



Summary of Qualifications

Dr. Hedin is one of the leading authorities on the treatment of mine drainage and the restoration of streams polluted by mine drainage. He began researching mine drainage issues in 1988 at the US Bureau of Mines. In 1994 Dr. Hedin formed Hedin Environmental in order to provide personalized consulting services for a wide range of clients interested in mine drainage treatment. Dr. Hedin is the author of numerous publications regarding passive treatment of mine drainage and related topics, such as resource recovery. He has also given numerous presentations at technical conferences and served as an expert witness in court proceedings. For more information about projects performed by Hedin Environmental, please refer to the corporate resume.

Current Responsibilities

Dr. Hedin is the president of both Hedin Environmental and of Iron Oxide Recovery, Inc, a sister company that specializes in recovering a marketable iron product from passive treatment systems. Dr. Hedin oversees all Hedin Environmental projects and performs data evaluation, treatment system conceptual design and sizing, and restoration plan formulation.

Special Awards and Recognitions

Carnegie Science Center Innovator of the Year, 2003

DEP Secretary's Task Force Invited Member, Long Term Passive Treatment Cost Evaluation Committee, 2001 – Current

Pittsburgh Research Center, Publication of the Year, 1989, 1990, 1991, 1994, 1995

U.S. Dept. of the Interior, 1990, Secretary's Stewardship Award for Science and Technology

Three Rivers Environmental Award, 1995





Work Experience

1986 – 1988, Research Fellow, Oak Ridge Associated Universities, Oak Ridge, TN

1988 – 1994, Research Biologist, US Bureau of Mines, Pittsburgh, PA

1994 – present, President, Hedin Environmental, Pittsburgh, PA

2001 – present, President, Iron Oxide Recovery, Pittsburgh, PA

Education

B.A. Environmental Studies and Economics, St. Lawrence University, 1978

Ph.D. Ecology, Rutgers University, 1987





Selected Presentations

Keynote Address, “What Color Is Your Watershed”, Coalition for Abandoned Mine Reclamation Annual Conference, Scranton, PA, 2003

Keynote Address, “Recovery of a Marketable Iron Product from Mine Water,” Mine Water Assessment and Treatment Conference, New Castle upon Tyne, England, 2002

Selected Publications

Harris, G. R., A. Grover, B. Hale, and R. Hedin. 1979. The role of lakeshore homeowner associations in environmental management. *Environmental Management* 3: 195–203.

Caccamise, D. F. and R. S. Hedin. 1985. An aerodynamic basis for selecting transmitter loads in birds. *Wilson Bull.* 97: 306–318.

Hedin, R. S. 1988. Volunteer revegetation processes on acid coal spoils in north western Pennsylvania. Bureau of Mines Information Circular 9184, pp. 111–118.

Hedin, R. S., D. M. Hyman and R. W. Hammack. 1988. Implication of sulfate–reduction and pyrite formation processes for water quality in a constructed wetland. Bureau of Mines Information Circular 9183, pp. 382–389.

Erickson, P. M. and R. S. Hedin. 1988. Evaluation of overburden analytical methods as means to predict post–mining coal mine drainage quality. Bureau of Mines Information Circular 9183, pp. 11–21.

Hedin, R. S. and P. M. Erickson. 1988. Relationships between the initial geochemistry and leachate chemistry of weathering overburden samples. Bureau of Mines Information Circular 9183, pp. 21–29.

Hedin, R. S., R. W. Hammack, and D. M. Hyman. 1989. The Potential importance of sulfate reduction in wetlands constructed to treat mine drainage. //: D. Hammer (ed.) *Constructed Wetlands for Wastewater Treatment: Municipal, Industrial, and Agricultural* (Lewis Publishers, Chelsea MI), pp. 508–516.





- Kleinmann, R. L. P. and R. S. Hedin. 1989. Biological treatment of mine water: an update. *In*: M. E. Chalkley, B. R. Conard, V. I. Lakshmanan and K. G. Wheeland (eds.) *Tailings and Effluent Management* (Pergamon Press, New York, NY), pp. 173–179.
- Hedin, R. S. 1989. Treatment of coal mine drainage with constructed wetlands. *In*: S. K. Majumdar, R. P. Brooks, F. J. Brenner and J. W. Tiner, Jr. (eds.) *Wetlands Ecology and Conservation: Emphasis in Pennsylvania* (Pennsylvania Academy of Science, Philadelphia, PA), pp. 349–362.
- Hedin, R. S. and E. R. Hedin. 1990. Stimulation of aspen establishment on unreclaimed mine spoils, *In*: D. H. Graves and R. W. DeVore (eds), 1990 National Symposium on Mining (University of Kentucky, OES Publications, Lexington, KY) pp. 85–95.
- Dvorak, D. H., R. S. Hedin, H. M. Edenborn and P. E. McIntire. 1992. Treatment of metal-contaminated water using bacterial sulfate reduction: results of pilot-scale reactors. *Biotechnology and Bioengineering* 40: 609–616.
- Nairn, R. W., R. S. Hedin and G. R. Watzlaf. 1992. Generation of alkalinity in an anoxic limestone drain. *In*: *Achieving Land Use Potential through Reclamation* (American Society for Surface Mining and Reclamation, Princeton, WV), pp. 206–220.
- Watzlaf, G. R. and R. S. Hedin. 1993. A method for predicting the alkalinity generated by anoxic limestone drains. *In*: Thirteenth Annual West Virginia Surface Mine Drainage Task Force Symposium, West Virginia University, Morgantown.
- Kleinmann, R. L. P. and R. S. Hedin. 1993. Treat mine water using passive methods. *Pollut. Eng.* 25:20–22.
- Hedin, R. S. and R. W. Nairn. 1993. Contaminant removal capabilities of wetlands constructed to treat coal mine drainage. *In*: Moshiri, G. A. (ed.) *Constructed Wetlands for Water Quality Improvement, Proceedings of an International Conference* (Lewis Publishers, Chelsea, MI). pp. 187–197.
- Hedin, R. S. and G. R. Watzlaf. 1994. The effects of anoxic limestone drains on mine water chemistry. *In*: *Proceedings of the International Land Reclamation and Mine Drainage Conference and the Third International Conference on the*





- Abatement of Acidic Drainage (United States Department of the Interior, Bureau of Mines Special Publication SP 06A-94, Washington DC) pp. 185-195.
- Hedin, R. S., R. W. Nairn and R. L. P. Kleinmann. 1994. Passive treatment of polluted coal mine drainage. Bureau of Mines Information Circular 9389. United States Department of Interior, Washington DC.
- Hedin, R. S., G. R. Watzlaf and R. W. Nairn. 1994. Passive treatment of acid mine drainage with limestone. *Journal of Environmental Quality* 23:1338-1345.
- Hedin, R. S. 1996. Environmental Engineering Forum: Long-Term Effects of Wetland Treatment of Mine Drainage. *Journal of Environmental Engineering*: 83-84.
- Schmidt, T. W., R. S. Hedin and P.R. Lorello. 1996. Assessment of an anoxic limestone drain for a surface mine in east central Tennessee. *In: Proceedings of 13th Annual Meeting of the American Society for Surface Mining and Reclamation (ASSMR, Princeton, WV) pp. 384-390.*
- Fish, C. L., R. S. Hedin and J. Partezana. 1996. Chemical characterization of iron oxide precipitates from wetlands constructed to treat polluted mine drainage. *In: Proceedings of 13th Annual Meeting of the American Society for Surface Mining and Reclamation (ASSMR, Princeton, WV) pp. 541-549.*
- Hedin, R.S., 1998. Potential recovery of iron oxides from coal mine drainage. *In: Nineteenth Annual West Virginia Surface Mine Drainage Task Force Symposium, West Virginia University, Morgantown.*
- Hedin, R.S. 1999. Recovery of Iron Oxides from Polluted Coal Mine Drainage. Patent No. 5,954,969. U.S. Patent and Trademark Office, Washington D.C.
- Dempsey, B.A., Roscoe, H.C., Ames, R., Hedin, R. and B_H Jeon. 2001. Ferrous oxidation chemistry in passive abiotic systems for treatment of mine drainage. *Geochemistry, Exploration, Environment, Analysis*, 1: 81-88.
- Kairies, C.L., Watzlaf, G.R., Hedin, R.S. and R.C. Capo. 2001. Characterization and resource recovery potential of precipitates associated with abandoned coal mine drainage. *In: Proceedings of 18th Annual Meeting of the American Society for Surface Mining and Reclamation (ASSMR, Lexington, KY).*





- Hedin, R.S. 2002. Recovery of marketable iron oxide from mine drainage. *In*: Proceedings of 19th Annual Meeting of the American Society for Surface Mining and Reclamation (ASSMR, Lexington, KY).
- Younger, Paul L., Banwart, Steven A., Hedin, Robert S., "Mine Water: Hydrology, Pollution, Remediation" (textbook), Kluwer Academic Publishers; February 1, 2002.

