ILLINOIS COMMERCE COMMISSION

DOCKET NO. 00-0714

PREPARED SURREBUTAL TESTIMONY OF

RUSSELL A. OGLE

AUGUST 1, 2001

I. INTRODUCTION

1. Q. Please state you name, business address and present position.

A. Russell A. Ogle, 1950 North Washington Street, Naperville, Illinois 60566. I am Vice President – Chemical Engineering for Packer Engineering, Inc.

2. Q. Please summarize your educational and professional qualifications.

A. I hold a Ph.D. from the University of Iowa in Chemical Engineering. IP Exhibit 4.2 is a copy of my resume summarizing my educational background and professional experience.

3. Q. What is the subject matter of your testimony?

A. Packer Engineering, Inc. was retained by Illinois Power Company on July 26, 2001 to perform a safety analysis of the Freeburg propane facility. IP Exhibit 4.3 is a copy of the report we prepared. It sets forth the reason for our retention, the scope of our investigation, our findings, and the conclusions and recommendations we reached.

4. Q. Does this conclude your prepared surrebuttal testimony?

A. Yes, it does.

Russell A. Ogle, Ph.D., P.E., C.S.P.

Vice President, Chemical Engineering

PROFESSIONAL EXPERIENCE

1995-Present PACKER ENGINEERING, INC. - Naperville, Illinois

This department is primarily concerned with the proper use of hazardous chemicals to prevent fires, explosions and releases to the environment. Recent project experience includes: scientific investigation of fires and explosions in residential, commercial, industrial and chemical plant settings; chemical process safety management; hazard analysis of materials, equipment and processes; failure analysis of chemical process equipment and processes; investigation of environmental compliance issues and risk management; and investigation of chemical exposure incidents.

1990-1995 Rust Environmantal & Infrastructure - Naperville, Illinois

Department Manager of Remediation responsible for managing thirteen engineers with annual revenue of $3,000,000. Performed, managed and directed remedial investigations, feasibility studies, remedial design and construction oversight projects. Technology experience includes groundwater pump and treat, soil vapor extraction, air sparging, bioremediation, thermal desorption, soil washing, slurry walls and soil covers. Work involved petroleum substances, hazardous wastes, radioactive materials, PCBs and asbestos. Experienced in federal and state cleanup regulations including CERCLA (Superfund), RCRA Corrective Action, Nuclear Regulatory Commission and Underground Storage Tanks.

1990-1990 Chemical Waste Management - Geneva, Illinois

Chemical Engineer II responsible for managing the operation of a pilot-scale treatability laboratory for thermal treatment of contaminated soils. Supervised one technician and managed a $400,000 annual operating budget. Conducted 17 treatability studies working with soils contaminated with volatile organics, heavy metals, PCBs and pesticides. Performed data evaluation, wrote reports, managed subcontractors and prepared proposals. Responsible for general laboratory management including tracking, handling and shipping hazardous waste samples; procurement of laboratory equipment and supplies; implementation of design modifications to the pilot-scale system; and compliance with all health, safety and environmental regulations.

1986-1989 Alliant Techsystems (formerly Honeywell Defense Systems) - Minneapolis, Minnesota

Principal Development Engineer and Project Manager for development engineering of military weapon systems. Performed engineering analysis, mathematical modeling, design and field testing of various propulsion and explosion devices. Coordinated and led the efforts of five to ten engineers and technicians on multiple projects with an annual budget averaging $750,000. Conducted engineering analyses on numerous propulsion and warhead concepts including feasibility, performance and optimization studies. Specific areas of expertise included gun and rocket propulsion, explosion dynamics, energetic material hazards and structural damage assessment due to blast or impact loading. Involved in the analysis, design and testing of several weapon systems.

ACADEMIC

Ph.D. University of Iowa, Iowa City, Iowa - Chemical Engineering (1986)

B.S. Purdue University, West Lafayette, Indiana - Chemical Engineering (1980)

CONTINUING EDUCATION

- Statistical Design Experiments (1987)
- Project Management (1987)
- Advanced Strength of Materials (1989)
- Management of Multiple Projects and Conflicting Priorities (1992)
- Industrial Wastewater Treatment (1993)
- Boiler Operations (1999)
- Root Cause Analysis of Accidents (TapRooT) (2000)
- Methods for Sizing Pressure Relief Vents (2000)

PROFESSIONAL REGISTRATION AND CERTIFICATION

LICENSES

Licensed Professional Engineer in Illinois

CERTIFICATIONS

Certified Safety Professional

AFFILIATIONS

American Chemical Society
American Institute of Chemical Engineers
American Society of Safety Engineers
Combustion Institute

National Fire Protection Association
National Safety Council
Society of Fire Protection Engineers

PUBLICATIONS & PRESENTATIONS

1. R.A. Ogle, J.K. Beddow, A.F. Vetter and L.D. Chen, “Thermal Theory of Laminar Premixed Flame Propagation”, Chemical and Physical Processes in Combustion, Eastern States Section: The Combustion Institute, Providence, Rhode Island, (1983).

2. R.A. Ogle, J.K. Beddow and A.F. Vetter, “Numerical Modeling of Dust Explosions: the Influence of Particle Shape on Explosion Intensity”, Process Technical Program: International Powder Bulk Solids Handling Process, Rosemont, Illinois, (1983).

3. R.A. Ogle, J.K. Beddow, A.F. Vetter and L.D. Chen, “ Thermal Theory of Laminar Premixed Dust Flame Propagation”, Combustion and Flame, 58:77-79 (1984).

4. R.A. Ogle, J.K. Beddow and A.F. Vetter, “Applications of Symmetry Classifiers in Morphological Analysis”, 9th Annual Powder & Bulk Solids Conference/Exhibition, Rosemont, Illinois, (1984).

5. R.A. Ogle, P.D. Scholz, J.K. Beddow and A.F. Vetter, "Free Molecular Electrophoresis of Highly Dispersed Aerosol Particles in an Isothermal Gas", 16th Annual Meeting of the Fine Particle Society (1985).

6. R.A. Ogle, “A New Strategy for Dust Explosion Research; A Synthesis of Combustion Theory, Experimental Design and Particle Characterization”, Ph.D. Dissertation, University of Iowa, (1986).

7. R.A. Ogle, “A New Strategy for Dust Explosion Research”, 17th Annual Meeting of the Fine Particle Society, San Francisco, California, (1986).

8. R.A. Ogle, “Dust Explosion Kinetics”, 17th Annual Meeting of the Fine Particle Society, San Francisco, California, (1986).

9. R.A. Ogle, “Parametric Sensitivity of a Mathematical Model for Closed Bomb Dust Explosions”, Chemical and Physical Processes in Combustion, Eastern States Section, The Combustion Institute, Gaithersburg, Maryland, (1987).

10. R.A. Ogle, J.K. Beddow, L.D. Chen and P.B. Butler, “An Investigation of Aluminum Dust Explosions”, Combustion Science and Technology, 61:75-99 (1988).

11. R.A. Ogle, E.H. Peterson, O.A. Souka and T.J. Holmquist, “The Effect of Recoil Dynamics and Soil Response on the Interior Ballistics of a Lightweight Launcher”, 1989 JANNAF Propulsion Meeting, Cleveland, Ohio, (1989).
12. C.B. Brumleve, S. Joyner and R.A. Ogle, “Hydrogeology and Remedial Action Modeling for a Superfund Site in a Glaciated Area”, Solving Ground Water Problems with Models Conference, National Ground Water Association, Dallas, Texas, (1992).

13. R.A. Ogle, "The Role of Incident Investigation in Mechanical Integrity Programs", American Petroleum Institute, 61st Spring Refining Meeting, Chicago, Illinois, (1996).

14. R.A. Ogle and J.L. Schumacher, “Application of Fire Testing and Modeling in a Forensic Investigation”, Society of Fire Protection Engineers, 2nd International Conference on Fire Research and Engineering, Gaithersburg, Maryland, (1997).

15. R.A. Ogle and J.L. Schumacher, “Fire Patterns on Upholstered Furniture: Smoldering vs Flaming Combustion, Fire Technology 34:247-265 (1998).

16. R.A. Ogle and J.L. Schumacher, “Investigation of an Explosion and Flash Fire in a Fixed Bed Reactor”, Process Safety Progress, 17:127-133 (1998).

17. R.A. Ogle and J.L. Schumacher, “Investigation of a Steam Explosion in a Petroleum Product Storage Tank”, Process Safety Progress 17:171-175 (1998).

18. R.A. Ogle, “Explosion Hazard Analysis for an Enclosure Partially Filled with a Flammable Gas”, Process Safety Progress 18:170-177 (1999).

19. R.A. Ogle, “Explosion Risk Analysis for a Commercial Building Near a Closed Landfill”, SFPE Symposium on Risk, Uncertainty and Reliability, Society of Fire Protection Engineers, Baltimore, Maryland (1999).

20. R.A. Ogle, K.M. Smith and S. Strack, “Investigation of a Boiler Explosion Caused by a Natural Gas Detonation”, American Society of Mechanical Engineers, Pressure Vessels and Piping Conference, Boston, Massachusetts, (1999).

21. R.A. Ogle and A.R. Carpenter, “Fire Patterns on Combustible Flooring”, Society of Fire Protection Engineers, 3rd International Conference on Fire Research and Engineering, Chicago, Illinois, (1999).

22. R.A. Ogle, “Ethics in Forensic Chemical Engineering”, AIChE Spring National Meeting, American Institute of Chemical Engineers, Atlanta, Georgia, (2000).

23. R.A. Ogle, “The Need for Scientific Fire Investigation”, Fire Protection Engineering, Issue No. 8 (Fall 2000).

24. R.A. Ogle and D.R. Morrison, III, “Evaluation of Accident Investigations Conducted by Regulatory Authorities and Advisory Agencies”, Beyond Regulatory Compliance: Making Safety Second Nature, Mary Kay O’Connor Process Safety Center, Texas A&M University, College Station, Texas (2000).

25. R.A. Ogle and D.T. Morrison, “Investigation of an Acid Spill Caused by the Failure of an Air-Operated Diaphragm Pump”, Process Safety Progress, 20:41-49 (2001).

26. R.A. Ogle and A.R. Carpenter, “Lessons Learned from Fires, Flash Fires and Explosions Involving Hot Work”, AIChE Spring National Meeting, American Institute of Chemical Engineers, Houston, Texas (2001)

SAFETY ANALYSIS OF THE FREEBURG PROPANE PLANT

INTRODUCTION

Illinois Power operated a propane plant in Freeburg, Illinois, from 1971 to 2000. The Illinois Commerce Commission (ICC) staff has questioned why Illinois Power decided to retire the plant in 2000. Illinois Power has reported that safety and the potential for additional regulatory compliance issues factored significantly in the retirement decision. It is Packer Engineering's understanding that the ICC staff has questioned the validity of Illinois Power's safety concerns.

Packer Engineering was retained by Illinois Power Company to perform an independent safety analysis of the Freeburg facility. This report is a summary of our findings.

INVESTIGATION

Packer Engineering has reviewed the original design documents for the Freeburg facility, as well as technical publications, consensus standards and government regulations. Documents relating to the facility that were reviewed include the following:

1. Letter from Pittsburgh Corning Corporation to Mr. Wayne Hood dated July 23, 1996;
2. Handwritten drawings dated June 12, 1996
3. Infrared Scanning Technologies Thermographic Report
4. Infrared Scanning Technologies Thermal Difference video tape
5. Construction drawings
6. Illinois Power Company, Freeburg Propane Vapor Plant, Operating Manual B-39950

External sources consulted include, but are not limited to, the following:

1. Hildebrand and Noll. Propane Emergencies. Red Hat Publishing, Chester, MD (1999)
2. Lemoff. LP-Gases Handbook, 4th Edition. NFPA, Quincy, MA (1995)
3. Center for Chemical Process Safety (CCPS). Guidelines for Evaluating the Characteristics of Vapor Cloud Explosions, Flash Fires and BLEVEs. American Institute of Chemical Engineers (AIChE), New York (1994)
4. CCPS. Guidelines for Evaluating Process Plant Buildings for External Explosions and Fires. AIChE, New York (1996)

SCOPE OF ANALYSIS

The scope of Packer Engineering's analysis addresses four main safety topics:

- Propane Hazard Analysis
- Mechanical Integrity of the Propane Storage Vessel
- Safety Management and Regulatory Compliance
- Additional Costs of Operating the Facility

Propane Hazard Analysis

Propane is a severe fire and explosion hazard. As with any flammable gas, the hazard of fire and explosion is directly proportional to the quantity of propane released (i.e., the severity of the fire or explosion grows as more propane is released).

At ambient conditions, it is a clear, colorless, odorless gas. However, in industry it is most commonly stored and transported as a pressurized liquid. When released from its container into the atmosphere, it returns (vaporizes) to the gaseous state. Propane vapor occupies 240 times the volume occupied by its liquid. Thus, a small quantity of liquid propane, once vaporized, can occupy an enormous volume of space. A container of fixed volume and pressure rating can hold much more propane than natural gas because the natural gas does not liquefy at room temperature and modest pressures (100 to 250 pounds per square inch, psi).

The fact that propane exists as a liquid presents a special hazard not found with natural gas: the ability to suffer a Boiling Liquid Expanding Vapor Explosion (BLEVE). In the event of a fire caused by a leak in the propane storage system, the storage vessel can become weakened by the fire, which allows the vessel to rupture. The vessel rupture results in the spontaneous (and nearly instantaneous) vaporization of the propane liquid. The presence of a pre-existing fire nearly guarantees the ignition of the propane, resulting in a devastating explosive blast and fireball.

The Freeburg facility stored approximately 800,000 gallons of liquid propane. In the event of a BLEVE, the consequences would be enormous:

- The primary fireball would measure approximately 2,100 feet in diameter.
- The explosive blast would destroy any residential or commercial structures within 1.2 miles of the facility.
- The explosive blast would break windows in buildings out to a distance of 3 miles from the facility.
- The fireball would cause second-degree burns to exposed human skin at a distance of 1.75 miles from the facility.

Predictions of the fire and explosion damage caused by an accident such as this contain some uncertainty. The reported distance from the facility to the nearest community (2.5 miles) is not a sufficient buffer zone distance to protect these residents from injury and/or property damage.

A cursory review of the fire literature demonstrates that these accidents happen:

- Feyzin, France, 1966: fire at a propane storage facility resulted in the BLEVE of a 300,000 gallon sphere; 18 fatalities, 81 injured.
- Crescent City, Illinois, 1970: fire resulted in the BLEVEs of multiple Propane Rail Cars; 66 injuries.
- Rio de Janiero, 1972: fire at refinery resulted in a BLEVE of a 420,000 gallon sphere of propane; 37 fatalities, 57 injured.
- Texas City, Texas, 1978: series of fires and explosions involving three propane spheres, each of 210,000 gallon capacity; no fatalities or injuries.

- Mexico City, Mexico, 1984: multiple BLEVEs of propane spheres; over 500 fatalities.

Aside from an accidental release, another potential mechanism for the release of propane at the Freeburg facility is an act of terrorism. In 1999, the Federal Bureau of Investigation investigated two separate attempts to commit an act of terrorism against propane storage facilities (one in Illinois and one in California). Both incidents were thwarted, but the threat has nevertheless been demonstrated.

Mechanical Integrity of the Propane Storage Vessel

The vessel in question is 30 years old. There is a lack of inspection or test data to address the integrity of the storage vessel. This is not uncommon for a storage vessel in this type of service. However, there is evidence of corrosion of the vessel wall due to water trapped between the vessel and its exterior insulation. Therefore, prior to further service, it is recommended that the vessel be tested to determine whether corrosion has significantly degraded the wall thickness of the vessel. Our estimates of expected corrosion rates indicate that the expected operating life of the vessel may have been exceeded and that repairs or replacement of the vessel may be necessary.

The associated piping and equipment also require careful inspection. In many flammable vapor accidents, the piping and equipment were the source of the initial leak rather than the storage vessel itself.

Safety Management and Regulatory Compliance

There are five issues of concern with regards to safety management:

1. Fire protection
2. Operator training
3. Emergency response
4. Physical security
5. Regulatory compliance

The current fire protection systems and procedures for the Freeburg facility are adequate only for small fires controllable by on-site personnel. In the event of a serious fire that could lead to a BLEVE, the Freeburg facility is not adequately protected. Depending on the level of fire risk deemed acceptable by Illinois Power, it may be necessary to install fire monitors (permanently fixed hose streams) capable of delivering up to 5,000 gallons per minute of water for a period of up to one hour. This implies the need for fire pumps, piping, back-up power supplies for the pumps and a water supply of 300,000 gallons. This level of protection can be reduced to the extent it is possible to rely on the local fire department for support and on the ability to access a reliable municipal water supply. Further study would be required to establish a reasonable level of protection.

Illinois Power has properly identified operator training as a safety-critical element of the Freeburg facility. The effectiveness of operator actions in preventing or mitigating accidents decreases as the frequency of operation decreases, i.e., routine operations become non-

routine. Without formalized training and practice, the probability of operator error may increase as the operator becomes less familiar with the facility and its equipment.

The closest fire department to the Freeburg facility is the Freeburg Volunteer Fire Department, which is located 2.5 miles from the facility. Volunteer fire departments tend to have smaller training budgets and less experience in dealing with propane fires than full-time fire departments. This may be a strong argument for increasing the level of fire protection at the Freeburg facility.

Although the plant currently is compliant with applicable safety regulations, there are two bodies of regulation that should be considered as potentially applying to the facility in the future. These are Process Safety Management regulations (OSHA) and Risk Management Program regulations (USEPA). Both sets of regulations apply to facilities that handle large quantities of flammable gases. They require development of safety programs and documentation far beyond what is normally done in a typical industrial operation. Should the Freeburg facility ever become subject to these regulations, the cost impact could be substantial.

Additional Costs of Operating the Facility

Packer Engineering has developed the following additional costs associated with operating the Freeburg Propane facility. These costs do not include any equipment replacement or repairs previously identified by Illinois Power.

Develop New Operator Training Program	$50,000
Annual Operator Training	$10,000
Update Engineering Documents	$30,000
Comprehensive Propane Sphere Inspection	$75,000
BLEVE Fire Protection Equipment	$500,000

These additional costs result in a total of $665,000 for the continued operation of the facility and to provide an increased level of safety to the surrounding community not previously identified by Illinois Power.

CONCLUSIONS

Packer Engineering has performed a safety analysis of the Freeburg Propane facility. Our conclusions are summarized below:

1. The propane storage facility is far more hazardous to operate than a natural gas storage field.
2. The propane storage vessel should be inspected prior to further use. It is probable that it has exceeded its useful life due to corrosion.
3. There are a number of safety management issues that require further study before the facility could be put back into service. Numerous safety measures may require implementation to achieve a level of protection acceptable to Illinois Power.

This report is based on current information. Packer Engineering reserves the right to supplement this report as new information becomes available.

PACKER ENGINEERING, INC.

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