RAS 14300

Citizens Exhibit D

U.S. NUCLEAR REGULATORY COMMISSION
In the Matter of American Energy Co., LLC
Docket No. 50-0219-LR Official Exhibit No. Citizens Exh. D
OFFERED by: Applicant / Licensee
NRC
IDENTIFIED on 9/20/07 N/A
Action Taken: ADMITTED REJECTED WITHDRAWN
Reporter/Clerk DW

Rudolf H. Hausler

SUMMARY Over 30+ years planned, conducted, and directed advanced chemical research focused on oil production and processing additives. Acquired expertise in corrosion prevention, chemical inhibition, and materials selection, failure analysis, trouble shooting and economic analysis. Proficient in German, French, and Italian.

DOCKETED
USNRC

October 1, 2007 (10:45am)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

EXPERIENCE:

1996 - Present **CORRO-CONSULTA** (Dallas TX, and Kaufman TX)

President private Consulting Company

Consulted with major Oil Companies on selection, testing and application of Oil Field Chemicals, primarily corrosion inhibitors.

- Worked on Global Sourcing Team for Mobil Oil Company (major fulltime 6+ months study)
- Consulted for Mobil Oil Company on production chemical usage at Mobile Bay sour gas production field and prepared for changeover to alternate chemical supplier (two year project).
- Consulted for Arco Oil company
    - on sour production in Middle East
    - reviewed North Slope corrosion data (statistical evaluation)
- Consulted for Mobil Oil Company at major CO_2 flood in Oklahoma (extensive laboratory and field testing - two major publications)
- Consulted with Teikoku Oil Company (Japanese National Oil Company) on various subjects of
    - drill string corrosion
    - amine unit corrosion of 304 stainless steel
    - corrosion of 13%-Cr in sweet production and the chemical inhibition thereof
    - identifying qualified corrosion testing laboratories in the US and the world
    - application limits for 3% Cr-steels in oil and gas production
- Consulted for Exxon Mobil on new sourcing study for combined Mobile Bay operations. (Developed novel approach for bid procedure and evaluation of bids on purely technical basis. Developed long-range approach to streamlining operations with potentially large savings.)
- Consulting for Oxy Permian Ltd. on major gas gathering system (changing from dry gas gathering to wet gas gathering)
- Prepared several major publications (see list of publications)
- Major consulting contract for ExxonMobil in Indonesia
- Consulting with various smaller Producers in the US (incl. Anadarko Petroleum Corp and Swift Energy Company)

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SECY-02

- Consulting with various engineering companies (e.g. Stress Engineering Services Inc.)
- Consultant on call for Blade Energy Partners
- Consulted with various organization concerned with nuclear safety, including the safety of spent fuel storage casks.

1991 - 1995 **MOBIL Oil Company** (Dallas Research Center), Dallas, Texas

Senior Engineering Advisor

Developed corrosion testing facilities for basic research and to meet specific oil field requirements.

- Planned and developed H_2S corrosion test facility
- Planned safety and wrote safety manual
- Developed unique continuous flow-through corrosion test facility ($$ 1.5MM)
- Developed test protocols and supervised operations of the FTTF
- Extensive consultation with Affiliates on problem solving and chemical usage
- Established supplier relationships and consulted with Affiliates on establishing Enhanced Supplier Relationships
- Developed theory and practice of novel approach to autoclave testing

1979 - 1991 **PETROLITE CORPORATION** St. Louis, Missouri

Research Associate 1986 - 1991

Directed and conducted the development of novel corrosion inhibitors for extreme operating conditions

- New corrosion inhibitor to combat erosion corrosion of carbon steel in gas condensate wells
- Extensive studies on CO_2 corrosion aimed at establishing predictive corrosion model
- Developed the only qualified corrosion inhibitor for nuclear steam generator cleaning (EPRI publication NP-3030 June 1983)

Special Assistant to Executive Vice President 1985 - 1987

Special Assignments focused at support of International Sales

- Extensive travel to secure major accounts in Europe, Russia and East Asia
- Monitored out-sourced R&D in Germany and England

Senior Research Scientist 1979 - 1985

- Developed novel chemical composition under contract with EPRI for corrosion inhibition of cleaning fluids used in nuclear steam generators and methodology of application (only effective formulation still used today)
- Developed unique corrosion model for CO_2 corrosion in oil and gas wells
- Conducted numerous detailed field studies to establish case histories of chemical performance and applications technology

1976 - 1979 **Gordon Lab, Inc.,** Great Bend, Kansas

Technical Director

Responsible for all technical issues involving formulation, application and sales of sucker well production chemicals (corrosion, emulsion, scale, bacteria)

- Conducted failure analysis for customers and developed pertinent reports
- Supervised service laboratory
- Established technical training of sales and support personnel
- Developed technical sales literature and company brochure

1963 - 1976 **UOP (a division of SIGNAL COMPANIES)** Des Plaines, Illinois

Research Associate	1972 - 1976
Associate Research Coordinator	1967 - 1972
Research Chemist	1963 - 1967

To conduct research in electrochemistry, analytical methods development, heat exchanger fouling processes and refinery process additives

- Developed novel organic electrochemical synthesis procedure
- Developed unique (patented) test apparatus for measuring anti-foulant activity
- Introduced statistical design and evaluation of experiments to R&D department and Developed 20 hr course on statistics.
- Developed full 3 credit hour corrosion course to be taught at IIT and DeSoto Chemical Company

EDUCATION

- Ph.D. Chemical Engineering; Swiss Federal Institute of Technology, Zurich Switzerland
- BS, MS Chemical Process Technology, same as above

PROFESSIONAL ASSOCIATION

- American Chemical Society
- The Electrochemical Society
- Society of Petroleum Engineers
- NACE International (Corrosion Engineers)
- American Society fro Metals (ASM)

- Active in NACE on local, regional and national level

RECOGNITION

- N ACE Technical Achievement Award (1990)
- NACE Fellow Award 2003

ACHIEVEMENTS

- 17 patents, 58 publications and more than 100 technical presentations
- Registered Professional Engineer (Corrosion Branch, California)
- NACE certified Corrosion Specialist

ATTACHMENT 1

Corro-Consulta

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Richard Webster, Esq.
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Rutgers University
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July 29, 2007

Mr. Webster:

I have read "AmerGen's motion in limine to exclude portions of Citizen's initial written submission".

Just as medical doctors, for instance, have to be well versed in general medicine, before specializing in surgery or any other medical specialty, so have corrosion engineers to be well versed in the various basic scientific and technical aspects underlying their science. Corrosion Engineering is probably one of the most complex technical endeavors one can think of. It involves well over 30 odd distinctly separate sciences [1)] from electrochemistry to metallurgy and chemistry as well as physics, including semiconductor phenomena. It is precisely the broadly conceived curriculum at the Swiss Federal Institute of Technology, one of the foremost European institutions of higher learning that prepares for, among many other possibilities, the entry to such a demanding field as Corrosion Science and Technology. Since gaining that education, I have acquired additional expertise through long experience.

For example, in the work carried out for EPRI aimed on the development of a corrosion inhibitor for the aggressive solvents in use for chemical cleaning of nuclear steam generators, I have demonstrated detailed knowledge of organic chemistry, electrochemistry, electrolyte (complexing) chemistry, as well as metallurgy and chemical process chemistry (removal of denting) [2)]. The inhibitor became commercial and was used around the world in many cleanings for at least 20 years. (It should be mentioned, perhaps that the work was carried out under EPRI guidance in close cooperation with Babcock and Wilcox, Westinghouse and Combustion Engineering, as well as numerous other companies).

With regard to expertise on coatings, one of the activities a corrosion engineer is often called upon is failure analysis. I routinely carried out such failure analyses at Petrolite as

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[1)] see Donald Tuomi: *Corrosion, the most general problem in material science,* published in Corrosion Chemistry, George R. Brubaker. Beverly P. Phipps, editors, ACS Symposium Series, Vol 89, pg. 1, 1979. The Symposium had been organized and conceived by Dr, R. H. Hausler, see foreword.

[2)] This work was done after the nuclear power plant operators under the oversight of NRC had badly misjudged the effects of galvanic coupling between Inconel and carbon steel on the corrosiveness of the cleaning solution in use at the time.

a service to customers and at Mobil for the purpose of understanding failure mechanisms of oil field tubulars. Such tubulars are frequently internally coated and failures of these coating systems were rather frequent. One of the most frequently used coatings is based on epoxy chemicals (Tuboscope's TK-7 for instance). One of the failure mechanisms, established in detailed examination by means of Scanning Electron Microscope studies of the underlying steel surface is the formation of a minute oxide layer prior to coating. This, in addition to slow diffusion of water and corrosive gases across the epoxy boundary is often the cause for de-lamination, blister formation, and subsequent breaking of the bubble and rapid attack of the metal. The various and detailed studies regarding coating failure I performed in line of service to either Gordon Lab, Petrolite, or Mobil are too numerous to list.

With regard to statistical experience, please find attached a summary of selected papers that I have published that used statistical analysis to assess corrosion. The summary also includes my selected experience with statistics gained through education, teaching, and practical experience. Once again, I trust the panel will find my experience to be more than sufficient for the present purpose.

Best regards

Rudolf H. Hausler

Selected Papers by Dr. Rudolf H. Hausler on the Application of Statistics in Diverse Corrosion Studies

1. **The Use of Statistical Design and Analysis in the Development of a Corrosion Inhibitor Test;** R. H. Hausler, L.A. Goeller, R.H. Rosenwald, Proceedings of the National Association of Corrosion Engineers, 26 the National Conference, March, 2-6, 1970, paper # 63
2. **Rust Inhibition and Inhibitor Testing, A Critical Discussion of Mil –I-25017-C,** R. H. Hausler, R. C. Kunzelman, Materials Protection and Performance, 11. (#11) 27, 1972, *(This paper uses binomial statistics to critically analyze results obtained from a "go-no-go" test procedure routinely used by military procurement offices).*
3. **CORROSION MANAGEMENT IN THE ARUN FIELD L.M. Riekels, R.V.** Seetharam, R.M. Krishnamurthy, C.F. Kroen, J.L. Pacheco, R.H. Hausler, V.A.M. Semerad, CORROSION/96, paper No. 24, NACE, 1996 *(This paper involved extreme value statistics for the prediction of the useful life of oilfield tububulars)*
4. **DEVELOPMENT OF A CORROSION INHIBITION MODEL: I. LABORATORY STUDIES,** R.H. Hausler, T.G. Martin, D.W. Stegmann, M.B. Ward, CORROSION/99, paper No. 2, NACE 1999
5. **DEVELOPMENT OF A CORROSION INHIBITION MODEL: II. VERIFICATION OF MODEL BY CONTINUOUS CORROSION RATE MEASUREMENTS WITH NOVEL DOWNHOLE TOOL.** T.G. Martin, M.T. Cox, R.H. Hausler, R.J. Dartez, P. Pratt, J.C. Roberts, CORROSION/99, paper No. 3, NACE 1999. *(both papers, 4 and 5, involve the use of statistics in the design and evaluation of the experimental approaches as well as the extensive use of contour plots).*

Dr. R. H. Hausler, Educational Background in Statistics and Due Diligence

1. Dr. Hausler received formal training in Theory and Application of Statistics as part of the compulsory curriculum in the second year at the Swiss Federal Institute of Technology, one full semester course.
2. Dr. Hausler attended a two day seminar on Statistical Design and Evaluation of Experiments by Stewart Hunter and Norman Draper presented in Detroit May 19-20, 1967.
3. Dr. Hausler subsequently studied statistics on his own time using the following bibliography:
    a. Owen L. Davies: *Statistical Methods in Research and Production (Hafner)*
    b. Owen L. Davies: *Design and Analysis of Industrial Experiments* (Hafner)
    c. W. G. Cochran, G.M. Cox: *Experimental Design* (J. Wiley)
    d. C.A. Bennett, N.L. Franklin: *Statistical Analysis* (J. Wiley)
    e. K.C. Peng: *Design and Analysis of Scientific Experiments* (Addison, Wesley)

f. M. J. Moroney: *Fact and Figures,* (Pelican)
g. N.R. Draper, H. Smith: *Applied Regression*
h. G. E. P. Box, J.S. Hunter, *Fractional Factorial Design,* published in Technometrics, 3., (#3), 311 (1961), and 3., (#4), 449 (1961)
i. J.S. Hunter, *Some applications of Statistics to Experimentation (EVOP),* Chem. Eng. Progress Symposium Series Vol. 56, #31, (1960)
j. L. Bryce Anderson, *Statistics in Chemical Engineering,* (in 12 parts in CE Refresher, Chemical Engieering, 69, (22) 119-123 (1962), and 11 subsequent installments.

4. Lecturing in Statistics

While at UOP (former Universal Oil Products Company, Mount Prospect, Illinois) Dr. Hausler developed a lecture series of 20 sessions of 2 hours each for the scientists and engineers in UOP's research department. The subjects covered were defines as

- Basics, Variance, F-test, and t-test
- Analysis of variance (examples from UOP researchers)
- Factorial Designs (examples from UOP Catalyst and Chemical Development Activities)
- Simple and Multiple Regression'
- Theory of least squares
- Assumptions of Normal Distribution
- Randomization (effectiveness of experimental designs)
- EVOP (Evolutionary Operations)
- Computer Applications `

All Lectures were patterned around live, timely applications.

- **Part 1**: Measures of Variability
- **Part 2**: Establish the Difference between two Analysts
  - Compare means on basis of "some sort of variance"
  - Compare the mean of the differences on some sort of variance
  - Calculate complete ANOVA
- **Part 3**: Ground Rules
  - Comparison of Means
  - Applications of F- Test
- **Part 4**: What do Different Variances mean
- **Part 5**: Basic Principle of the Analysis of Variance (ANOVA)
- **Part 6**: Real live Examples
  - Work done by Ed. Latos
    - Introduction of Anova to Crossclassification
- **Part 7**: Real Live Example
  - Work Done by Ed. Latos
    - Develop Equations for the Residual

        - The Interaction and its Origin
    - **Part 8**: Discussion of Homework
        - Review of 2 stage process and, Anova and Error Propagation
        - The Meaning of the various sums or squares in the Anova
    - **Part 9**: Discussion of Homework
        - How to separate interaction from residual
    - **Part 10**: Regression Analysis and Polynomial Curve Fitting
        - Application of Orthagonal Polynomials in Analysis of Variance.
    - **Part 11:** Introduction of Gaussian Error Propagation
    - **Part 12:** The General Analysis of Variance
    - **Part 13:** 3 Factor Experiments
    - **Part 14:** Design of Experiments, Factorial Theory
    - **Parts 15 through 20:** These parts dealt specifically with Factorial and Fractional Factorial Designs of Experiments, both in Theory as well as in practice.

5. **Additional Activities**

Dr. Hausler used statistical approaches in nearly all his consulting work. For instance: One of the clients in Japan was interested in establishing the use of 3% Cr-steel for oil and/or gas production in Venezuela. An extensive literature study revealed a multitude of experimental and field data, which needed to be correlated. Multiple correlation however revealed that there was no consistent picture, and all claimed conclusions were either invalid (because of irrelevant experimental procedures) or not applicable because of incomplete description of parameter field. A publication of this work is pending.

Dr. Hausler has also bee called upon repeatedly to analyze ILI pipeline data (intelligent line inspection) for the purpose of evaluating corrosion mechanisms, and/or inhibition effectiveness. In the course of this work extensive use of extreme value statistics was made in order to assess corrosion rates and predict time to failure.