USING SUBSURFACE TRANSPORT RESEARCH TO ACHIEVE AGENCY OUTCOMES

Moving Science into Action

JimWeaver,OfficeofResearchandDevelopment,NationalExposureResearchLaboratory,EcosystemsResearchDivision,Athens,Georgia;JosephE.Haas,NewYorkStateDepartmentof EnvironmentalConservation,StonyBrook,NewYork;MatthewC.Small,USEPARegion9,SanFrancisco,California

Approach

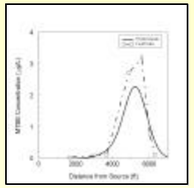
Researchonsubsurfacecontaminationprovidesthe scientificbasisforansweringthequestionsofagency decisionmakers.

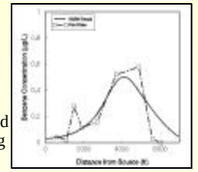
Fourexamplesaregiven:

- **Methyl *tert*-ButylEther (MTBE)Transport**
- **GasolineComposition Change**
- **ExoticChemicalsas Tracers**
- **ToolsforSiteAssessors**

Toreadmoreonthesethemessee: http://www.epa.gov/nerl/nerlmtbe.htm and http://www.epa.gov/athens/onsite

Methyl *tert*-Butyl Ether (MTBE) Transport





Questions:

Howis Methyl *tert*-ButylEther (MTBE)transported inthesubsurface?Whataretheimpactstodrinking wateraquifersinalocationwheretherehavebeen significantnumbersofreleases?

Use of ORDResearch:

ORDhasworkedwiththeStateofNewYorkinstudyingMTBEtransportinthe aquifersofLongIslandforovereightyears. Workonwellcharacterizedsites leadtofindingsconcerningMTBEtransportinthedrinkingwateraquifersofthe Island. Bystudyingseveralplumesthatarelocatedinverysimilarhydrologic andgeologicsettings,keyvariablescausingdifferingtransportbehaviorcould beisolated. Thisleadtotheobservationthattherewereresignificantimpacts fromreleasesthatoccurredwithrelativelylowamountsofMTBEinfuel,that MTBEcouldmostlyleachfromthefuelsourcesandthatconcentrationswere proportionaltotheamountofMTBEinthefuel.

Impact:

Thisinformationwassuppliedtothe1998EPABlueRibbonPanelonMTBE whoviewedthisdetailedinformationasauniqueandvaluableinputtotheir deliberationsasitillustratedthemagnitudeoftheproblemonLongIsland.

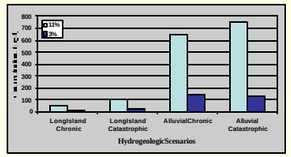
Gasoline Composition Change

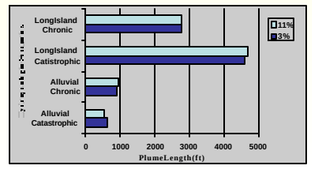
Question:

WouldreducingtheamountofMTBE ingasolinefrom11%to3%be protectiveoftheenvironment?

Use of ORDResearch:

Aproposed"compromise"solutionto theproblemsgeneratedbyMTBE wastoreducetheamountofMTBE ingasolinefrom11%to3%. A modelingandtheoreticalstudywas undertakentoevaluatethis proposition. Themodelswerebased upontheworkdonewithNYSDEC onLongIsland. Transportof benzene,toluene,ethylbenzene, xylenesandMTBEhadbeen modeledsuccessfullyandthe calibratedmodelswereusedasa startingpointforinvestigatingthe differencesbetween3%and11%. Modelresultsshowedthat reducing theamountofMTBEingasoline reducedthegroundwater concentrationsproportionately,but reducedtheplumelengthsbya muchsmallamount.Atheoretical analysisalsoboreoutthisresult.





Impact:

Asaresultofthiswork,acomplete banonMTBEwasproposed,rather thanareductionto3%.

Exotic Chemicals as Tracers

Question:

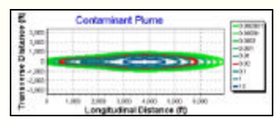
Ifcertainchemicalswereusedastracersingasoline wouldtherebeadverseenvironmentalimpacts?

Use of ORDResearch:

Aseriesofexotictracerswas proposedforuseingasolinetank tightnesstesting. Asuiteof11 chemicalswereproposed,based mostlyontheirabilitytobe measuredbyanalyticalinstruments. Sincethepropertiesofthese chemicalswereunknown,theEPA-developedSPARC(**SPARC PerformsAutomatedReasoninginChemistry:SeeRightImage**) propertyestimatorwasusedto estimatetheenvironmental partitioningbehaviorofthese chemicals. Asaresultitwasdiscoveredthatthere wouldbesignificantimpactstotheair,andthatthe chemicalswouldbehaveinwayssimilartochlorinated solventsifthemselvesreleased. Subsurfacetransport modelswereagainusedtodeterminehowtransport wouldoccurincomparisontoothercomponentsof gasoline(**benzeneandMTBE:SeeBottomRight Image**).

Impact:

Thisworkprovidedinputtothescientific understandingofpotentialimpactstothe OfficeofUndergroundStorageTanksfor useindecisionmaking.



Tools for Site Assessors

Problem:

ThereiswidespreadlackofknowledgeforcontaminanttransportamongState Agencyemployeesandprivatesectorconsultantsthatassessleakingunderground storagetanksites(LUST).

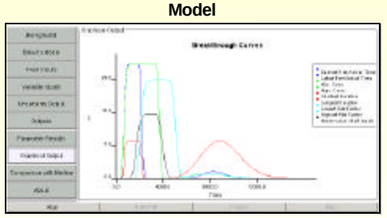
Use of ORDResearch:

ORDhasdevelopedasuiteofon-linecalculatorsandtrainingmaterialstoprovide prepackageddataandformulastoaidinassessingLUSTsites. Theseinclude methodstoestimatetransportproperties,models,unitconversionsandscientific demos.Thewebsiteat **http://www.epa.gov/athens/onsite** containsthecalculators andbackgroundinformationtohelpunderstandthebasisofthecalculations. The calculatorsaredividedintofourcategories: **ParameterEstimates,Simple TransportModels,UnitConversionsandScientificDemos.** Thepurposeof thesecalculatorsistoprovidemethodsanddataforcommoncalculationsusedin assessing impactsfromsubsurfacecontamination.

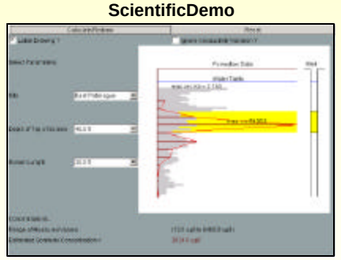
Impact:

Sincetheir **inceptionin1998** thecalculatorshavebeenusedbyseveralstate agencies,EPARegionalOfficesandprivateconsultingfirms. Somestate agencieshave,infact,mandateduseofthecalculatorsforcertaintasks. From theweblogsweknowthattherehasbeenasteadyincreaseinusageofthesite.

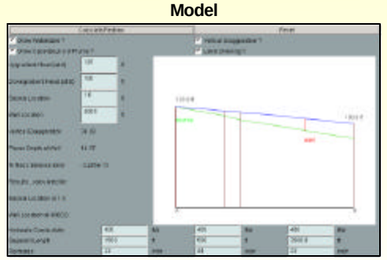
Model



ScientificDemo



Model



ParameterEstimate

Partnering to Protect Human Health and the Environment