PBMO™ Interface for Launching Optimization Tasks (PILOT)

PBMO™ Medallion System

Global Optimizers
SLA, SQP and LGO
(1st Half of the Medallion)

SME-Based, Physically Based,
Data-Driven, or Fused Models
(2nd Half of the Medallion)

MODFLOW/MT3D and MODHMS®

Stakeholders

Graphical User Interface

Optimal Decision Strategy

MODHMS®-Integrated Flow/Transport Simulator

PBMO™ Application to Remedial Design Optimization at Umatilla Army Depot, OR
HGL is pleased to introduce our state-of-the-art PBMO™ Medallion System for Physics-based Modeling Optimization and development of optimal decision strategy.

Why Optimization?
- Management Optimization provides the most effective strategy among all available options to manage and utilize resources
- Optimization saves time and money by elimination of redundancy and inefficiency
- Facilitation of stakeholder interaction by incorporation of stakeholder's input into the search for optimal decision strategy

**PBMO™ Medallion System**
- Configured as a medallion with two halves: global optimizers and physics-based modeling tools for running a calibrated flow/transport model. Linkage of the optimization and modeling components is conducted by exchange of information pertaining to prescribed values of decision variables and resulting model output.

**PBMO™ Global Optimizers**
- Global optimization algorithms used include: Sequential Linear Approximation (SLA), Sequential Quadratic Programming (SQP) and Lipschitz Global Optimization (LGO) algorithms.¹
- SLA for linear and mildly non-linear flow optimizations.
- SQP for non-linear flow optimizations.
- LGO for flow/transport optimizations.
- PBMO™ Interface for Launching Optimization Tasks (PILOT) a stand-alone program developed by HGL that provides a user-controlled interface between the model and the optimizer. This user interface allows users to select a model, manage decision variables and constraints, and define the objective function. PILOT builds the files required by PBMO™, then launches the optimizer and monitors its progress through completion.

**PBMO™ Currently Available Physics-based Modeling Tools:**
- MODFLOW/MT3D - Public domain modeling software² for simulating saturated groundwater (GW) flow and solute transport.
- MODHMS³ - HGL’s comprehensive MODFLOW-Based Hydrologic Modeling Software for integrated GW/Surface water flow and transport simulations. Included in MODHMS³ is MODFLOW-SURFACT⁴ for simulating saturated and variably saturated subsurface flow and transport in porous/fractured media.
- Graphical User Interfaces (GUIs) - Commercially available GUIs for modeling support include: GW-Vistas, and Visual-MODFLOW.

**Practical PBMO™ Applications:**
- Environmental Remediation
- Water Resource Evaluation
- Mining Operation
- Energy Production

**Environmental Remediation:**
- Development of Cost-efficient and Sustainable Remedial Design (RD)
- Remedy-in-place (RIP) Evaluation and Operation and Maintenance (O&M) Optimization
- Development of Exit and Site Completion Strategy

**Water Resource Evaluation:**
- Water Resource Allocations Among Competing Users
- Flood Management and Risk Reduction
- Drought Management
- Maximizing Sustainable Yield of Well Fields Subject to Regulatory Requirements

**Mining Operation:**
- Site-wide Mine Water Management
- Optimizing Costs Versus Impacts from Mine Dewatering
- Optimizing Dewatering Operation for Coal Seam Gas Production

**Energy Production:**
- Optimizing Power Generation “Spin Up” and Online Times to Meet Fluctuating Demands
- Balancing Loads Between Various Sources of Power
- Optimizing the Mixture of Renewable Power Sources with Traditional Technologies