M501: MEASUREMENT OF HAZARDOUS SUBSTANCES INCLUDING RISK ASSESSMENT

ANSWERS TO CASE STUDY 5 QUESTIONS

1. Alkyl lead is organic and soluble in hydrocarbons. Being a hydrocarbon it has a solvent effect on the skin with subsequent defatting. This facilitates the absorption of the compound through the skin and the subsequent uptake by the blood for transport throughout the body. The liver metabolises the tetraethyl lead to the more toxic tri-ethyl form.

2. Samples 3 and 4 were collected the next day when the alkyl lead would have been excreted from the body. Medical opinion is that samples must be taken between four and six hours following exposure and definitely before 12 hours.

3. Hazards identified should include:

   - Toxic atmospheres (alkyl lead, hydrocarbons especially benzene, inorganic lead as dust, welding fumes)
   - Oxygen depletion
   - Flammable atmospheres
   - Absorption of alkyl lead through the skin
   - Heat stress (use of impermeable suits)
   - Electrical safety
   - Quality of breathing air
   - Fitting of respirators
   - Noise (grit blasting)
   - Ergonomic aspects

4. Exposures to lead could have occurred in a number of ways:

   - Through contamination of the airlines. This can result from absorption of the organic material through the airlines, particularly if they are left lying on the ground. Aromatic compounds are particularly damaging to a wide range of plastic type materials.

- The air intake of the air compressor could have been too close to the skip where the sludge was being tipped.
- Meal breaks and rest periods would have involved the removal of protective equipment and possible skin contamination and ingestion.
- Being a hot day there is also the possibility of the respirators being removed due to discomfort.

5. The LEL of gasoline (petrol) is about 14,000 ppm. A <5% LEL reading could represent up to 700 ppm of total hydrocarbons which in this case would be mostly gasoline. With an average molecular weight of around 80 this is equivalent to over 2000 mg/m^3 which is well in excess of the Occupational Exposure Standard for petrol.

6. The readings in Table 3 could be very misleading, particularly with reference to the hydrocarbon levels as measured by the explosimeter reading. These instruments are not designed to measure contaminants in the atmosphere for occupational health purposes. Monitoring must be performed to determine the levels of toxic hydrocarbons including benzene, hexane, toluene etc.

7. The results give some idea of the lead levels *at the point of sampling only* and are no representative of the breathing air where the welding is taking place. This highlights one of the disadvantages of not performing *personal* monitoring.

8. The lead in air samples were not taken at the actual work area. The welders were most likely exposed to the background lead levels plus the additional lead released when the steel plates were heated during welding.

9. The sample volume collected was 300 x 2 L/min = 600 L

   Dust on filter = 0.2 mg

   Lead on filter = $0.2 \times \frac{0.5}{100} = 0.001$ mg

   Concentration of lead in atmosphere = $0.001 \times \frac{1000}{600} = 0.002$ mg/m^3

10. See answer to Question 7.