

# Ishwar P. Murarka Resume

## *Ish Inc.*

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## **Education:**

Ph. D.	1971	Soil Science and Statistics, Oregon State University
MBA	1979	Management Science, University of Chicago
MS	1968	Soil Science, Oregon State University
MA	1964	Geography, Calcutta University
1971 - 1973		NIH Post-doctoral Fellow in Bio-mathematics, N.C. State University, Raleigh, NC

## **Current Employment**

### **February 2003 – present, University of Illinois at Chicago**

Visiting Research Associate to engage in basic research on environmental processes and behavior of chemicals and to collaborate with university research faculty on environmental engineering projects

### **April 1998 – Present, Ish Inc.**

Founder, President, and Executive Scientist of an exciting new science and technology consulting company that specializes in addressing the following issues:

- ❖ Contaminated sites
- ❖ Combustion waste disposal and use
- ❖ Soils
- ❖ Groundwater
- ❖ Sediments
- ❖ Surface water
- ❖ Solid & Hazardous waste management.
- ❖ Statistical and Mathematical analysis of Monitoring data

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## Previous Employment

- 1979-1998** Technical Executive, Electric Power Research Institute (EPRI)  
Land and Groundwater Protection and Remediation Business Area
- 1974-1979** Environmental Scientist, Environmental Impact Studies,  
Argonne National Laboratory -
- 1973-1974** Statistician, Texas Instruments, Indian Point, NY-  
Ecological Studies

## Business Experience

- Building and managing a premier R & D Program at EPRI, (over \$12 million in annual revenue) for diverse projects covering all environmental aspects of soils, sediments, groundwater, combustion wastes and surface water.
- Budgeting, technical and financial management for developing, delivering and applying Research Results.
- Planning, bidding, negotiating and establishing contracts.
- Serving U.S. and international clients in the utility industry.
- Assisting in technical issues on Coal Ash and MGP Sites for Attorneys and providing some litigation support

## ***Technical and Professional Experience***

- Experience in dealing with organic compounds include:
  - ❖ Extensive technical work in characterizing, assessing and remediating manufactured gas plant sites. Directed and completed several field investigations at MGP sites to delineate the distribution of coal tar (NAPL) in the subsurface as well as MAHs and PAHs in sediments, soils and groundwater.
  - ❖ Defining and implementing laboratory and field investigations and modeling projects to solve regulatory and science/engineering issues in the delineation, containment and restoration of contaminated sites including sites with non-aqueous phase liquids (i.e., coal tar, petroleum products).

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## Technical and Professional Experience (continued)

- ❖ Using treatment technologies such as thermal desorption and coburning of soils and tar in utility boilers.
- ❖ Implementing treatability tests for stabilization, containment and removal of coal tar.
- ❖ Interpreting chemical analysis data for fingerprinting and source differentiation.
- ❖ Collaboration in the development of methods for establishing partitioning and release of PAHs from contaminated soils and coal tar.
- ❖ Some experience in field-scale use of air-sparging and bioventing technologies.
- ❖ Extensive knowledge in delineating and defining the speciation, transport and fate of cyanides in groundwater.
- ❖ Familiarity with chemometrics evaluation methods for interpretation of groundwater quality data.
- ❖ Conceiving and managing the development and use of water quality data management and data analysis software (i.e., MANAGES).
- ❖ Designing and implementing projects on source removal/containment and natural attenuation for restoration of groundwater.
- ❖ Developing and sustaining a research portfolio on the release, fate and remediation of hydrocarbons and chlorinated compounds used in the Transmission & Distribution systems of the electric utilities.
- ❖ Developing and directing research on metals in fossil fuel combustion wastes from the standpoint of disposal and use practices for environmental protection and regulatory compliance.
- ❖ Extensive experience in working with utilization of coal combustion byproducts focusing on the mine fills by CCBs.

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## Technical and Professional Experience (continued)

- Extensive technical experience in dealing with metals in soils and groundwater including:
  - ❖ The fundamental geochemistry of Cadmium for adsorption-desorption reactions, and for precipitation-dissolution reactions involving a number of solubility controlling solids.
  - ❖ The detailed geochemistry of Selenium, Arsenic, and Iron.
  - ❖ Broad familiarity with inorganic chemicals e.g., Boron, Lead, Sulfur compounds, Barium, Molybdenum, Nickel, Vanadium, Copper, and Zinc.
  - ❖ The fundamental geochemistry of Chromium for redox effects, adsorption-desorption reactions, and for precipitation-dissolution reactions involving a number of solubility controlling solids.
- Extensive technical experience in use of transport and fate models to predict the migration of dissolved chemicals. Responsible for the development and use of software's such as MYGRT, ROAM and FOWL-GH. MYGRT is an analytical groundwater transport/fate model. ROAM is a remediation options analysis model to predict performance of contemplated remedial actions at a site with groundwater restoration needs. FOWL-GH is a leaching chemistry software specifically designed to calculate leachate concentrations of the inorganic constituents which may be dissolved from combustion wastes.
- Extensive technical experiences in field measurements and use of data analysis methods (statistical and through models) for water quality impact evaluations.
- Extensive involvement in regulatory deliberations at state and federal government level.

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## **National Committees Experience**

- ❖ Served through the end of September 1997 as the Chair and through September 1998 as the Past Chair of the Environmental Engineering Committee. Served as a member of the Executive Committee of the U.S. EPA's Science Advisory Board from October 1993 to September 1997.
- ❖ From October 1997 to September 2001, served as a member of the Research Strategies Advisory Committee of the U. S. EPA's Science Advisory Board.
- ❖ From October 1997 through December 1999, served as the Chair of the, Subcommittee on Environmental Regulatory Modeling for the Executive Committee of the EPA Science Advisory Board.
- ❖ Have served in a Blue Ribbon panel of the National Research Council on irrigation water issues.
- ❖ Have served on several University sponsored research steering and review committees including the Rice University's Department of Defense program on site remediation
- ❖ Served for four years on the Board of Directors for CAST (Council for Agricultural Science and Technology)

## **Publication and Presentations**

- ❖ Author and editor of 3 books
- ❖ Over 15 oral presentations annually to regulators, scientific gatherings and at symposiums/conferences
- ❖ Over 100 publications in various journals, symposium proceedings and technical reports.

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## Recently completed and ongoing projects on Coal Ash Management

- Technically supporting AES Somerset plant on stabilized sludge landfill permitting issues (May 2005 – July 2005 )
- Providing consulting services on coal ash placement and potentially impacted water supply wells for a utility company and its attorneys. (March 2004 -- continuing )
- Providing technical consulting including field scale assessment of hydrology and groundwater impacts with arsenic from retired coal ash basins. Client- PPL (2003-continuing)
- Providing technical consulting and field work for the assessment of seeps in a large coal ash Basin and helping in developing abatement options. Client; PPL (2004-continuing).
- Providing technical support on the leaching and groundwater impacts from an ash impoundment/landfill. Client – IKEC (2003-continuing)
- Conducting laboratory batch and column studies on the attenuation of arsenic species, selenium species, and boron for soils from three power plant sites. Client – EPRI and DOE (2003-2006)
  - Prepared and published a report on leaching of inorganic constituents from coal combustion byproducts under field and laboratory conditions (Nov. 1998). Client-EPRI.
  - Prepared and published a literature review report on attenuation of arsenic species by soils. Client-EPRI (2000).
  - Carried out laboratory leaching tests and modeling for assessment of groundwater protection requirements for a new coal ash landfill in Nebraska (March 2000-March 2001). Client-Nebraska Public Power District.
  - Completed leaching and attenuation work on arsenic, cadmium, selenium, iron, and manganese from coal ash from Belews Creek power plant. (September 2000-December 2001). Client-Duke Power Company.
  - Completed field and laboratory studies on leaching, attenuation and fate of manganese from coal ash impoundments (June 1999-June 2002). Clients-EPRI, DMG Corporation.

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- Completed laboratory and field studies on ammoniated ash to determine leaching, conversion, and fate of several constituents in groundwater (October 2001-December 2004). Client-Allegheny Energy and EPRI
- Carrying out field and laboratory studies of minefilling with coal ash at the Universal site in Indiana (February 2000-September 2005). Clients-Department of Energy/Combustion Byproducts Reuse Consortium; Cinergy Corporation; EPRI, ACAA.
- Completed analysis of ash composition and leaching characteristics information for an FBC power plant in Hawaii. Also supporting work for the permit renewal for the use and disposal of the FBC ash. (October 2000-June 2002). Client-AES Hawaii.
- Served as an external peer-reviewer to EPA Office of Solid Waste on its continuing activities on Minefilling of the Fossil Fuel Combustion Wastes (January 2001-December 2001). Client-U.S. EPA.

### **Examples of several projects where Ish Inc. has have been heavily involved In Site Assessment and Remediation Activities:**

1. **South Glens Fall, NY – (Site 24)** — Designed and implemented a site assessment effort that led to the delineation of “coal tar source area” and the associated groundwater plume containing monocyclic and polycyclic aromatic hydrocarbons. Developed and implemented a source removal remedy in conjunction with a monitored natural attenuation program for the restoration of the impacted groundwater. Carried out transport and fate modeling to predict the dissipation of the groundwater plume over a ten- year period following the source removal. Designed and implemented a ten-year long semi-annual groundwater monitoring program to document/demonstrate the dissipation of the groundwater plume. The State of New York removed this site from its hazardous waste site list due to the work performed at the site.
2. **West Station MGP Site, Rochester NY** — Conducted site investigation and delineation of NAPL distribution in the subsurface. Assisted in the evaluation and selection of remediation options for the site. Worked with the utility to carry out demonstration of coburning of contaminated soils and coal tar in the coal fired power plant. Worked on designing and completing

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experiments to render the remediation waste non-hazardous and to prepare for coburning. Part of the site was subsequently remediated by excavation and off-site thermal desorption.

3. **East Station MGP Site, Rochester NY** — Designed and completed the supplemental remedial investigations involving soil, groundwater, coal tar NAPL, sediments, and fractured bedrock at the East Station MGP site. Worked on NAPL, VOCs, SVOCs and cyanide complexes as the contaminants. Developed a feasibility study and recommended a combination of alternatives to remediate the site. Completed laboratory treatability testing of tar containing soils for in-situ chemical oxidation. Possibly, the selected final remedy will involve a combination of stabilization, in-situ chemical oxidation, source removal for tar well and purifier box wastes, and monitored natural attenuation for the restoration of groundwater.
4. **East Station MGP Site, Rochester, NY.** --. Have worked with the utility company to provide project management and technical oversight for designing and implementing an IRM for removal of former gas holder/tar well and surrounding areas. There was a very heavy involvement in addressing water management issues and working closely with the state regulators in New York.
5. **East Station MGP Site, Rochester, NY.** --. We are working with the utility company and the state regulators on use of ISS technology for the remediation of NAPL seeps on the river bank and to also remove the deposits of purifier box wastes present near the river bank.
6. **Owego MGP Site, NY** — designed and completed field investigations to determine the nature and extent of cyanide impacted groundwater. Worked with the utility and NYSDEC to design a monitored natural attenuation remedy with 5 years of groundwater monitoring starting in 2003. Also evaluated the residual effects on groundwater from the excavation and removal remedy for coal tar in the holder and heavily impacted soils.

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Determined that further groundwater monitoring will document that the remediation goals for organic compounds as well as for cyanide species have been achieved. Obtained NYSDEC approval to implement the monitoring and data evaluation program.

7. **Brockport MGP Site, NY** — assisting the utility in developing necessary information on cyanide complexes and species in soils and ground water at the site. The results will be used to negotiate reasonable remediation objectives with the NYSDEC for site clean up.
8. **Elmira MGP Site, NY** — Developing and implementing a sampling and analysis program to determine the nature and extent of cyanide complexes and species in soils and groundwater as part of the Supplemental Remedial Investigation.
9. **Brooks Avenue, NY** —recently started working on this RCRA corrective action investigation and remediation project. The site contains subsurface contamination consisting of LNAPL, DNAPL, groundwater contamination, and impacted soils. Commingled impacts from petroleum and coal tar sources are being addressed in this project. Also will need to deal with contributions from multiple sources.
10. **MSE Method Development and Incorporation in EPA SW-846** — worked with an analytical laboratory to develop and validate micro-solvent extraction (MSE) method to reduce analytical costs and rapidly determine concentrations of MAHs and PAHs in soil and water matrices. Worked with EPA Office of Solid Waste to obtain approval for the MSE methods which have become part of the EPA SW-846 methods.
11. **Microdiffusion Method Optimization and Validation for Approval by U.S. EPA** — received funding from several utilities to optimize and develop method validation data for microdiffusion method to measure “free cyanide” in water, wastewater, and solid waste samples. USEPA approval for the microdiffusion method is expected in early 2004. The approved method will enable an accurate and reliable determination of free cyanide in samples

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collected from MGP sites thereby will reduce regulatory conservatism by orders of magnitude.

12. **Calhoun Park MGP Site, South Carolina** — working with the utility and other consultants for the utility to design and conduct site investigations for determining the distribution of coal tar NAPL as well as the nature and extent of impacted groundwater. Involved in developing and implementing cost-effective remediation alternatives to achieve the remediation goals/objectives established in the ROD for the site. Participate in regular meetings and discussions with the State and Federal regulators concerning approval of the remedial design and implementation plans.
13. **Burlington MGP Site, North Carolina** — Assisting utility in determining the NAPL impacts on soils, weathered bedrock and the fractured bedrock. Also evaluating the nature and extent of groundwater impacts. Evaluated leach ability of benzene and naphthalene from impacted soils at the site. Provided technical advice in evaluating the use of Permeable Reactor Barrier Technology, In-Situ Chemical Oxidation Technology, and In-situ Stabilization Technology for the site.
14. **Raleigh #2 MGP Site, NC** — providing technical assistance in remedial investigations and assessment of contamination in soil, groundwater, sediments and surface water. Prepared and presented technical information to State regulators to facilitate approval of improved RI methods for use in site investigation.
15. **Greenville, SC** — worked with the utility to first investigate and establish the nature and extent of contamination of soils and groundwater and the distribution of NAPL. Carried out modeling analysis to determine the extent of soil excavation to achieve remediation goals. Worked with the utility to design and implement a coburning demonstration project for the tar contaminated soils from the site. Also evaluated the performance of bioremediation technology to treat the PAHs and MAHs in the contaminated soils. Finally, assisted the utility in using off-site thermal

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treatment facility to desorb, remove and destroy the hydrocarbons in the excavated soils.

16. **Murphysboro MGP Site, Illinois** — worked for the utility with additional consultants in carrying out remedial investigation and feasibility study to delineate the source areas, groundwater impacts, and to identify cost-effective remedial technologies for implementation. Designed and carried out study to develop data on background concentrations for hydrocarbons and arsenic in soils to statistically determine alternative clean-up levels.
17. **Americus, Georgia** — works with the utility in designing and developing a strategy and a plan for remediation that utilizes the in-situ chemical oxidation technology to achieve groundwater clean-up goals. Collected soil samples to characterize the contaminant distribution and to determine the level of chemical oxidation treatment needed. Carrying out monitoring and evaluation of the effectiveness of the in-situ treatment technology.
18. **Charlotte MGP Site, Michigan** — serving as a technical advisor, peer reviewer, and strategist for the remediation of NAPL, soil, and groundwater. Excavation, removal, and land filling of vadose zone soil were implemented as part of the remediation strategy. In-situ chemical oxidation technology has been initiated to destroy NAPL and the dissolved hydrocarbons in impacted groundwater. Phase I has been completed and Phase II plans are being developed now. Soil sampling and groundwater monitoring to demonstrate the performance of the technology are integral part of the remediation efforts at the site.
19. **Manistee MGP Site, Michigan** — assisting the utility company and its local consultants in developing and implementing strategies for the delineation and remediation of coal tar impacts in the subsurface. Designed incorporation of ORC material in the excavated subsurface to enhance bioremediation of the residual contamination. Assisted in the selection of air sparging and SVE system to contain the discharge of contaminated groundwater to the nearby river. Reviewed and evaluated the technical

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details of the design, installation, and start up of the SVE and air sparging system.

20. **Bay City MGP Site, Michigan** — providing ongoing assistance to the utility and its local consultants in developing and implementing remedial investigation work plans. Continuing to assist in deciding on excavation and removal plans for heavily contaminated soils containing coal tar and purifier box wastes. Continuing with groundwater monitoring and further assessment of impacts from residual contamination at the site. Developing plans to complete the remediation of the site to achieve regulatory closure.
21. **Dansville MGP Site, New York**. —. Have been performing supplemental site investigations to delineate the extent of NAPL, soil and groundwater impacts from former MGP operations and then will evaluate and select appropriate remedy for the site for implementation.
22. **Canandaigua MGP Site, New York**---. Have been performing site investigations to delineate the nature and extent of NAPL distribution, impacted soils, impacted sediments, and impacts on groundwater from the former MGP operations. The next step will be conduct feasibility analysis and select remedy(ies) for the site.
23. **Norwich MGP Site, New York**---. Have been conducting site investigations to delineate the distribution of NAPL on-site and off-site as well define the groundwater plume and impacts associated with the presence of NAPL. Then we will assist the utility in determining the feasibility of remediation of the site.
24. **New York Gas Group, New York**. —. Have been carrying out research on modification of Weak Acid Dissociable Cyanide method and pursuing the identification and characterization of an unknown iron cyanide complex present at MGP sites. Conducting experimental work on the photodissociation characteristics of FFC and iron cyanide complexes.

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25. **Florence MGP Site, SCANA.** Provide technical support on the selection and implementation of remedies for the NAPL and groundwater impacts at the site. Providing peer review and regulatory support for the project.
26. **Huger Street MGP Site, SCANA .** Providing technical expertise in support of the site characterization, risk characterization, and three-dimensional visualization of the impacted subsurface conditions. Providing peer review and strategies to support the client.
27. **Deming Street MGP Site, Berkshire Gas.** Providing full technical consulting and field work support to assess and remediate the impacts of NAPL in the subsurface, impacted soils and groundwater, and sediments at the site in Massachusetts.
28. **Greenfield MGP site, Berkshire Gas.** Providing full technical and engineering consulting services for the site management for groundwater, NAPL, sediments and soils impacted by the coal tar constituents at the site in Massachusetts.
29. **Saginaw MGP Site, Consumers Energy.** Assisted in reviewing and discussing characterization of soils, groundwater, NAPL, and sediments impacted from former MGP operations at the site in Michigan. Designed and implemented a Pilot ISCO study using Fenton's reagent as the chemical oxidant. Continuing to consult on technical issues related to impacted sediments and their remediation including discussions with the MDEQ on toxicity based clean up goals.
30. **Tar Well/ Oil-water separator at West Station MGP Site, NY. --.** Ish Inc. has been selected to start conducting the field work for evaluating the potential for NAPL on the land side of the target area and the potential connection to NAPL in the adjoining river sediments.
31. **EPRI, California.** —. Have been carrying out research on residual saturation of coal tar NAPL in soils from MGP sites in the country.