

# CURRICULUM VITAE

*Prof. Dr. Tarik Abdel-El-Rahman Tawfic*

## **Current Occupations:**

President of Tawfic & Associates – Environmental & Water Consultants

Director of Central Laboratory for Environmental Quality Monitoring

## **Contact Information:**

### ***Tawfic & Associates – Environmental & Water Consultants:***

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### ***Central Laboratory for Environmental Quality Monitoring (CLEQM):***

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## **Personal Information:**

Born on the 1<sup>st</sup> of September 1952, to an Egyptian family Dr. Tarik received his M.Sc. in water management in 1985 and Ph.D. in environmental chemistry in 1990, both from Colorado State University. From 1990 to 1993, Dr. Tarik continued Post-Doctoral studies on environmental assessments at the University of Wyoming. He has and continues to participate on a number of environmental projects with scientific, governmental, private and international organizations. Over 35 years in managerial and technical experience in various environmental fields which include water quality monitoring and assessment, pollution control, risk assessment, geochemical modeling, environmental impact assessment, institutional capacity building, project evaluation and development that covers the continents of Africa, Asia, Europe and North America. Dr. Tawfic has been working as a consultant for a number of development projects sponsored by the World Bank, the African Development Bank and the Islamic Development Bank UN-ESCWA and German InWent. Dr. Tarik has been teaching on an annual basis a comprehensive class on environmental risk

assessment at the Bari Institute in Italy since 1997. Additionally, he also gives frequent lectures, short courses and workshops organized by a number of international organizations such as CIHEAM, ICARDA, ESCWA, InWent and EICA. In 2009, Dr. Tarik became President of the environmental and water services consultancy firm Tawfic & Associates based in Cairo.

## **Education:**

- 1992 Post-Doctoral:** Environmental Assessment, Civil and Environmental Engineering Department, Wyoming Water Resources Center, University of Wyoming, Laramie, WY, USA.
- 1990 Ph.D.:** Environmental Chemistry, Colorado State University, Fort Collins, CO, USA.
- 1985 M.S.:** Water Management, Colorado State University, Fort Collins, CO, USA.
- 1980 Diploma:** Water Management, Colorado State University, Fort Collins, CO, USA.

## **Employment**

- 2009 – Present**      **President:** Tawfic & Associates – Environmental & Water Consultants
- 1998-Present**      **Director:** Central Laboratory for Environmental Quality Monitoring (CLEQM), National Water Research Center (NWRC), Cairo, Egypt. The CLEQM is one of the largest (3000 m<sup>2</sup>. Of labs) and one of the most advanced environmental facilities in the Middle East. The newly constructed laboratory houses a full-line of fully automated equipment. The facility is the focal point of the water quality monitoring network in Egypt and has been selected to be the reference laboratory for Nile Basin Insitute. CLEQM also includes a highly advanced and a fully equipped training center for water quality professionals. CLEQM has met the requirements of ISO/IEC 17025-1999 and is internationally accredited by CAEAL (Canadian Association for Environmental Analytical Laboratory)
- 1993-1998**      **Deputy Director & Manager of Operation,** Central Laboratory for Environmental Quality Monitoring (CLEQM), National Water Research Center (NWRC), Cairo, Egypt. Main duty was to fully supervise the lab establishment including; layout, construction, instrumentation.

**1992-1993**                    **Environmental Chemist and Data Analysis Specialist**, Wyoming Water Resources Center, University of Wyoming, Laramie, WY, USA. Project sponsored in part by National Science Foundation (NSF).

Modeling contaminated groundwater and soils data collected from the western states. Preparation of reports and publication of research papers.

**1990-1992**                    **Post-Doctoral Research Associate and Environmental Chemist**, Wyoming Water Resources Center, University of Wyoming, Laramie, WY, USA. Project sponsored in part by Electrical Power Research Institute (EPRI).

Work on development of techniques for chemical stabilization of alkaline clean coal technology solid wastes using energy conversion processes, including experimental design, on-site environmental impact assessment, planning, data analysis and publication. Responsible for the management of the Environmental Engineering Laboratory, supervising graduate students and technicians work in the laboratory, conducting theoretical and analytical research related to the effects of solid wastes disposal and trace metals on groundwater contamination, application and teaching of geochemical models, preparation of technical reports and research proposals, giving seminars, workshops, and publication of research papers.

**1986-1990**                    **Graduate Research Assistant**, Soil-Water and Environmental Chemistry, Colorado State University, Fort Collins, Colorado.

Conducting theoretical and laboratory research on the levels of trace metals in contaminated and uncontaminated soil and water environments. Developing laboratory and computer modeling techniques to identify trace metals ion-activities in soil and water.

**1985**                            **Teaching Assistant**, Soil Science, Colorado State University, Fort Collins, Colorado.

**1984-1985**                    **Graduate Research Assistant**, Soil and Water Management, Colorado State University, Fort Collins, Colorado.

Conducting theoretical and field work related to on-farm irrigation efficiency.

**1983-1984**                    **Head of the Soils and Agro-Economic Department**, Project Preparation Unit, Ministry of Irrigation, Cairo, Egypt. Project sponsored in part by World Bank,(WB).

## **Affiliations**

- 2009 – Present** Elected team leader of the Nile Basin Trans-boundary Environmental Project Network
- 2004-Present** Water Quality Working group member in Nile Basin Initiative.
- 2004-Present** Official representative of the Egyptian Government in the water quality component of the Nile Basin Initiative, World Bank.
- 2002-Present** National Committee for International Agreements, Ministry of State for Environmental Affairs.
- 2001-Present** National Energy Committee, Ministry of Electricity and Energy.
- 1997-Present** Visiting Professor, Environmental Science: International Center for advanced Mediterranean Agronomic Studies; Bari Institute. Valanzano, Bari, Italy.
- 1999-2001** Senior Environmental Consultants: Cabinet of Ministers, Social Fund for Development, Cairo, Egypt.
- 1997-1999** Senior Environmental Consultants: Cabinet of Ministers, Egyptian Environmental Affairs Agency.

## **Special Missions**

- 1993-Present** Worked on various missions related to water management, water quality, human resources development, environmental impact assessments, project management, assessment of organizational operational capacity levels, environmental management & institutional capacity building, environmental training, environmental policies & legislation, waste management, point and non-point source pollution of water resources, geochemical modeling, salt water intrusion, environmental analytical parameters and instrumental analysis.
- 2007-Present** EIA and water works consultant to the development of a touristic resort on 7,400,000 m<sup>2</sup> in Sharm El-Sheikh, Golden Pyramids Company -City Stars.
- 2008 – Present** Assessment of Water Quality Status and laboratory requirements for Southern Sudan.

- 2008** A panel member for the selection of Environmental Management Specialist, Nile Trans boundary Environmental Action Project & Eastern Nile Technical Regional Office (ENTRO), Addis Abba.
- 2008** EIA and water works consultant to the development of a touristic resort and marina, Orientals for development, Marsa Alam
- 2007** Invited speaker and moderator for the workshop on water quality problem in the MENA region, InWent.
- 2006** Yemen and Jordan mission to assess water quality management problems, ESCWA.
- 2005** Assessment and treatment of wastewater, Alger, Algeria
- 2005** Review of reclaimed water quality guidelines, Bari, Italy.
- 2005** Evaluation of wetland systems in wastewater treatments.
- 2005** EGM on upgrading Environmental Monitoring Systems in the ESCWA Region, Beirut, Lebanon.
- 2004** ESCWA, keynote speaker to the workshop on water quality and environmental labs, Improving Environmental Quality Monitoring in ESCWA Region, Beirut, Lebanon.
- 2004** Environmental assessment of hazards chemicals, Bari, Italy.
- 2003** Environmental Impact Assessment of the use of hand-pump in drinking water, Cairo, Egypt.
- 2003** Evaluation of in-stream constructed wetlands as a method for wastewater treatment, Cairo, Egypt
- 2002** Design and implement a clean-up system for artificial lakes, Sharm El-Sheikh, Egypt.
- 2001** Water Reuse in Mediterranean; Elaboration of Guidelines. Chairman; other uses of reclaimed water and aquifer recharge committee, Rabat, Morocco.
- 2001** Environmental Impact Assessment, Coastal Development Plan, Kingdom of Saudia Arabia.
- 2001** Environmental Impact Assessment, Taba Power, Sharm El-Sheikh.

- 2001** Environmental Impact Assessment, Global Energy and Electricity, Sharm El-Sheikh.
- 2001** Environmental Impact Assessment, King Tut Hotel and Resort, Marsa Alam, Red Sea.
- 2001** Project Development Plan and Environmental Impact Assessment for land reclamation, SIWA OASIS, Egypt. Amoun Inc. for Land Reclamation.
- 2001** Environmental Impact Assessment, Agriculture and Tourism Development Project. Siwa Oasis.
- 2000** EIA and Feasibility Study for a Rice Mill Project, Emirate of Abu Dhabi, General Industry Corporation. UAE.
- 2000** Project Development Plan and Environmental Impact Assessment for land reclamation, SIWA OASIS, Egypt. Alrawaby Inc. for Land Reclamation and Development.
- 2000** Environmental Specialist, Member of the M.Sc. Examination Committee; Bari Institute, Italy.
- 2000** Ke-Macina Irrigation Project-Phase II, Republic of Mali, Environmental Impact Assessment Report.
- 2000** Environmental Concept and Sustainable Development, International Center for advanced Mediterranean Agronomic Studies; Bari Institute; Italy.
- 1999** Environmental Impact Assessment, Water Quality Modeling, Al-Sharm Al-Qebly Resort, Al-Qusear; Oriental for Urban Development, Cairo, Egypt.
- 1999** Project Development Plan and Environmental Impact Assessment for land reclamation, SIWA OASIS, Egypt. International Company for Land Reclamation.
- 1999** International Center for advanced Mediterranean Agronomic Studies; Bari Institute: Teach regular course on application of geochemical models to environmental exposure problems. Valanzano, Bari, Italy.
- 1998** International Center for advanced Mediterranean Agronomic Studies and the International Center for Agricultural Research in the Dry Areas: Risk assessment trainer in the advanced short course on:

Sustainable Use of Non Conventional Water Resources in the Mediterranean Region. CIHEAM/ICARDA. Aleppo, Syria.

- 1998** Environmental Impact Assessment. Nabq Resort-Sinai. Project Owner; Oriental for Urban Development, Cairo, Egypt.
- 1997** Environmental Impact Assessment Specialist. HAS Irrigation Development Project. Tirana, Albania. Islamic Development Bank (IDB); Sabbour Associates.
- 1997** International Center for advanced Mediterranean Agronomic Studies; Bari Institute: Short Term Environmental Assessment Trainer, preparation and teaching of advanced short course on: Application of geochemical models to environmental exposure problems. Valanzano, Bari, Italy.
- 1997** Short Term Consultant, Environmental Pollution Prevention Project. Egypt. USAID.
- 1997** Halcrow Rural Management & Sabbour Associates: Short Mission, Environmental Consultant. Ghana. AfDB.
- 1996** Halcrow Rural Management & Sabbour Associates: Environmental Impact Assessment Specialist. Small Scale Irrigation Project. Ghana. AfDB.
- 1996** Egyptian International Center for Agriculture (EICA): Training Advisor on water quality management and monitoring. Giza, Egypt.
- 1995** Selection criteria for Laboratory Information Management Systems (LIMS). National Laboratory for Environmental Testing. Special Mission, Toronto, Canada. CIDA.
- 1995** Evaluation and assessment of environmental laboratories training needs. ZENON Environmental Laboratories. Special Mission, Quebec, Canada. CIDA.
- 1995** CIDA: Evaluation and Assessment of Environmental Quality Monitoring Programs and Laboratory Facilities in Egypt. Special Mission, Aswan, Egypt.
- 1994** Determination of Laboratory Design Criteria For Environmental Monitoring Programs. Special Mission, Netherlands - Germany- USA - Canada. CIDA.

- 1992** Wyoming Water Resources Center (WWRC): Modeling of Ground water Polluted by Selenium. National Science Foundation (NSF), USA.
- 1991** Wyoming Water Resources Center (WWRC): Application of Geochemical Models to Environmental Exposure Assessment Problems, Modeling Workshop "part of the training program given to graduates in environmental studies". Civil Engineering Department, UW, USA.
- 1990** Wyoming Water Resources Center (WWRC): Development of techniques for chemical stabilization of alkaline clean coal technology solid wastes using energy conversion processes. Electrical Power Research Institute (EPRI), USA.
- 1987** Soil Science Society of America (SSSA): Review of techniques used in the reclamation of salt affected soils. Soil Conservation Services (SCS), United States Department of Agriculture (USDA), Bureau of Reclamation. Grand Junction, CO, USA.
- 1983** Ministry of Irrigation: Evaluation of Drainage Systems in Upper Egypt, Special Mission. WB - USAID.

## **Research Interests & Experience**

- The principle research interests are chemical thermodynamics and chemical kinetics of soil - water environments and the use of computer models to understand the physical, chemical, and biological processes controlling pollutants in the environment. Understanding solid wastes chemical behavior and reactions in soils and aquatic systems. Application of geochemical models in environmental impact assessment and prediction of contamination problems associated with industrial, agricultural and irrigation practices. Evaluation of guidelines on analytical techniques for fate of soil & water contaminants and risk assessment methodologies. Investigation of environmental pollution problems associated with mining activities and coal combustion. Determination of trace metals-ion activities in organic and inorganic environments using various analytical techniques. The chemistry of saline and alkaline soils and their reclamation.
- Project Management & Sustainability. Environmental policies and legislation, Evaluation of Operational Capacity Levels. Analysis of needs. Establishing training programs based on the evaluation of educational background and work needs.
- Environmental impact assessment of development projects including, tourism, agriculture, and industrial development.



## ***Computer & Software Skills***

- Geochemical Models
- Air Quality Models
- Project Management
- Graphics
- Laboratory Information Management Systems

## **Teaching Experience**

### **1997 - Present, Regular Course:**

"Water Quality assessment and Management"

International Center for Advanced Mediterranean Agronomic Studies, (CIHEAM).  
Valanzano, Bari, Italy.

### **2002, Special Course:**

Environmental Impact Assessment. King Hassan the II Institute, Aghadeir, Morocco.

### **1998, Short Course:**

Introduction to Environmental Impact Assessment Techniques. WB & KFW.  
IIP, Kafer El-Sheakh - Egypt

### **1998, Advanced Short Course:**

"Sustainable Use of Non-Conventional Water Resources in the Mediterranean Region". The use of geochemical models as a decision support tool in non-conventional water resources management.

CIHEAM/MAI.B, ICARDA. Aleppo, Syria.

### **1998, Workshop:**

"Environmental Impact Assessment of Irrigation Improvement Project in Egypt.  
Questionnaire design and survey to collect EIA data. WB, KFW and IIP.

Alexandria, Egypt.

**1998, Intensive Course:**

Course Topic: "Environmental Impact Assessment of Irrigation and Drainage Projects".

Special topics given to international graduate students, Egyptian International Center for Agriculture (EICA). Giza, Egypt.

**1997, Intensive Course:**

Course Topic: "Environmental Impact Assessment of Irrigation and Drainage Projects".

Special topics given to international graduate students, Egyptian International Center for Agriculture (EICA). Giza, Egypt.

**1997, Short Course**

Course Topic: "Application of Geochemical Models to Environmental Exposure Problems".

Course attended by professionals from various Mediterranean Countries. International Center for Advanced Mediterranean Agronomic Studies, (CIHEAM). Valanzano, Bari, Italy.

**1996, Intensive Course:**

Course Topic: "Water Quality : Monitoring and Pollution".

Special lectures given to international graduate students, Egyptian International Center for Agriculture (EICA). Giza, Egypt.

**1996, Intensive Course:**

Course Topic: "Application of Geochemical Models to Environmental Exposure Assessment Problems".

Special course given to international graduate students, Egyptian International Center for Agriculture (EICA). Giza, Egypt.

**1992, One Semester**

Course Topic: "The Chemistry of Solid Wastes"; Graduate level

Full responsibility on teaching "Computer Application of Geochemical Models to Solid Waste Environments". Environmental Engineering Program, Civil Engineering Department, University of Wyoming. Laramie, WY.

## **1986-1990**

Course Topic: "Chemical Equilibria in Soils and water Environments"; Graduate Level

Assisted in the application of computer models to teach chemical equilibria in soil and water environments. Colorado State University. Fort Collins, CO.

## **1990, Intensive Course**

"Water Management"

Assistant Trainer, Colorado Institute for Irrigation Management. Colorado State University. Fort Collins, CO.

## **1989, One Semester**

"Introduction to Soil Science".

Teaching Assistant, Colorado State University. Fort Collins, CO.

## **1988, Intensive Course**

"Irrigation Management Systems"

Assistant Trainer, , Colorado state University. Fort Collins, CO.

## **Publications**

Tawfic, T.A. 2007, The Need For Advanced Water Quality Labs. International Conference: Sustainable Development and Management of Water in Palestine.

Tawfic T.A. 2007, Water Quality Management and Challenges in the MENA Region. International Conference: Water Governance in the MENA Region, critical issues and the way forward.

Tawfic T.A. 2007, Water Quality Management in ESCWA Region. Mission Report for ESCWA.

Tawfic T.A. 2004, Role of Advanced Labs and Water Quality Monitoring. ESCWA Experts Meeting on Improvement of Environmental Monitoring System in ESCWA Region Countries, Beirut

Tawfic, T.A. 2004, Empirical Model Development for Surface Water Quality (Case Study). Engineering Research Journal, Volume (91).

D.M. Hammad, T.A. Tawfic, A. S. Al-Noweihi and F.H. Abou El-Nour, 2004, The Use Of Selected Aquatic Plants In Tracing Some Heavy Metal Pollutants. Engineering Research Journal, Volume (91).

John Headely and Tarik Tawfic, 2003. Monitoring of Natural Hydrocarbon Release From Oil sands Deposits In a Canadian River Basin. The Transactions of the Egyptian of Chemical Engineers, Volume 29, No.2, pp.84-89.

John Headely and Tarik Tawfic, 2003. Abatement Of Polar Organics In Natural Wetlands and Rivers-Analytical Methods. The Transactions of the Egyptian of Chemical Engineers, Volume 29, No.2, pp.90-97.

Tawfic, T.A., 2003, CLEQM Operational Procedures. Journal of Water Science, 34th issue, pp. 39-44

Tawfic, T.A. 1998. Advanced Short Course On: Sustainable Use of Non-Conventional Water Resources in the Mediterranean Region, The use of geochemical models as a decision support tool in non-conventional water resources management. pp 433-464. CIHEAM/MAI.B, ICARDA. Aleppo, Syria.

Tawfic, T.A. 1997. Selenite Adsorption Mechanism in reclaimed mine soils using geochemical models. Journal of the Faculty of Education; Ain Shams University Press, No. 22:557-577.

Tawfic, T.A., M.J. Blaylock, and G.F. Vance. 1997. Selenite adsorption and solution complexes in reclaimed mine soils: A comparative study using geochemical models. International Conference on: water management, salinity and pollution control towards sustainable irrigation in the Mediterranean region, Bari, Italy.

Tawfic, T.A. and A.R. Abdel-Tawab. 1996. Application of geochemical models to study the environmental impacts of discharged industrial effluent on water quality. Canadian Water Resources Association. CWRA Proc. Vol. 1, pp 427-437.

El-Behairy, M, Al. Ibrahim, A.A. Emara and T.A. Tawfic. 1996. Synthesis, physicochemical studies and solvatochromism of some new lithium  $\pi$ -(tetraaryloxo)cobalt(II) and allied complexes. Journal of Chemical Research. 0206-0219: 22. The Royal Soc. of Chemistry. Cambridge, UK.

El-Behairy, M, A.I. Ibrahim, A A. Emara and T.A. Tawfic. 1996. Synthesis and physicochemical studies of new lithium alkoxocobaltate (II) complexes. Journal of Chemical Research. 0206-0219: 20-21. The Royal Soc. of Chemistry, Cambridge, UK.

Reddy, K.J., T.A. Tawfic, S.P. Gloss, and J.I. Drever. 1995. Development of a carbon dioxide pressure technique for chemical stabilization of alkaline clean coal technology (CCT) ash. Land and Water Quality Studies, Environment Division, Electric Power Research Institute, Palo Alto, California, TR-104840, 36pp.

Tawfic, T.A., K.J. Reddy, S.P. Gloss and J.I. Drever. 1995. Reactions of CO<sub>2</sub> with clean coal technology solids to reduce trace elements mobility. Water, Air and Soil pollution, No. 84:385-398, Kluwer Academic Publishers, Netherlands.

Blaylock, M.G., T.A. Tawfic, and G.F. Vance. 1995. Modeling selenite sorption in reclaimed coal mine soil materials. Soil Sci. Vol. 159, No. 1:43-48, Williams & Wilkins. Baltimore, MD21202, USA.

Tawfic, T.A., K.J. Reddy, S.P. Gloss, and J.I. Drever. 1995. Reaction of CO<sub>2</sub> with clean coal technology solid wastes to reduce trace element mobility. Water, Air, and Soil Pollution. 84:385-389.

Tawfic, T.A and K.J. Reddy. 1995. In-situ immobilization of contaminants in alkaline solid wastes, p345. Soil and Environmental Chemistry Division. Agronomy Abstracts.

Blaylock, M.J., T.A. Tawfic and G.F. Vance. 1995. Modeling selenite sorption in reclaimed coal mine soil materials. Soil Science 159:43-48.

Reddy, K.J., T.A. Tawfic, S.P. Gloss, and J.I. Drever. 1994. (Invited) Immobilization of contaminants in alkaline solid wastes derived from fossil energy conversion process. Book Chapter 6. In D.C. Adriano, Z.S. Chen, and S.S. Yang (eds) Advances in Environmental Sciences, Northwood, United Kingdom, pp69-80.

Reddy, K.J., S.P. Gloss, J.I. Drever and T.A. Tawfic. 1994. Development of a carbon dioxide pressure technique for chemical stabilization of clean coal technology (CCT) ash.

Reddy, K.J., T.A. Tawfic, S.P. Gloss, and J.I. Drever. 1993. Immobilization of contaminants associated with alkaline solid waste, p35. In: Proceedings of 2nd International Conference on the Biogeochemistry of Trace Elements.

Tawfic, T.A., K.J. Reddy, S.P. Gloss, and J.I. Drever. 1993. Immobilization of arsenic and selenium in alkaline solid waste, p46. Environmental Quality Division. Agronomy Abstracts.

BREWER, T., M.J. Blaylock, T.A. Tawfic and G.F. Vance. 1993. Selenite adsorption in reclaimed and abandoned coal mine soil materials. Agronomy Abstracts 85:223.

Tawfic, T.A., M.J. Blaylock and G.F. Vance. 1993. A comparative study of selenite adsorption and solution complexes in reclaimed mine soils using geochemical models. Agronomy Abstracts 85:237.

Tawfic, T.A., K.J. Reddy, S.P. Gloss, and J.I. Drever. 1992. Effects of a new CO<sub>2</sub> pressure treatment on trace metals solubility in clean coal technology by-products, 61. Environmental Quality Division. Agronomy Abstracts.

Tawfic, T.A and K.J. Reddy. 1992. (Invited) Immobilization of toxic elements in clean coal technology by-products, p204. In: Proceedings of 34th Annual Rocky Mountain Conference on Analytical Chemistry.

Tawfic, T.A., K.J. Reddy, S.P. Gloss, and J.I. Drever. 1992. Use of a CO<sub>2</sub> pressure technique to minimize leachability of toxic elements from clean coal technology solid wastes, pp9-10. In: Proceedings of the 5th Annual Meetings of the American Water Resources Association Wyoming Section.

Reddy, K.J., T.A. Tawfic, S.P. Gloss, and J.I. Drever. 1992. Development of a CO<sub>2</sub> pressure technique for chemical stabilization of clean coal technology solid wastes. One year progress report. Land and Water Quality Studies. Environment Division. Electric Power Research Institute, Palo Alto, California.

Tawfic, T.A., K.J. Reddy, S.P. Gloss, and J.I. Drever. 1992. Use of a CO<sub>2</sub> pressure technique to minimize leachability of toxic elements from clean coal technology solid wastes. 5th Annual Meetings of the American Water Resources Association Wyoming Section. Laramie, Wyoming.

Reddy, K.J., J.I. Drever, and T.A. Tawfic. 1991. Application of geochemical models to predict solid phase equilibria in solid waste environments, p251. Soil Chemistry Division. Agronomy Abstracts.

Drever, J.I., K.J. Reddy, T.A. Tawfic, and S.P. Gloss. 1991. Effect of CO<sub>2</sub> pressure process on solubilities of different elements in clean coal technology solid waste, p40. Environmental Quality Division. Agronomy Abstracts.

Tawfic, T.A., K.J. Reddy, S.P. Gloss, and J.I. Drever. 1991. A new treatment process for chemical stabilization of clean coal technology solid waste, p54. Environmental Quality Division. Agronomy Abstracts.