DESIGN CONSIDERATIONS FOR A TEN MILLION DOLLAR MIXED WASTE TREATABILITY LABORATORY

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ABSTRACT

The design of a new mixed waste treatability laboratory must consider use of state-of-art technologies for proper performance. Chem-Nuclear Environmental Services, in conjunction with Clemson University, is designing and building a ten million dollar facility for mixed waste treatment technologies. By using the hazardous waste laboratory and treatment systems of Chemical Waste Management and the nuclear laboratory and treatment experience of Chem-Nuclear Systems, CNES is designing a new laboratory. This paper addresses the concerns and design considerations of the laboratory and the transfer of operations from Chem-Nuclear Laboratory Services.

INTRODUCTION

Chem-Nuclear Environmental Services, Inc. (CNES), through its subsidiary, Chem-Nuclear Laboratory Services, Inc., is constructing a $10 million mixed waste treatability laboratory at Clemson Research Park in Clemson, South Carolina. The facility will be collocated with Clemson University's graduate level Department of Environmental Systems Engineering Center. Together, Chem-Nuclear and Clemson University will form a cooperative relationship to develop mixed waste treatment technologies. This unique partnership of academia and industry will facilitate the development of emerging treatment technologies for mixed waste from the research and development phase to the demonstration and field application phase.

Clemson University will conduct basic research with funds provided by CNES and other sources, such as the South Carolina University Research and Education Fund (SCUREF) managed by Westinghouse Savannah River Site and the U.S. Department of Energy. Promising technologies developed by Clemson University researchers will be evaluated and refined by CNES in our treatability laboratory. Pilot scale demonstrations will allow CNES's staff of engineers and scientists to modify, enhance and optimize operational conditions and process designs.

The Clemson Environmental Laboratory will be approximately 36,000 square feet and will have a full-time staff of approximately 50 engineers and scientists. The laboratory will serve as the focal point and sponsorship for infusion of talent to the mixed waste treatment arena from the entire Chemical Waste Management (CWM) family of companies. CWM employs a research staff of over 200 engineers involved in technology development at its Geneva Research & Development Center. In addition, another subsidiary of CNES, Sirrine Environmental Consultants, Inc. (SEC) in Greenville, South Carolina, employs a staff of nearly 200 and provides engineering consulting services to both private industries and federal government agencies including Department of Energy (DOE) prime contractors.

During the early planning stages of the Clemson Environmental Laboratory, we included a high-performance analytical laboratory in order to properly characterize mixed waste samples for the DOE and to support the treatability mission. The Clemson facility therefore will include a 12,000 square foot analytical lab equipped with extensive instrumentation designed to support the mixed waste industry.

In order to expedite the development of the Clemson mixed waste treatability facility, CNES acquired Enwright Environmental Consulting Laboratories, Inc. in 1990 to provide a core professional staff to facilitate the laboratory's management and operation. Enwright was selected based upon its location, staff base and experience in characterizing mixed wastes and performing treatability studies for the DOE, which lend themselves well to this mission.

Further, Enwright's two (2) laboratory facilities located in Greenville, South Carolina, both of which are licensed to handle low-level radioactive materials, are providing interim analytical and treatability services until the Clemson laboratory becomes operational in late 1991. Services will continue to be provided to DOE prime contractors at the Savannah River Site, Oak Ridge National Laboratory, Idaho National Engineering Laboratory, Feed Materials Production Center (Fernald), and the Portsmouth Gaseous Diffusion Plant.

Laboratory management will also be guided by Chemical Waste Management, Inc. (CNES's parent company) philosophy. CWM operates a network of approximately 35 laboratories nationwide, most of which are in support of its treatment, storage or disposal facilities. Each of these laboratory facilities is constructed in a manner to ensure safe handling of materials and to ensure compliance with environmental regulations. All operations must meet CWM's standard, high-quality criteria. This same philosophy of mandatory facility and program adequacy is being applied to the design of the CNES laboratory.

To accomplish CNES's objective of providing a safe and efficient facility for compliance with environmental and

nuclear regulatory agencies, special design considerations are being incorporated into the facility guided by a project team consisting of facility users (process engineers and scientists), corporate regulatory personnel, health and safety personnel, and environmental compliance personnel coupled with a strong project management team under CNES's sponsorship. This team has been instrumental in guiding a design that we believe will be a one-of-a-kind, state-of-the-art facility.

The design is being developed by a local, industrial-based engineering firm teamed with a laboratory specialty architectural firm. To facilitate a rapid development schedule the project is being managed on a fast-track basis with several unique construction packages being produced.

The CNES Clemson laboratory will be a two-level facility. The lower level will be dedicated to treatability studies, sample receiving, storage, and fingerprinting, and will include work space for bench scale testing and large bay areas for performing pilot scale demonstrations. The treatability bays will extend through the second level where work can be viewed from a viewing corridor by client and community group tours. Process areas will have limited access with entry and exit by employees only through rigidly controlled contamination screening facilities. The treatability area will contain monitored HEPA filtration systems at each bay which will connect to a common discharge point. Each work bay will have containment dikes as well as sloped floors towards a center collection area. Each process area will be under negative pressure. All process and laboratory wastewaters will be collected and pumped through a separate collection system to an above ground storage tank with level alarms. This tank will be monitored, and its contents pre-treated, if necessary, prior to discharging into local public treatment plant.

The upper level will house CNES's high-performance, analytical testing laboratories. Segregated laboratories will be constructed for organic, inorganic, metals, and radiochemistry instrumentation. The organic laboratory will contain gas chromatographs and gas chromatograph mass spectrophotometers. The metals laboratory will be equipped with inductively-coupled plasma spectrometers and atomic adsorption spectrometers.

CNES's radiochemistry counting laboratory will contain alpha spectrometers, liquid scintillation counters, gross alpha/beta counters, and gamma spectrometers. New, innovative technologies, such as the PERALS system for measuring alpha emitters, will also be included. Sample preparation areas will be under negative pressure to minimize laboratory-induced contaminants in the analytical instrumentation rooms. Robotics and auto samplers will be used to maximize the process of sample analyses.

Rigid environmental control systems will be installed for monitoring and treatment of all laboratory air emissions and wastewater discharges. All hood exhausts and local treatability exhaust systems will contain HEPA filters. Plumbing systems will segregate sanitary from laboratory wastewater for proper monitoring and control. No discharge of liquid or solid waste will be allowed from the treatability bays.

The facility will operate under a Radioactive Materials License issued by the South Carolina Department of Health and Environmental Control (SCDHEC), a TSCA permit for handling materials containing PCBs, a RCRA treatability exclusion permit, and a wastewater discharge permit issued by the local public treatment plant.

To comply with the requirement of a Treatability Study Exemption, the Clemson laboratory will operate with the following criteria:

- The quantity of waste for each study is limited to:
  - 100 kg of non-acute, hazardous waste per waste stream per process;
  - 1 kg of acute hazardous waste per waste stream per process;
  - 250 kg of soils, water or debris contaminated by acute hazardous waste per waste stream per process.
- The rate at which waste can be processed in a treatment study is limited to:
  - 250 kg of waste per day for the entire laboratory.
- The amount of waste that can be stored is limited to:
  - 1000 kg waste, i.e. "as received waste."
- The unused sample and any residue generated from treatment must be moved off site.
  - within ninety (90) days after study completion; or
  - one year after receipt of the sample (whichever is earlier).
- Special requirements apply to reporting and recordkeeping but, in general, deal with what information should be recorded and the length of time records are to be maintained.

All mixed wastes and sample residues will be collected locally at the bench level and moved *to a waste* storage area. Since there is presently no commercial mixed waste facility permitted, these wastes will be packaged according to DOT regulations and shipped overland back to the generator. By product low-level radioactive waste (non-mixed waste) will be disposed of at Chem-Nuclear's low-level disposal facility in Barnwell, South Carolina. Whereas, solely hazardous

wastes will be disposed of at one of Chemical Waste Management's permitted RCRA facilities.

Chem-Nuclear Environmental Services, Inc., using all of Chemical Waste Management, Inc. resources, has many technologies which we are confident can solve mixed waste problems. The technologies can either treat the hazardous component of mixed waste or treat the radioactive component. Both alternatives or a combination of both will be used to evaluate and modify, if necessary, existing technologies. Examples of these technologies and capabilities include:

- X*TRAX™ - a low-thermal desorption process for removing organics, which has shown great success in remediating Superfund sites and has been successfully demonstrated in EPA's SITE program and an on-site mixed waste demonstration at Martin Marietta Energy Systems' K-25 Site for wastes from the Y-12 Plant in Oak Ridge, Tennessee.
- PO*WW*ER™ - This is a patentable, proprietary process which combines evaporation and catalytic oxidation technologies for the treatment of process waters, leachate wastewaters, and contaminated groundwater.
- PCB-dechlorination - The KGME process is a new method for the chemical destruction of haloaromatics. This reagent offers significant advantages over the nucleophilic KPEG which is widely used.
- Solidification - Chem-Nuclear has numerous formulas for solidifying and stabilizing wastes containing organics, metals and radionuclides meeting the TCLP criteria.
- Bio-Remediation - Our staff has considerable experience in applying biotechnology to the treatment of wastewaters, soils, groundwater, and solid wastes.

In addition to demonstrating our technologies, the Clemson laboratory will be used to evaluate existing and emerging,commercially available technologies. CNES's approach to developing mixed waste technologies will be conducted using the approach illustrated in Fig. 1, Technology Development Logic.

Upon completion, the Clemson laboratory will be one of the premier mixed waste treatability facilities in the country. This facility will have the combined the knowledge of Chemical Waste Management hazardous laboratory criteria and radioactive laboratory programs to ensure safe successful mixed waste treatability studies.

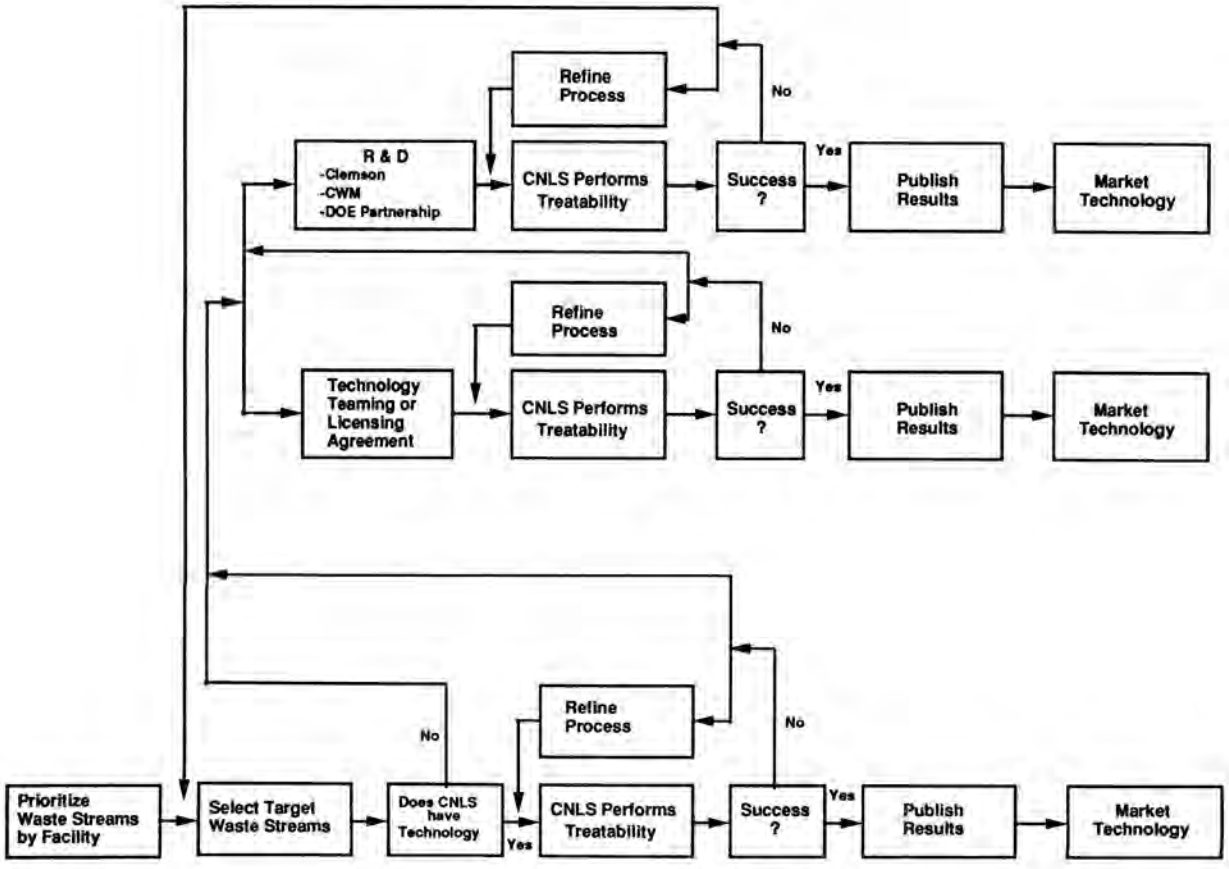

Fig. 1. Technology Development Logic.