Accelerating Phase-out of PCB Transformers: Software and Case Study

Project Review and Software Demo for the GLBTS Integration Workgroup Meeting – Chicago, 12/07/06

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Project Background & Goals

- Funded by US EPA under a grant to Tellus Institute (Boston, MA) and subcontractor EMARIC (Arlington, MA)
- EPA Project Officers Danielle Green and Tony Martig
- Project Goal – to help firms understand the true costs and savings associated with operating PCB transformers vs. phasing them out
- Project Products – an illustrative case study plus a spreadsheet software tool to help firms do their own financial analysis

Acknowledgements

- A private sector firm and its subcontractors provided much of the case study data and assumptions, but wish to remain anonymous for now
- Mary Davis of the Utility Solid Waste Activities Group
- Douglas Green of the Utility Solid Waste Activities Group
- George Kuper of the Council of Great Lakes Industries
- Dale Phenicie of Environmental Affairs Consulting, Peachtree, Georgia
- Lynn Fritz of Clean Harbors, Norwell, MA

Case Study - Background

- A hypothetical case study, but the events described and associated cost data are based on factual cases and data
- “Chimanco” - a mid-sized manufacturer with a number of electrical transformers on-site that contain PCBs
- A recent failure and fire involving a PCB transformer provided an incentive to consider replacement or retrofill of the other PCB units
- Future PCB-related liability of concern because most of the firm’s PCB transformers are older, and because the facility is located in a dense urban area with residences nearby
- First transformer chosen for analysis – 1000 KVA power transformer critical to operations, containing 400 gallons fluid, 1000 ppm PCBs

Case Study - Scenarios

- KEEP vs. REPLACE vs. RETROFILL the PCB transformers
- Costs evaluated:
  - One-time Investment Costs (e.g., purchase of new equipment)
  - Recurring Operating Costs (e.g., regulatory compliance costs
  - Non-recurring Costs (e.g., spills, fires, failures)
- The non-recurring events chosen for analysis were:
  - A dielectric fluid spill (50 gallons)
  - A transformer fire, with dispersal of smoke/soot

Case Study – Spill Assumptions

- The transformer contains 400 gallons dielectric fluid. Evaluated a 50 gallon spill, i.e., not trivial but not a complete rupture
- Spill radius 20 feet (entire vault floor) – contained
- Transformer shut down for 1 day to allow cleanup and repair
- Potential costs:
  - Regulatory & Other Notification
  - Regulatory Penalty
  - Cleanup & Waste Management
  - Equipment Repair
  - Interruption of Power/Operations
  - Legal & Liability

Case Study – Fire Assumptions

- No fluid spill
- Municipal fire department puts out fire easily
- Smoke/soot exits transformer vault via ceiling vents, into manufacturing building. Facility shut down for 3 days by regulatory agency.
- Smoke reaches neighboring apartment building. No medical problems reported, but building evacuated for 24 hours for analytical testing.
- Potential costs:
  - Regulatory & Other Notification
  - Regulatory Penalty
  - Cleanup & Waste Management
  - Equipment Repair (or Replacement)
  - Interruption of Power/Operations
  - Legal & Liability

Case Study – Spill – Results

P2F-PCB Beta version 10.0 CASE STUDY - SPILL

Summary of Cost Data	Scenarios		
	Keep	**Replace**	**Retrofill**
Investment Costs	$1,440	$25,619	$21,290
Recurring Op Costs	$720	$360	$450
Spill Costs	$47,080	$13,610	$13,360
Year of Spill	5	5	5

Financial Indicators	Discounted Payback (years)	*3 years*	*5 years*
		NPV	**NPV**
Replace vs. Keep	#N/A	($19,933)	($5,754)
Retrofill vs. Keep	4.97	($12,642)	$421
Replace vs. Retrofill	#N/A	($7,291)	($6,175)

Case Study – Fire – Results

P2F-PCB Beta version 10.0 CASE STUDY - FIRE

Summary of Cost Data	**Scenarios**		
	Keep	**Replace**	**Retrofill**
Investment Costs	$1,440	$25,619	$21,290
Recurring Op Costs	$720	$360	$450
Spill Costs	$565,599	$153,827	$153,827
Year of Spill	5	5	5

Financial Indicators	**Discounted Payback (years)**	*3 years*	*5 years*
		NPV	**NPV**
Replace vs. Keep	4.12	($19,302)	$137,022
Retrofill vs. Keep	4.08	($12,519)	$143,103
Replace vs. Retrofill	#N/A	($6,783)	($6,081)

Case Study – Overall Results

- If the case study spill occurs as assumed, Retrofill is financially justified
- If the case study fire occurs as assumed, both Replace and Retrofill are financially justified

BUT…

- These results are, of course, heavily dependent on the case study assumptions
- The case study spill/fire did NOT include worst case assumptions such as:
  - fluid spill reaches a waterway…
  - environmental and/or human health damage occurs…
  - firm is sued, resulting in legal/liability costs…

Major Cost Drivers

- Regulatory status (i.e., already in compliance or not)
- Transformer type/rating
- Fluid volume
- Fluid type and ppm PCBs
- Accessibility (i.e., easy to remove old unit?)
- Located Near (e.g., surface or ground water, sewer system, residences, schools, etc.)
- Spill Containment
- Fire Prevention
- Age & reliability
- Operational Importance

P2F-PCB Software - Features

- Enables financial assessment of the KEEP, REPLACE, and RETROFILL scenarios
- Points out the major cost drivers
- Includes lists of potentially relevant costs for each of the three scenarios – and gives help text on these costs
- Allows the user to input as little or as much cost data as desired
- Allows user to include equipment depreciation, income taxes, inflation, discounting
- Calculates Net Present Value (NPV) and Discounted Payback

P2F-PCB Software – Platform, Interface & Help

- **Microsoft Excel version 2002**

- **Software map and buttons allow easy navigation**
- **As few worksheet pages as possible**
- **As little clicking on the mouse as possible**

- **Help text available via button for each worksheet**
- **Help text available via Excel "comments" for individual cells**
- **Introductory Help text available on**
  - ***About the Software***
  - ***Software User Tips***
  - ***Background Info (e.g., what are PCBs, PCBs in Transformers, PCB Health Impacts)***
  - ***PCB Regulations***

Project Status

- Beta 10 is being reviewed by the project contributors – the case study firm, subcontractors, EPA staff, etc.
- Revised version will be reviewed externally
- Changes to the case study – will be based on feedback
- Changes to the software – no major changes due to budget
- EPA will distribute

Recommendations

- Develop an updated profile of what transformer sizes, types, and PCB concentrations are still out there, and in which sectors – perhaps via statistically designed data sampling?
- Develop a risk worksheet to assist companies to prioritize which transformers to phase out first – perhaps pull together existing risk worksheets developed by individual companies and combine
- Develop some basic, brief guidance on cost estimation of costs such as PCB cleanup and waste management as well as less-tangible costs such as potential liability