



D I A L

**Diagnostic Instrumentation & Analysis Laboratory
Starkville, MS 39759**

DRUM PRESSURE MONITOR

PROBLEM

At most waste sites, transuranic (TRU), low-level, and mixed wastes are stored in 55-gallon drums. Many of these drums contain hazardous, organic wastes as well. Radiolysis or other physical or chemical processes may result in gaseous emissions inside these drums. When this happens the pressure within the drum will increase, sometimes to unacceptable levels. In more drastic cases, these emissions may produce flammable or explosive atmospheres (e.g., hydrogen from radiolysis). Current regulatory procedures require that each drum be individually opened and inspected for the presence of hazardous organic waste. This situation will be dangerous for workers if either of the conditions described above exist (e.g., high pressure or flammable atmosphere). Several incidents have been documented at DOE Facilities in Oak Ridge, TN, Paducah, KY, Fernald, OH, and Hanford, WA in which drums were either ruptured as they were being moved or lids flew off as the drum was being opened. In most of these incidents, hazardous and/or radioactive wastes were spilled or sprayed about and workers were endangered.

PRINCIPLE

The lid of a 55 gallon drum is similar to the membrane of a drum. When a drum lid is tapped it vibrates at specific frequencies which are determined by its diameter and the tension of the membrane. The pressure in the drum directly affects the tension within the membrane lid. More specifically, the natural frequencies of vibration of the drum lid increase as the pressure inside the drum increases. Thus, the pressure within the drum can be determined by measuring the frequency at which the drum lid resonates.

TECHNOLOGY DESCRIPTION

The resonant frequency of the drum lid is determined by tapping on the lid with a soft object, such as a knuckle or an impact hammer with a soft tip, and "lis-

tening" to the resulting audible signal with a microphone. Standard signal processing techniques are used to convert this time domain signal to a frequency spectrum from which the resonant frequency of the drum lid can be determined. These signal processing techniques can be performed with either software or hardware. Currently the system is software based and can be easily transported to several different platforms (i.e. palmtop computer, DSP based architecture, or other hardware). In experiments conducted at DIAL in both 10 and 55 gallon drums, pressures as small as 0.2 psi have been detected. These changes are also audibly perceptible.

PATH FORWARD

Current efforts at DIAL are to design and build a simple, hand-held instrument that requires no specialized training to operate and works in real-time. The device will be able to detect whether the pressure inside a drum is at or above ambient. A slightly more sophisticated model will be able to predict the pressure within the drum with a resolution of approximately 0.2 psig. The device could be remote controlled for use with drums containing highly radioactive material.

Additional information about the Drum Pressure Monitor can be obtained by contacting:

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