



NORM AWARENESS EVOLUTION

L. Max Scott, Ph.D. CHP

Associate Professor Nuclear Science (retired)

Louisiana State University

ADA Consultants

225-241-4979

E-mail: Lscott6@LSU.edu

maxscott30@att.net



Five Stages of Senility

- Forgetting Names!
- Forgetting Faces!
- Going to the bathroom and forgetting to zip pants!
- Going to the bath room and forgetting to unzip pants!
- Invited to kick-off a Workshop on a topic a few misguided people that thought I knew something about!



LONGEVITY

- For the last 42 years I have been involved with NORM and TENORM on a regular basis.
- So if I don't qualify by knowledge maybe I do by longevity.




Genesis

- Genesis of NORM Awareness
- Connecting the Dots



Connecting the Dots

- Richard Rhodes in his Book The Making of the Atomic Bomb Relate that Several Future Nobel laureates were  close to explaining fission
- 9-11 commission pointed out missed information
- Publications regarding NORM if we only connected the dots.



Publications

K.G. Bell, Clark Goodman, and W.L. Whitehead,

Radioactivity of Sedimentary Rock and Associated Petroleum,
Bulletin of the American Association of **Petroleum** Geologist,
Vol 24.9, **1940**

Bruno Pontecorvo, **Radioactivity** Analyses in **Oil Well**
Samples Presented at Annual Meeting **1941**

L.C. Case, Application of **Oil Field Water to Geology**
and Production, The Oil Weekly, October 29, **1945**



Publications

John L.P. Campbell, Radioactivity Well **Logging Anomalies**, The Petroleum Engineer June **1951**

Garland B. Gott and James W. Hill, **Radioactivity** in some **Oil Fields** of Southeastern Kansas, Geological Survey Bulletin 988-E, **1953**

Bernard F. Armbrust, Jr., P.K. Kuroda, On the Isotopic constitution of **Radium** (Ra-224/Ra-226 and Ra-228/Ra-226) in petroleum Brines, Transactions, American Geophysical Union Vol 37.2 **1956**



Publications

Louis Gordon and Keith Rowley, Coprecipitation of **Radium with Barium Sulfate**, Analytical Chemistry, Vol. 29, NO. 1
January **1957**

Espen S. Larsen, Jr., and David Gottfried, Distribution of **Uranium** in Rocks and Minerals of **Mesozoic Batholiths** in Western United States, Geological Survey
Bulletin 1070-C, **1961**



Publications

G.L. Gates and W.H Caraway, **Oil Well Scale Formation** in Water flood Operations Using Ocean Brines, Wilmington, California, Report of Investigations 6658
Department of the Interior Bureau of Mines, **1965**

Mark A. Doering and Dan P. Smith, Locating **Extraneous Water Sources** with the Gamma Ray Log, American Institute of Mining, Metallurgical, and petroleum Engineers, Inc, **1974**



EXPECT TO SEE

Sometime I expect to see a plaintiff attorney allege that Colonel Edwin Drake knew or should have known that the 1859 discovery well contained NORM!



Common Knowledge

- Why in the 1980's did it become common knowledge that NORM was associated with petroleum production?
- The development and use of more sensitive gamma radiation detectors – Sodium Iodide scintillators instead of Geiger-Mueller survey meters.

Dr. John Frazier



Common Knowledge

- In my opinion The 1981 North Sea Reports were the first publications actually identifying the presences of NORM in petroleum production equipment.
- In the US 1986 was the year of revelations



My Introduction

- In the Spring of 1986 I received a telephone call from Dr. Ty Miller who asked me if I could analyze a pipe for radiation content.
- A section of pipe was transported to me.
- I took a hammer and beat on the pipe and knocked some of the scale out.



Results

- Contact reading ~ 500 microR/hr
- Ra-226 Concentration 5960 pCi/g
- Ra-228 Concentration (incorrectly reported as Th-232) 1110 pCi/g



Mississippi Pipe





Mississippi Pipe Scale





WHY SURVEYED?

- Survey conducted on the tubulars?
 - An engineer in Houston who had worked in the North Sea was aware of the Mississippi well workover. He suggested that a radiation survey might be a good idea.
 - An instrument was borrowed from a well service company.
 - A reading of 3 milliR/hr was observed.
 - **I don't know if any of the above is correct**



Why?

- It only a guess on my part, but I think that the instrument was not properly calibrated or the person making the measurement did not know what they were doing.
- I have often wondered how long it would have been before the US petroleum industry became aware of the problem if a correct reading had been made.



First Regulations

- 1988 MIKE McDaniel (LADEQ) appointed a committee of four to suggest Regulations for NORM
 - David Zalodec - LADEQ
 - Mike Manka - Chevron
 - Roy Parker – Independent Consultant
 - Max Scott – LSU Radiation Safety Officer



Deliberations

- The committee thought that a reading of 100 microR/hr would be a level if exceeded signaled the needed for additional investigation.
- The committee felt that LADEQ would not buy a level of 100 microR/hr so they decided on 50 microR/hr
- Was the limit net or gross?



Deliberations

- I don't remember. Over time I think both were in the Louisiana regulations.
- As obvious there was no risk associated with the 50 microR/hr.
- In 1988 interim regulations were issued.



Questions

- What is sacred about 5 pCi/g Ra-226?
- I do not know the origin of this value?
- Is it risk based?
- Why is Ra-228 included?



Regulatory Guidelines

Water
Treatment
Wastes

Uranium Mill
Tailing

Petroleum
Production
NORM

Rare Earth
Waste

RA-226

Ra-226

Ra-226

Ra-226

d

Does Where I originated make me a hazard?



Concerns

- Radon Decay Products
 - Gas Plants
 - Pipelines
 - Buildup in Fuel System
 - LNG Terminals
 - Plants Using Natural Gas as Feed Stock



Concerns

- Uniform Alarm Requirements for Gate Monitors
- Guidance Regarding Handling of Loads Rejected at Gate Because of Alarm
- Export/Import NORM Concentrations Guidance



Desires

- What I would like to see before I die but won't!
 - Uniform regulations of NORM across all Industries
 - Uniform regulations of NORM across all states/countries