CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

The XRF analysis of sulfur and lead contents in fuel oils was studied using a xe-filled proportional counter. The 740 MBq Fe-55 and 740 MBq Cd-109 annular sources were used for sulfur and lead analysis respectively. For sulfur analysis, the optimum sample-source-detector geometry was determined in order to minimize the interference from argon and absorption of sulfur X-rays in air; and to obtain the maximum sensitivity. The experiment showed that the source must be placed as close as possible to the detector while the sample must be at 2.5 mm. away from the source surface. The Cd-109 source must be placed some distance away from the detector and the back of the source must be shielded in order to reduce the backgroud radiations from Ag K X-rays (22.1 - 25.0 keV) and 88 keV gammas. In this research, Cd-109 was placed on the iron 10 mm. thick with a hole punched in the center with a diameter 2 mm. The iron was at 15 mm away from the detector. Although the source-to-sample distance did not greatly affect the Pb analysis, the sample is placed at 2.5 mm. away from the source.

The two channel analyzer was developed using the local components. The structures of circuits were designed to seperate the printed circuit board of each function, for quick fault finding and servicing. The results of circuits testing were found that the noise amplitude of high voltage output was less than 20 mV. at the maximum HV. For the linearity test of ULD and LLD control, the correlation coefficient between the pulse height amplitude and discrimination dials were found to be 1.0. At the detection unit, an amplifier with the adjusted gain at calibration energy, the output of amplifier was tested using an oscilloscope. It was given the noise amplitude 200 mV_{pp} which interferred the sulfur pulse height energy, causing an error in analysis. After attempting to improve the analysing system, however, it was found that the main problem of the electronic noise interference came from the preamplifier. In order to reduce the noise, the CANBERRA model 2006E preamplifier, was used to replace the designed one. After replacing the preamplifier the noise was reduced to 50 mV_{pp}.

The two channel analyzer was calibrated for S and Pb analysis with standard available from the Esso Standard (Thailand) Co., Ltd. The detection limits for sulfur and lead in fuel oils were found to be 0.014 % by weight and 0.011 gm/l respectively. The two channel analyzer was also tested for S and Pb analysis of 4 diesel oil samples and 4 high octane gasoline samples. The results were found to be 0.345, 0.571, 0.556 and 0.406 % by weight of S for the diesel oil samples, and 0.296, 0.459, 0.514 and 0.376 gm/l of Pb for the high octane gasoline samples. The discrepancies between the results from the two channel analyzer

and the S and Pb analyzer were less than 15 % for S analysis and 8 % for Pb analysis. However, S and Pb contents in the fuel oils could be confidently measured 0.5 % wt. up and 0.4 gm/l up, respectively.

6.2 RECOMMENDATIONS

The following recommendations are made:

6.2.1 To reduce the Mn escape peak, interfering the fluorescent S K X-ray peak, the krypton gas or the helium gas filled proportional detector should be used.

6.2.2 To reduce the scattering radiation, interfering the fluorescent S K X-ray peak, the radioactive point source should be used in place of the annular source. However, the direction of primary X-ray beam from the annular source must be 90° with respect to the position of the detector.

6.2.3 To reduce the dose rate of the user, the detector chamber should be designed in order to load both the radioactive sources and the samples at the side of the chamber.

6.2.4 To reduce or eliminate the electronic noise which occurred in the preamplifier, the low noise components should be used and the grounding system in the circuits should be also improved.