

**Environmental and Engineering Geologists Meeting  
February 8, 1995  
The H.E.S.S. Building on Buffalo Speedway**

***Naturally Occurring Radioactive Materials (NORM) in Scales Formed During the Production of Oil and Gas***

by John E. Oddo, Water Research Institute, Inc., Houston

Some oil field scales have the potential to contain regulated levels of naturally occurring radioactive materials (NORM) generally in the form of radium-226. It is estimated that between 300,000 to 1,000,000 tons of NORM scale are produced in the United States each year, if all NORM scales are included. However, these estimates drop dramatically to 15,000 to 50,000 tons/year if included scales are limited to  $>2,000$  pCi/gram. Due to the uncertainties in the amount of material produced and the low average radionuclide content, it is difficult to assess the risk. However, state agencies have defined and are further defining regulations to monitor and dispose of NORM scale materials and scaled equipment.

Mineral scales are deposits pro-

duced in field production facilities due to temperature and pressure changes during the gas and oil recovery processes. Scale deposition in producing wells and associated facilities negatively impacts rates of production and is expensive to treat and remediate, regardless of the environmental regulations involved. The most common NORM containing scale is  $BaSO_4$ , or barite. The presentation will address the causes of  $BaSO_4$  scale along with prediction and control methods for field use. A field example of  $BaSO_4$  NORM scale control is included.

**Biographical Sketch**

Dr. John E. Oddo received a B.S. degree in Geology from the University

of Akron in 1969. He obtained a M.S. in Geology from Toledo University in Ohio and a Ph.D. degree from Rice University in 1980. Dr. Oddo has studied natural water systems, production problems, and related phenomena and has over 50 publications in this field. Dr. Oddo worked with Conoco in International Exploration from 1982 – 1988 and is well versed in industrial needs with regard to scale and corrosion control, water treatment, and the economics of the petroleum business. He is a Certified Petroleum Geologist and a member of the AAPG, the SPE, the National Association of Corrosion Engineers. He is the founder and president of the Water Research Institute, Inc. and Water Research Chemicals, Houston, Texas.