■ DIAGNOSTIC INSTRUMENTATION & ANALYSIS LABORATORY ■

LONG-TERM STEWARDSHIP

CAPABILITY STATEMENT JUNE 2000

The Diagnostic Instrumentation and Analysis Laboratory (DIAL) at Mississippi State University is a multidisciplinary group of scientists and engineers focused on measurement and testing. DIAL currently has programs in the energy, environmental, infrastructure and industrial sectors. DIAL personnel have been involved with many sites across the DOE complex (e.g., Hanford, Savannah River, Oak Ridge, Fernald, Paducah). DIAL is a participant in NASA's remote sensing program, and has strong ties to programs in both the Army and the USGS which are relevant to the needs of the Long-Term Stewardship (LTS) program. DIAL offers a unique combination of capabilities to support DOE's LTS program.

Innovative monitoring technologies

DIAL is the developer of a wide range of innovative monitoring technologies which are applicable to the LTS program.

• DIAL scientists have developed monitors for structures made from wood, concrete, and metal. These can provide real-time information about stresses on the structure, as well as status information on its structural integrity. DOE EM currently has title to approximately 10,000 structures. For most of these, radionuclides and hazardous substances will be stabilized in place, and the building sealed. Thus, knowing the condition of the structure, and being able to take preventive action, will be a key component of a successful stewardship program.

• In consultation with the SubCon Focus Area, we have developed a simple, inexpensive monitor for detecting moisture, for example in the vadose zone. This can serve as a "first alert" system for release of radioactive material from underground locations on arid sites.

• DIAL is developing ultra sensitive monitors for organic materials in soil, both for DOE and for the U.S. Army. For example, we have demonstrated that our cavity ringdown monitor for TNT can detect TNT vapor at the ppb level, and expect to extend that down to the ppt level. This is of importance because for many DOE sites, residual organic material is likely to be a major risk component. DIAL has active programs developing instrumentation for VOCs, aromatics, and other hazardous organics as well.

• DIAL is developing several monitoring systems for sensitive detection of radionuclides and hazardous inorganic species. For radionuclides, these systems will be capable of isotopic resolution, if necessary, as well as trace analysis. We have demonstrated the ability to detect hazardous metals in air at the microgram per cubic meter level. DIAL has worked with theU.S. Army Corps of Engineers to adapt some of these techniques to use with a cone penetrometer.

• DIAL has a very active spectral imaging program. Identification of *hot spots* - areas of higher concentrations of hazardous species - is an important feature of these programs.

Remote sensing

DIAL is also involved in programs exploring the use of remote sensing for soil and plant monitoring. For example, we are participating in a program analyzing the use of remote sensing data for soil characterization and plant stress monitoring. In follow-on studies, we plan to investigate the use of remote sensing data to monitor heavy metal uptake by plants. With the growing emphasis on phytoremediation within the DOE complex, application of techniques aimed at monitoring uptake of radionuclides and other contaminants by vegetation will be essential.

Knowledge fusion

DIAL has also made important theoretical and practical contributions in the area of knowledge fusion. For many closed sites, more than one source of information will be available to determine the effectiveness of a closure action. For example, the effectiveness of a clay cap over a closed burial ground might be monitored by moisture infiltration and by release of contaminants. It is inevitable that disparate information sources will give conflicting information. The LTS program needs the capability to consistently and correctly act on conflicting information. Working for DOE ID, DIAL has identified the best knowledge-engineering approaches to fuse sometimes conflicting information, and has developed practical systems based on those approaches to direct site actions.

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Web-based data acquisition, control and remote monitoring

DIAL also is experienced in web-based data acquisition, control and remote monitoring. For example, we designed an imaging system for monitoring a thermal treatment process. This system was actually in operation in Idaho, but monitored and controlled at DIAL. By providing similar capabilities, the LTS program can significantly enhance DOE's credibility with the public, while minimizing system costs.

Direct field support

Finally, DIAL's direct field support capability is almost unique among technology providers. Our instrumentation development is predicated on application to real-world problems. As a result, DIAL personnel are experienced in site investigations and assessments, and in meeting regulatory requirements. As an example, DIAL was responsible for characterizing a brownfield site for the local community, which required frequent interactions with regulators.

A STRATEGY FOR LONG-TERM MONITORING OF CLOSED SITES

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A Discussion Paper Prepared for Kathleen Falconer, BBWXI

Need

Over the past decade, the Department of Energy has taken its initial steps on the long journey toward eliminating the environmental legacy of the Cold War. In the coming century, DOE will complete remediation of nearly all of its sites. As a result, DOE will shift much of its environmental focus from management of active waste sites to monitoring of closed sites and facilities across the country.

This shift in focus is a huge undertaking. Management of waste is an active process, based on the assumption that contamination from the waste is likely to occur if action is not taken. The goal of waste management is essentially to maintain the waste in a stable condition. Conversely, monitoring is a passive activity: its focus is information, not action. The goal of monitoring is to detect a change in the condition of the waste - indicating movement - based on the assumption that the condition of the waste should not change, i.e., movement of contamination should not occur.

This shift from management to monitoring will require DOE facility managers to change the emphasis, type and allocation of resources at each site. Effective direction and management of the long-term monitoring component of the Stewardship program is essential to avoid unnecessary expenditure while ensuring program effectiveness. Key components which must be addressed are:

• **Personnel costs.** Roughly three-fourths of DOE's waste management bill is for people. If savings are to be realized by closing sites, then monitoring must be done with a minimum of human involvement.

• **Public involvement.** Experience at sites such as Hanford and Fernald indicate that, without public confidence, delays are inevitable, which drive up the total cost. While the public is unlikely to understand technical nuances, they will certainly expect assurance that no harm will befall them from a closed site. This translates into a requirement that monitoring must be reliable and able to provide timely warning of a change in condition of a given site. Further, it points out that public perception will also play an important role in determining what is done at a given site. Thus, it is in DOE's best interests to involve the public in its decision-making processes as early and often as possible.

• **"Long-term" means long-term.** Significant hazards may exist on a given site for decades if not centuries. Over that time frame, better solutions almost inevitably will evolve, particularly for monitoring. Obsolescence must be planned for. All too often, DOE's waste management program has not been able to take advantage of new technology, because removal of the old is prohibitively expensive. In

the case of long-term monitoring, new technologies in the area of long-lived batteries, telemetry, sensors, nanotechnology and remote sensing are likely to revolutionize site monitoring over the next quarter century. The monitoring component of the Stewardship program must be set up so that DOE can take advantage of advances such as these.

• **Adequacy of resources.** Every major DOE waste management project has suffered because of under funding of the analytical function. In the case of the DWPF, for example, the throughput of the facility is limited by the capacity of the analytical laboratory. In the case of the long-term Stewardship program, there is a danger that inadequate emphasis on the role of analysis and monitoring could undermine public confidence.

This Discussion Paper is a first step in establishing a dialogue which we hope will lead to our involvement in addressing some of these pivotal issues in DOE's Long-Term Stewardship program. DIAL and AEA Technology have the combination of technical and programmatic capabilities and experience which can help ensure that DOE develops a cost-effective and reliable monitoring program which will effectively meet its, and the public's, needs.

Proposed Approach

AEA Technology and the Diagnostic Instrumentation and Analysis Laboratory at Mississippi State University (DIAL) believe that the following approach goes a long way toward providing DOE with a cost effective and publicly-acceptable long-term monitoring program for DOE sites. This suggested approach for long-term monitoring will help focus DOE management, the technical community and other stakeholders on the risks associated with each site, and will lead to cost effective solutions which are acceptable to all. Elements of this approach are:

• Development of a risk-based process for identifying long-term monitoring needs. This process will include public involvement as a cornerstone. Use of risk as the determinant of what is needed will ensure that a consistent approach is taken across the entire DOE complex. The success experienced in the UK in gaining public acceptance of waste management decisions will also be utilized to reduce the danger of public perception hindering progress toward solutions.

• Selection of monitoring systems for each site which can detect any change in the condition of contaminated waste materials - whether the contamination is radioactive or chemical - in a timely fashion. The Stewardship program will do the same for monitoring the integrity of closed buildings. The Stewardship program is the only entity with the responsibility and the capability to optimize system costs, so it must take the lead in helping individual sites. However, because much of the requisite technology is outside the DOE community, involvement of such groups as the U.S. Army Corps of Engineers, NASA, and the USGS is a necessity.

• Establishment of an RD&D program to develop monitoring systems to fill any gaps identified through site-specific technology selection.

• Development of a monitor performance tracking program which will follow reliability, availability, maintainability, and performance of monitoring systems. This will be used to facilitate future cost and performance improvements through focused R/D.

• DOE's Stewardship program will establish an ongoing web-based system - similar to that in use in the UK - which will allow any member of the public to have access to all of the monitoring data at a given site. Through this public involvement, public confidence will be greatly enhanced. Both site managers and the public should see that, if followed, this approach will lead to effective and cost-controlled monitoring of closed sites and facilities. Through use of the approach, initial costs will be minimized, and there will be a path toward reducing the long-term mortgage without diminishing the performance of the monitoring system. The use of risk will ensure a consistent approach across the Department, and thereby avoid some of the problems which have occurred in managing the same types of wastes at different sites. Most importantly, this approach will allow DOE to reassure the public that DOE is doing the right thing, assure Congress that present costs are being held down and that DOE is on a path which will lead to enhanced perfor-

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mance (better information at lower cost) in the future.

AEAT and DIAL

DOE's Stewardship program will need a strong technical arm to implement this approach. AEAT and DIAL believe they have the skills needed to help DOE's Stewardship program in establishing and maintaining a successful long-term monitoring program.

AEAT works extensively in the risk management area, including the development of risk-informed approaches to decision-making and stakeholder involvement. Such techniques have proved to be highly effective in the UK and Europe, and have gained acceptance in other parts of the DOE EM program. Indeed, recent work for DOE has included risk communication approaches and an assessment of risk management issues in long-term stewardship. In addition, AEAT is a leader in implementing web-based systems which allow anyone complete real-time access to site monitoring data.

DIAL is the developer of a wide range of innovative technologies, particularly for monitoring non-radioactive species. These include monitors for structures, groundwater and soil characterization, and the use of remote sensing technologies to characterization of the status of

soil and vegetation. DIAL, too, has been involved with many sites across the DOE complex (e.g., Hanford, Savannah River, Oak Ridge, Fernald, Paducah). DIAL is involved in NASA's remote sensing program, and has strong ties to relevant programs in both the U.S. Army and the USGS.

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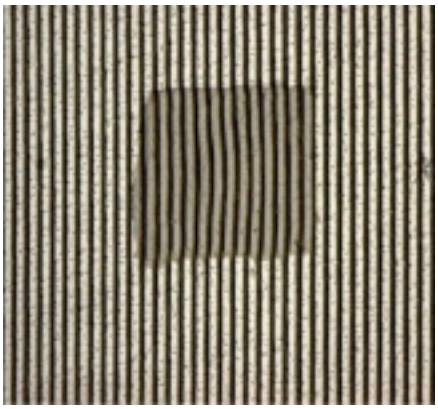

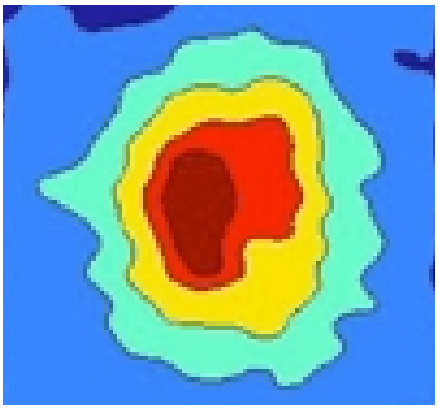

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