Cost Performance Index (CPI)

CPI = EV / AC

CPI > 1 = physical progress at a lower cost than planned

CPI < 1 = physical progress at a higher cost than planned

CPI can be thought of as a “value for money” indicator.

In example, CPI = $250K / $750K = 0.33. You paid $1 for every 33 cents worth of work.
Using EVM to Forecast Project Costs at Completion

Forecast assumes that the CPI remains constant through to the end of the project, unless judged to be atypical.

**EAC** = Estimate at completion = PV (at completion) / CPI

**ETC** = Estimate to complete = EAC – AC

**VAC** = Variance at completion = PV (at completion) - EAC
MNR MCL Project Scope Activity Breakdown

- Mob/Demob
- Camp Costs
- Construction
- Structure Demolition
- Non-haz waste soils
- PCB Soils
- Drums
- Tanks
- Debris and Other
- Hydrocarbon Stained Soils
- Clean Up Areas Outside Sites
- Other Haz Materials
- Regrading
- Revegetation
- Free Product in Soil
- Monument
- Final reports and Documentation
- Landfill Construction
- MNR Costs
- Monitoring and Verification
- Engineering Services
<table>
<thead>
<tr>
<th>Scope Item</th>
<th>Earned Value (EV)</th>
<th>Cumulative Expenditures (Actual Cost, AC)</th>
<th>Cost Performance index (CPI = $EV/∑AC)</th>
<th>Adjusted Expected future CPI based MNR input</th>
<th>Original Total Planned Value (PV)</th>
<th>Planned Value, Remaining Sites PV (Yr 4-6)</th>
<th>Expected Estimate to Complete (ETC) based on MNR input</th>
<th>Expected Estimate at Completion (EAC)</th>
<th>Total Variance at Completion (VAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mob &amp; Demob</td>
<td>$5,636,798</td>
<td>$3,921,051</td>
<td>1.44</td>
<td>1.00</td>
<td>$13,376,594</td>
<td>$7,739,797</td>
<td>$7,739,797</td>
<td>$11,660,847</td>
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<td>Camp Costs</td>
<td>$7,545,871</td>
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<td>$15,960,837</td>
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<td>$8,414,967</td>
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<tr>
<td>Construction</td>
<td>$1,289,609</td>
<td>$2,856,672</td>
<td>0.45</td>
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<td>$1,289,609</td>
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<tr>
<td>Structure Demo</td>
<td>$2,127,486</td>
<td>$2,700,016</td>
<td>0.79</td>
<td>1.00</td>
<td>$5,685,226</td>
<td>$3,557,741</td>
<td>$3,557,741</td>
<td>$6,257,756</td>
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<tr>
<td>Other Contaminated Soils</td>
<td>$1,270,196</td>
<td>$195,709</td>
<td>6.49</td>
<td>6.49</td>
<td>$2,219,965</td>
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<td>PCB Soils &amp; Equip</td>
<td>$8,171,326</td>
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<td>0.84</td>
<td>$10,269,828</td>
<td>$2,098,502</td>
<td>$2,511,936</td>
<td>$12,293,128</td>
<td>($2,023,300)</td>
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</tbody>
</table>
Summary of Earned Value Analysis Results

• Cumulative Cost Performance Index for Project is slightly less than 1.0 and within 7% of budget.

  => Variance due to unplanned scope items

• The project is slightly over budget for Years 1 through 3 due to Year 1 unanticipated scope change.

• On the way to being over budget at the end of Year 6 unless minor adjustments in scope are made or savings found.

• Larger variances are related to PCB soils remediation, construction costs, debris clean up and non activity-specific project requirements.
Conclusions / Outcome

• EVM shows very good performance for Project of this nature and risk.

• Minor scope changes required to stay within budget.

• Based on EVM results along with a risk management plan review, scope items that could be deferred or risk managed were identified.

• The plan for the out years was revised to focus on remaining large site (Site 415), with smaller Doppler sites for Years 5 and 6.

• EVM is one tool in a tool box to monitor and control a project.

• Also important to have an up to date risk management plan and strong communication strategy, as is the case for this Project
Acknowledgements

• Special Thanks to Ontario Ministry of Natural Resources
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