MICHEL WHITAKER, P.E.

Summary: Twenty-five years of engineering experience in maintenance, project, reliability and consulting engineering. Experience has been in nuclear power, specialty chemicals, commodity chemicals, sugar refining, mechanical support of an environmental engineering firm and energy management for the Air Force. Significant experience in the manufacture of copper sulfate pentahydrate, copper hydroxide, ammonium chloride, sulfuric acid and titanium dioxide. Work has covered all facets of manufacture including process engineering, support and design of a large variety of process equipment, particularly materials handling, spray dryers, crystallizers, micronizers, burners, calciners, rotary dryers, drum dryers, pumps, heat exchanger, scrubbers, utilities (including boilers and steam, including superheated steam, air compressors, chillers, water and industrial gases), dust collection, bag-houses and packaging. Project work typically included initial feasibility studies of entire projects including process and utility requirements, preliminary design, HAZOPs and other hazard analysis, cost justification packages, detailed design, construction management, startup, troubleshooting, maintenance and operator training, Management of Change documentation, maintenance spare parts and other follow-up.

Professional Experience:

May 2010 to Present: Indigo Consulting Group, LLC, Beaufort, SC

- **Vice President, Engineering**: Design, project engineering and project management for multi-faceted consulting practice that focuses on FDA regulated industries such medical devices, pharmaceuticals, cosmetics, and foods. Recent activities include Project Manager for demolition of a large chemical facility, EO scrubber process risk analysis, and ethylene oxide sterilization facility PM /SOP development.

February 2011 to October 2011: Hargrove Engineers + Constructors, Savannah, GA

- **Senior Mechanical Engineer IV:** Design, project engineering and project management to all manner of clients, primarily in the chemical realm. Assignments included P&ID development, detailed design and scope development for a $10MM expansion, Senior Mechanical Engineer for a $24MM new plant and design / construction management for a $1.5MM catalyst plant reconfiguration. Responsibilities included mentored junior engineers with less industry experience.

May 2010 to February 2011: Tetra Tech-EMI, San Diego, CA

Tetra Tech is a large, multi faceted engineering firm providing services to the public and private sector. Their EMI division focuses on energy and resource management for the military services.

- **Resource Efficiency Manager (REM):** Provided energy and resource management for the Air Force Combat Command for Shaw Air Force Base in Sumter, SC. The role entailed communication with the various customers in the Air Force, other REMs in the network to provide cost effective solutions to the client's energy and resource needs to support Executive Orders and other government mandates.

Jan. 2010 to May 2010: Imperial Sugar, Port Wentworth, GA

Imperial Sugar is a sugar refinery which converts raw sugar to various grades of white, powdered brown and liquid sugar. Facility employs large numbers of pumps, blowers, conveyors, dust collection, product conveying and high speed packaging equipment. Site is managed under FDA GMP regulations as a food manufacturer. The facility is under close OSHA scrutiny particularly as it relates to combustible dust.

- **Reliability Engineer:** Reported to the Reliability Engineering Supervisor assigned to support development of a new reliability engineering department. Tasks included update and set up

of a vibration monitoring system and implementation of infrared inspection, lubrication analysis and other inspection programs as needed by the plant. Work also included development of TPM, 5S and various FMEA techniques to support the plant while also providing maintenance and process engineering support during plant startup after a two year idle time.

Apr. 1998 to Dec. 2009: Kemira/Kerr-Mcgee/Tronox Pigments, Savannah, GA

Manufacturers of Titanium Dioxide pigment, a premium whitener and opacifier using the Chloride process. Site utilized chlorine in a coke-charged high temperature fluidized bed to chlorinate the Titanium, then various distillation, separation, treatment, milling and packaging systems to complete the process. The site employed Process Safety Management and Risk Management Program regulated materials as well as other acids and bases, requiring careful and complete documentation of the process and a thorough knowledge of various materials of construction. (The TiO_2 operation was closed in Dec. 2009).

- **Reliability Engineering Group Leader:** Direct supervisor for a team of engineers and technicians responsible for all aspects of reliability improvement. This includes NDT of vessels and piping, particularly as it regards Process Safety Management. Focus was on cost savings, increase in MTBF, vibration monitoring, lubrication, improved maintenance practices, training and engineering for reliability. Improved the vibration monitoring program and developed a robust backlog system to document and prioritize NDT related repairs while continuing to design and implement capital projects.
- **Senior Project Engineer:** Develop and implement capital projects within the project engineering group. Included development of scope, funding authorization, detailed design, installation, commissioning, maintenance spare parts, etc.
- **Reliability Engineer:** Developed maintenance strategies, procedures and documentation, along with maintenance upgrades and maintenance-oriented capital projects. The goal was to increase up-time and profitability.
- **Chloride Business Unit Maintenance Engineer:** Focus was on small capital projects (up to $1MM), including all disciplines: mechanical, electrical, civil/structural, control engineering, facilities, etc., with emphasis on rapid development and implementation. Approximately 20% of efforts were directed at maintenance engineering.
- **Sitewide Maintenance Project &Construction Engineer:** Project Engineering efforts focused on maintenance and capital projects ranging up to $1.2 million including member of an energy use reduction team focused on reducing waste in all types of utilities (gases, HVAC, steam, water, electricity, etc.) Direct supervision and expansion of a Maintenance Construction group aimed at reducing dependence on outside contractors.

  Notable accomplishments include design of a ceramic-lined fluid energy mill, saving over $1MM per year, development of a detailed procedure to eliminate installation failures of a high speed motor that had bedeviled the company for twenty years, redesign of a repulper, reducing failure rates from twice per year to indefinite life, and implementation of various mechanical sealing systems and proper installations, yielding dramatic increases in Mean Time Between Failure.

Mar. 1996 to Dec. 1997: **Mechanical Engineer/Project Manager,** RMT/Hydroscience, Inc., Beaufort, SC

RMT/Hydroscience was an office of RMT, Inc., an environmental consulting engineering firm. (The office was closed in Dec. 1997) Major design projects entailed detailed design and project management for:

- Utilities for an industrial park, including sewer, potable water and fire protection
- Dust collection systems
- Steam piping/traps/insulation systems
- HVAC Designs (VAV, Constant Volume, DX, Fan Coil)

Mar. 1993 - Mar. 1996: **Plant Engineer,** Phibro-Tech, Inc., Sumter, SC

Phibro-Tech produces a variety of copper based products and copper etchants including the recycling of copper bearing hazardous waste streams by extract the copper and render the remainder non-hazardous. As Plant Engineer, handled a broad range of tasks including:

- Technical guidance for the maintenance department
- Facilities, safety, project and maintenance engineering
- Capital budget of approximately $1,000,000
- Development of Preventive Maintenance programs
- Hands on experience designing and maintaining all plant and utilities systems including compressed air, packaging, bulk handling, instrumentation, water, wastewater, chillers, chemical processing equipment, buildings, floors, etc.
- Overall design/construction responsibility for a complex major expansion. First time in plant history that a major system started up and worked properly essentially first try

Dec. 1990 - Mar. 1993: **System Engineer,** Carolina Power & Light, Robinson Nuclear Project, Hartsville, SC:

Assigned technical responsibility for all aspects of several cooling and accident mitigation systems, as well as preventive and predictive maintenance.

- Performed and reviewed testing on various components (pumps, valves, heat exchangers, etc.).
- Reviewed and prepared maintenance, operating & test procedures for the systems.
- Significant time spent planning outage maintenance and modification activities.

Sept. 1986 - Dec. 1990: **CO-OP Student Engineer,** Carolina Power & Light, Robinson Nuclear Project, Hartsville, SC:

Performed a wide variety of engineering evaluations of plant equipment and conditions.

- Implemented plant modifications, prepared and reviewed operating, engineering and maintenance procedures.
- As a part-time employee, managed and co-designed a temporary shutdown cooling system budgeted at over $1,000,000.

Education:

University of South Carolina: Graduated 1990, B.S. Mechanical Engineering
Clemson University: Graduated 1980, B.S. Agricultural Mechanization and Business

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License: Professional Engineer, South Carolina No. 18022, TWIC, expiration 10 May 2016

Training: Chesterton Rotating Equipment and Mechanical Seal School; Jenike and Johanson's Introduction to Flow of Solids in Bins, Hoppers and Feeders; AICHE Drying, Relating Principles to Design; Certified Energy Manager training, Lean Manufacturing, IBC 2003 Structural Steel training, Emerson Process Management: Fundamentals of Vibration and Fundamentals of the 2120

Skills: Autocad versions 12 through 2004, Microsoft Office Programs (Word, Excel, etc.), Microsoft Project

Engineering Code/Standard Familiarity: ASME Section VIII, Div. 1, ASME B31.3, API-510, API-653, API-570, API-574