Raymond N. Dickes Radiation Safety Officer Explosives Safety Officer Oilfield Services RECEIVED

NOV 1 9 2007

Schlumberger

# DNMS

November 15, 2007

U.S. Nuclear Regulatory Commission, Region IV Material Radiation Protection Section 611 Ryan Plaza Drive, Suite 400 Arlington, Texas 76011-4005

## RE: Event 43690, Reported to NRC Operations Center on October 4, 2007

Dear Sirs:

Schlumberger Technology Corporation ("Schlumberger") is filing this written report, as required by 10 CFR 20.2201, in regard to a missing fluid density meter ("Densitometer") from its Rock Springs, Wyoming facility. In accordance with NRC protocols, Schlumberger timely reported the missing Densitometer to the NRC Operations Center on October 4, 2007. An extensive search has not located the Densitometer.

On November 1, 2007 Schlumberger requested and was granted an extension until November 16, 2007 to file this report. The following report details the search for this Densitometer, Schlumberger's findings after a thorough investigation, the probable cause of the event, the potential for public exposures above public dose limits and corrective actions.

Event #:	43690
Date:	October 4, 2007
Company:	Schlumberger Technology Corporation
License:	42-27055-01
Location:	2901 Yellowstone Road, Rock Springs, Wyoming
Manufacturer:	Thermo MeasureTech
Model:	5192
Sealed Source and	TX0643D105B
Device Registration	
(SSDR):	
Serial #:	D111
Nuclide:	Cs-137
Activity:	111 mCi on October 4, 2007
	200 mCi per assay on February 25, 1982
Form:	Sealed Source contained within a shielded fluid density
	meter

#### TABLE 1 – KEY INFORMATION

## SUMMARY OF EVENT

During preparations for a routine compliance inspection of the Rock Springs, Wyoming facility on October 2, 2007, Schlumberger employees identified that one Densitometer could not be located at the operating base in Rock Springs, Wyoming. To ensure that this was not an administrative error, Schlumberger management in Rock Springs, Wyoming confirmed over the next two days that the Densitometer was not in use at remote wellsites or located at one of several neighboring Schlumberger operating bases. Schlumberger management in Rock Springs, Wyoming reported this to the Schlumberger Radiation Safety Officer (RSO), who reported this to the NRC Operations Center on October 4, 2007.

Schlumberger began a comprehensive search and investigation following this report to the NRC. As of the date of this report, Schlumberger has not located the Densitometer. Schlumberger has provided the Sweetwater County Sheriff's office with a description of the device and has offered a \$5,000 reward for the recovery and return of the Densitometer. Schlumberger has been actively investigating the whereabouts of the Densitometer, and will continue to do so diligently.

The Densitometer contains a 111 mCi sealed source of Cesium-137. The source is contained in a heavily shielded source holder and is difficult to extract from the shielding. The potential for a person to receive a dose larger than the annual public dose limit of 100 mrem from the meter is minimal.

## SEARCH FOR THE DENSITOMETER

Schlumberger conducted an extensive search for the Densitometer immediately upon learning of this incident. The following steps were taken:

- 1. <u>Physical Inventory</u>: All Schlumberger locations that utilize densitometers in the United States and Canada conducted a physical inventory of any densitometers assigned to their facility or in their possession. This search included 53 locations and accounted for 336 densitometers. All densitometers were properly accounted for, except for the missing Densitometer;
- 2. <u>Other Schlumberger Facility Searches:</u> Schlumberger personnel conducted both physical searches and searches using radiation detection instruments at two additional Schlumberger facilities in Rock Springs, Wyoming. These facilities are located at 93 Reliance Road, Rock Springs, Wyoming and 2000 Mineral Drive, Rock Springs, Wyoming. The Densitometer was not located during these searches;
- 3. Job Site Search: Schlumberger conducted both physical searches and searches using radiation detection instruments at all wellsites and client equipment staging areas where densitometers from the Rock Springs, Wyoming location were used

or temporarily stored in preparation for use during 2007. The Densitometer was not located during this search;

- 4. <u>Vehicle and Equipment Search:</u> All 219 vehicles and trailers assigned to Rock Springs were searched. The Densitometer was not located during this search;
- 5. <u>Manufacturer Search:</u> Schlumberger also promptly contacted Thermo MeasureTech, the manufacturer of the Densitometer, to request that it review its internal records to ascertain whether the Densitometer was returned to it for repair or disposal. Thermo MeasureTech completed this review and informed Schlumberger that the Densitometer had not been returned to them for repair or disposal;
- 6. <u>Search of Local Scrap Metal Recycling Company</u>: Schlumberger employees traveled to Pacific Steel and Recycling, the local scrap metal dealership in Rock Springs, Wyoming, as part of the investigation. During the visit, Schlumberger assessed Pacific Steel and Recycling's screening process for radioactive material to determine whether the Densitometer could have been inadvertently sent as scrap metal. Schlumberger determined that it is unlikely that the Densitometer was disposed of as scrap metal because: 1) An automatic radiation detection portal screens all incoming material to preclude the acceptance of items that contain radioactive materials, 2) in the event this portal is not operating, Pacific Steel and Recycling performs manual scans of all material, and 3) Pacific Steel and Recycling performs scans on all outgoing shipments before they leave the facility. Pacific Steel and Recycling stated that it did not identify any radioactive material in any scrap received from Schlumberger;
- 7. <u>International Transfer Assessment:</u> During the course of our internal investigation, Schlumberger learned that in March 2003, Densitometer D111 had been identified for internal transfer (*along with other equipment*) to Schlumberger's operation in Argentina. After a thorough internal review Schlumberger determined that the Densitometer was not shipped from the Rock Springs, Wyoming location to Argentina with the other identified equipment ("Transferred Equipment").

Argentina Physical Inventory and Records Review: Schlumberger confirmed with the Schlumberger employee in Argentina who received the Transferred Equipment that the Densitometer was not with the shipment when it arrived. Schlumberger inventoried all of its densitometers in Argentina. The Densitometer was not located during this inventory.

**Freight Forwarder Facility Search**: Schlumberger searched the storage facilities for Elite Freight Forwarders ("Elite") and NSSI, Inc. (both in Houston, Texas). The Transferred Equipment was temporarily stored at Elite before shipment to Argentina. Schlumberger periodically has used NSSI, Inc. for the temporary

storage of densitometers before exporting these from the United States. The Densitometer was not located during these searches.

**Freight Forwarder Records Review:** Schlumberger instructed Elite to take the additional precautionary measure of reviewing its internal records associated with the Transferred Equipment to Argentina to further confirm that the Densitometer was not included. Elite completed this review and informed Schlumberger that no densitometers were received or included in the transfers to Argentina. Schlumberger then requested that Elite expand their search to include all records of shipments between March 2003 and March 2004 for any references to the Densitometer. Elite completed this review and informed Schlumberger that **no records referencing the Densitometer were found;** 

### INTERNAL INVESTIGATION FINDINGS

Schlumberger conducted a comprehensive investigation of the event. This investigation focused on inventory control, security for densitometers and the transportation of these devices. Schlumberger has summarized the findings and conclusions from this investigation below:

- 1. Six of seven model 5192 densitometers and ten of ten model 5190 densitometers have been accounted at the Rock Springs, Wyoming location;
- 2. The Densitometer was used as a spare densitometer for the Rock Springs location and was not assigned to a specific crew. It was utilized when needed by multiple crews, frequently stored for extended periods of time and locked in a secure facility when not being used;
- 3. Schlumberger determined that the on-site RSO recorded a physical inventory for the Densitometer on February 6 and August 14, 2007. However, Schlumberger learned during the investigation that the on-site RSO did not follow procedures and confirm the serial number of the Densitometer when performing the physical inventory on August 14<sup>th</sup>. Hence, Schlumberger has determined that it cannot rely on any physical inventory recorded by this individual to establish when the Densitometer was present at the Rock Springs, Wyoming location;
- 4. The Densitometer was locked within a shielded storage container when it was not in use. This container was located in an equipment storage area at the 93 Reliance Road facility. The door to this storage area was also locked. The storage container is heavy enough to require a forklift to move and can hold up to six densitometers. Only authorized Schlumberger employees were issued keys to the lock on the storage container;
- 5. Schlumberger learned that the hasp on the door to the storage area at the 93 Reliance Road facility was discovered broken during the first week of September 2007. Schlumberger concluded that the security for the storage container had not been affected since the lock on the storage container was intact. Schlumberger moved the storage container from the 93 Reliance Road facility to the new facility

at 2901 Yellowstone Road immediately after its employees discovered the broken hasp;

- 6. The entire 2901 Yellowstone Road facility is surrounded by a perimeter fence with access limited to authorized persons. At this facility, the storage container was placed in a secured equipment storage area. Access to this storage area is controlled by a security card reader and is surrounded by a security fence. Access through this fence is also controlled by a security card reader. The storage area is under video surveillance;
- 7. After the densitometer storage container was moved to the 2901 Yellowstone Road facility, Schlumberger's investigation determined that the storage container was apparently not opened until October 2, 2007 when the new on-site RSO was conducting a physical inventory of the densitometers assigned to the Rock Springs, Wyoming facility. The on-site RSO opened the storage container in preparation for the routine compliance audit scheduled to begin the next day, October 3, 2007. Two densitometers, serial numbers B5683 and B5684, were in the storage container. The Densitometer was not contained in the storage container;
- 8. Schlumberger learned through its investigation that the Rock Springs, Wyoming employees did not consistently follow the company's prescribed security procedures for densitometers during transport and while at wellsites;
- 9. Schlumberger learned through its investigation that the Rock Springs, Wyoming employees apparently at times shipped densitometers on Schlumberger vehicles to wellsites without completing shipping papers. When shipping papers were prepared, the number of densitometers in a shipment was accurately listed but did not always list the correct serial numbers;
- 10. Schlumberger learned that the identification plates on model 5192 densitometers in this location are exposed to harsh conditions. The identification plates on all model 5192 densitometers in this location were difficult to read;
- 11. The on-site RSO also served as a maintenance technician and did not functionally report to the Quality, Health, Safety and Environment (QHSE) coordinator. The QHSE coordinator is the primary advisor to the location manager on all compliance issues;
- 12. Schlumberger learned during the investigation that the on-site RSO did not perform radiation surveys of the densitometer's Transport Index and surface radiation levels as prescribed by Schlumberger policy.

### **PROBABLE CAUSE OF THE EVENT**

Based on the information gathered during the investigation the two most probable explanations for the disappearance of the Densitometer are that: 1) the Densitometer was inadvertently left at a wellsite or 2) lost from a vehicle during transport.

Though possible, Schlumberger has largely ruled out theft as the reason for the Densitometer's disappearance, because:

1. Though the hasp on the door to the equipment storage area at 93 Reliance Road was discovered broken in September, the lock on the storage container was intact;

- 2. Two additional lighter-weight densitometers were contained in the storage container when the container was opened on October 2, 2007;
- 3. The radioactive source contained in the Densitometer holds 111 mCi of Cesium-137 which is less that the threshold values for a Category 3.5 source. In addition, this small source is difficult to extract from the shielding of the Densitometer;
- 4. There have been no reported thefts of other valuable equipment from Schlumberger's facilities in Rock Springs, Wyoming or from wellsites. Other, more valuable equipment, including computers, are available at Schlumberger's facilities in Rock Springs, Wyoming and at most wellsites; and
- 5. The Densitometer is not a particularly valuable piece of equipment and a thief would not be able to readily profit from the theft.

The above facts, when taken together cause us to reasonably conclude that the Densitometer is not missing as the result of theft.

## **PUBLIC EXPOSURES**

The potential for a person to receive a dose larger than the annual public dose limit of 100 mrem from the meter is minimal. The SSDR for this device on page 6 states,

## "These devices are designed to include sufficient shielding to reduce radiation levels anywhere to less than 5mR/hr at one foot from any accessible surface at maximum loading."

Using this maximum dose rate, a person spending a 2000-hour work year at a distance of 10 feet (3 meters) would receive 100 mrem. The 111 mCi, Cesium-137 sealed source is contained in a heavily shielded source holder and is difficult to extract from the shielding. Based on the maximum dose rate provided by the manufacturer and the difficulty in extracting the source from the shielding, **an exposure above public dose limits appears to be unlikely**.

## **CORRECTIVE ACTIONS**

- 1. **Reported to Authorities Reward Offered**: Schlumberger has provided the Sweetwater County Sheriff's office with a description of the device and has offered a \$5,000 reward for the recovery of the Densitometer.
- 2. **Revised RSO Reporting Structure**: The organization in this location has been changed so that the on-site RSO will functionally report to the QHSE coordinator.
- 3. **Appointed New RSO**: A new on-site RSO was appointed for the Rock Springs facility. The new on-site RSO attended a 40-hour training course for on-site RSO's prior to commencing his duties. He identified the absence of the Densitometer after assuming his duties.
- 4. **Disciplinary Action Taken**: Appropriate discipline action will be taken for the previous on-site RSO.

- 5. Security Access Further Restricted: Security for the densitometer storage has been changed so that only three employees have both keys to the lock on the storage container and hold security cards allowing access to the storage area.
- 6. **Storage Log Implemented**: Schlumberger has now implemented a new log system recording each movement of a densitometer into and out of the storage container.
- 7. **Physical Inventory Procedural Change Implemented Prior to this Event**: Independent of and prior to this event, Schlumberger changed its policy on physical inventories to require a physical inventory every three months and a physical inventory documented by a date-time-stamped photograph of each densitometer every twelve months. Schlumberger has already completed physical and photographic inventory of all densitometers in all Schlumberger locations in the United States and Canada.
- 8. **Conducting Radiation Safety Training**: Schlumberger is requiring that all employees working with densitometers in the Rock Springs, Wyoming location complete remedial training on radiation safety and control of radioactive materials. This training shall be completed by December 31, 2007.
- 9. Identification (ID) Tag Replacement: Schlumberger will replace the manufacturer's identification tags on all model 5192 densitometers in Rock Springs, Wyoming by January 31, 2008. As necessary assistance from the manufacturer will be requested.
- 10. Follow-up Internal Audit: A Schlumberger employee from the corporate radiation safety office in Sugar Land, Texas will conduct a follow-up audit of the Rock Springs, Wyoming location by June 30, 2008.
- 11. **Training Module on this Event**: Schlumberger is preparing a training package covering this event, our findings and corrective actions. All employees working with densitometers in the United States shall complete this training by April 30, 2008.

Schlumberger will continue its efforts to investigate and evaluate any new information in regard to this matter and shall report within thirty days any additional substantive details that are discovered.

Sincerely Raymond Dickes