DPL Case Study

A Cleanup Problem: The Brownfieldford River

Case Background

Due to decades of unregulated industrial activity, the sediments at the bottom of the Brownfieldford River contain various hazardous substances. It has been determined that this contamination poses a risk to human health and the environment.

It must be decided whether and how to clean up the river. Three decision alternatives have been proposed:

1. Do nothing
2. Encapsulate the contaminants to prevent them from spreading
3. Remove all the contaminated soil and dispose of it at a remote site

Furthermore, three attributes will be considered in the cleanup:

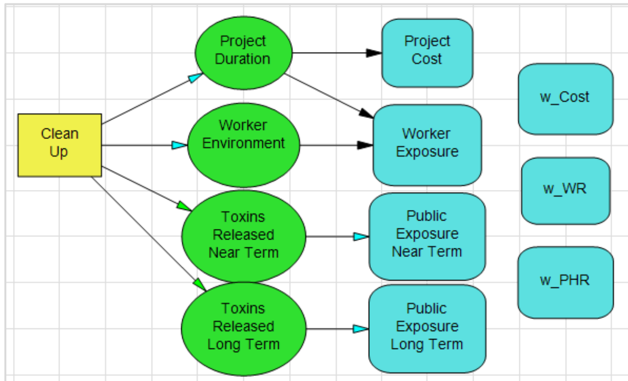
1. Cost
2. Worker risk
3. Public health risk

Environmental Remediation of a Polluted River

Pros and Cons

Relative to these attributes, each alternative has it's own pros and cons:

1. Do nothing
   - Pro: low cost, no worker risk
   - Cons: high public health risk
2. Encapsulate
   - Pro: moderate cost, low worker risk
   - Con: potential public health risk after remediation
3. Remove
   - Pro: no risk to public health after remediation
   - Con: high cost, high worker risk



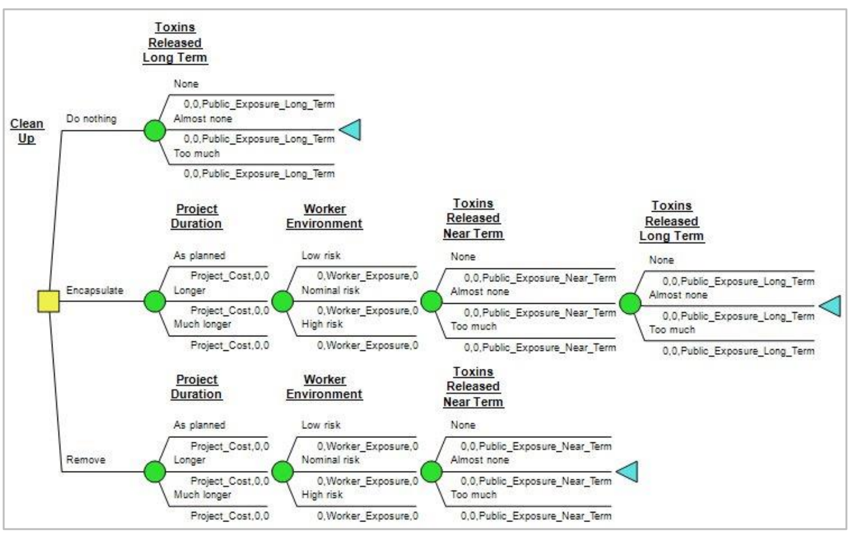
DPL Brownfieldford Influence Diagram

The Model

The Brownfieldford decision model calculates cost, worker exposure, and public exposure and has preliminary weights for the three attributes. Weights for the attributes are defined via value nodes named w_Cost, w_WR, and w_PHR. Further an objective function for the model that uses the three weights to combine the three attributes has been defined to be minimized:

Cost *w_Cost+Worker_Risk*w_WR+Public_Health_Risk*w_PHR

Get/Pay expressions have been added to the decision tree to reflect the three attributes:



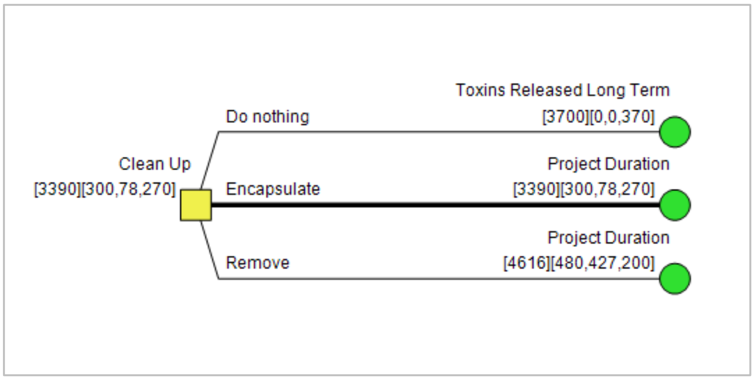
DPL Brownfieldford Decision Tree with Multiple Attributed Defined

The Policy Tree ™ shown to the right displays not only the expected value of the objective function (3390) but also the expected value of each attribute defined. The optimal decision policy is to Encapsulate.

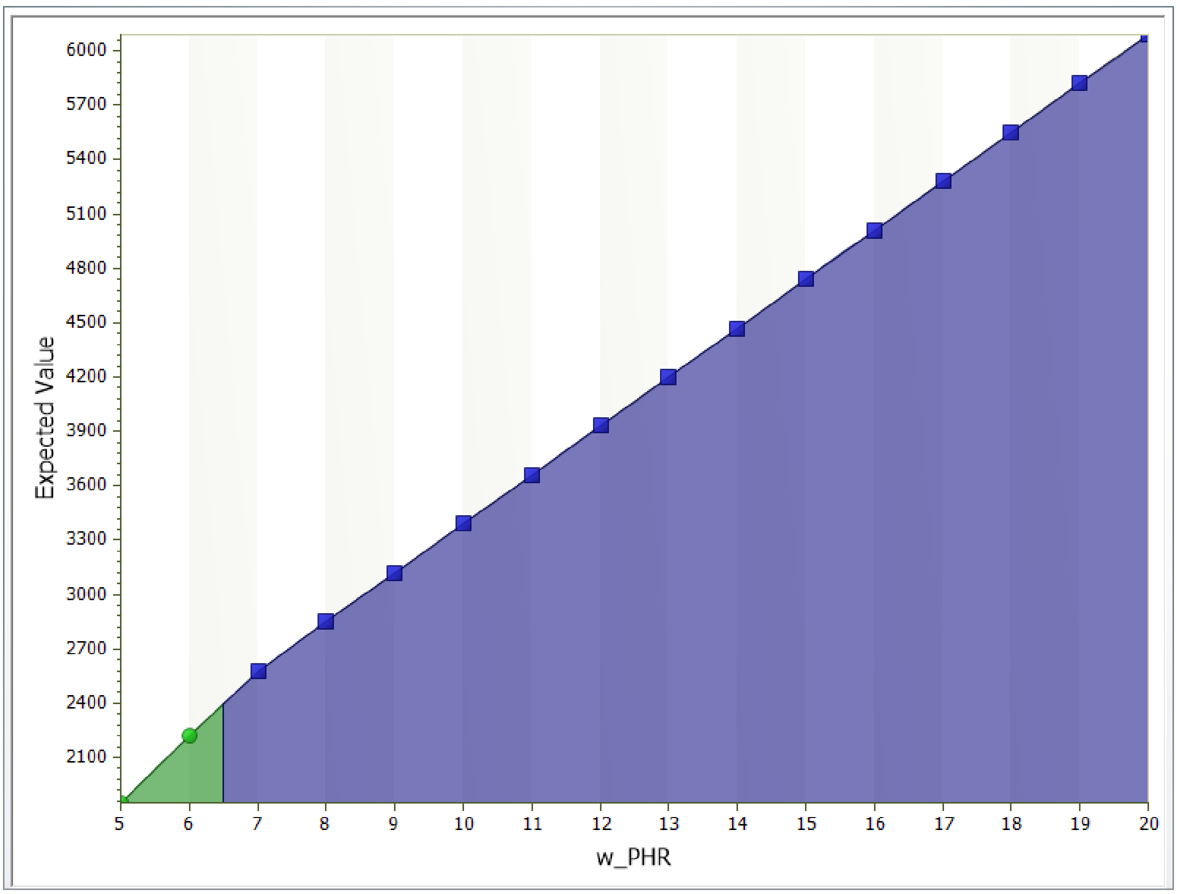
Combining multiple attributes can be a challenging task, as competing objectives are often difficult to reconcile. Typically the different attributes have different units of measure – as is the case with the Brownfieldford River problem.

Consequently, weights are challenging to assess and can have a large impact on the optimal decision policy. Therefore, we always recommend performing sensitivity analyses on your weights. For example, the Rainbow Diagram below displays the changes in the value of the objective function and decision policy when the weight for public health risk is varied from 5 to 20.

The color change indicates that the optimal decision policy changes when the this weight is between 6 and 7.



DPL Policy Tree™ Output



DPL Rainbow Diagram for Public Heath Risk Weight