

From: Bernd Franke, IFEU (for IEER)
To: Arjun Makhijani (IEER), Joni Arends (CCNS), John Till and Helen Grogan (ITAT)
Date: September 16, 2002
Re: Environmental monitoring issues

It is the purpose of this memorandum to discuss three issues regarding the environmental monitoring at LANL: (1) the adequacy of the periodic review for station siting especially with regard to the North Mesa residences, (2) the reliability of alpha spectroscopy for Pu-238, and (3) the accuracy of TLDs compared to electret ionisation chambers (EICs).

AIRNET station siting

The siting of AIRNET stations is subject to periodic review as specified in procedure MAQ-238. The periodic review requires a constant update of information about diffuse emission sources. Based on the procedures, NSR data for TA-21 and elsewhere does not require installation of additional AIRNET stations. In his September 11, 2002 E-mail entitled "Airnet siting & TA-21 potential releases TSPA", David Fuehne presents results of CAP88 calculations. He concludes that even for a source located in the Eastern section of TA-21, the LA Airport Terminal station can serve "as an indicator of rad concentrations for North Mesa residences, since the concentrations are so close to one another". Consequently, an additional AIRNET station is not required.

The underlying calculation assumes a steady-state release and is modelled with a simplified flat-terrain model. Both assumptions are not valid in this case. The use of a complex terrain model may lead to a different conclusion for a "TA-21 East" source. In addition, the releases from a diffuse source are most likely to occur during high wind speeds (>10 mph) when material can be readily suspended into air. High wind speed situations are more likely during wind blowing from the South/Southeast (see Figure 1).

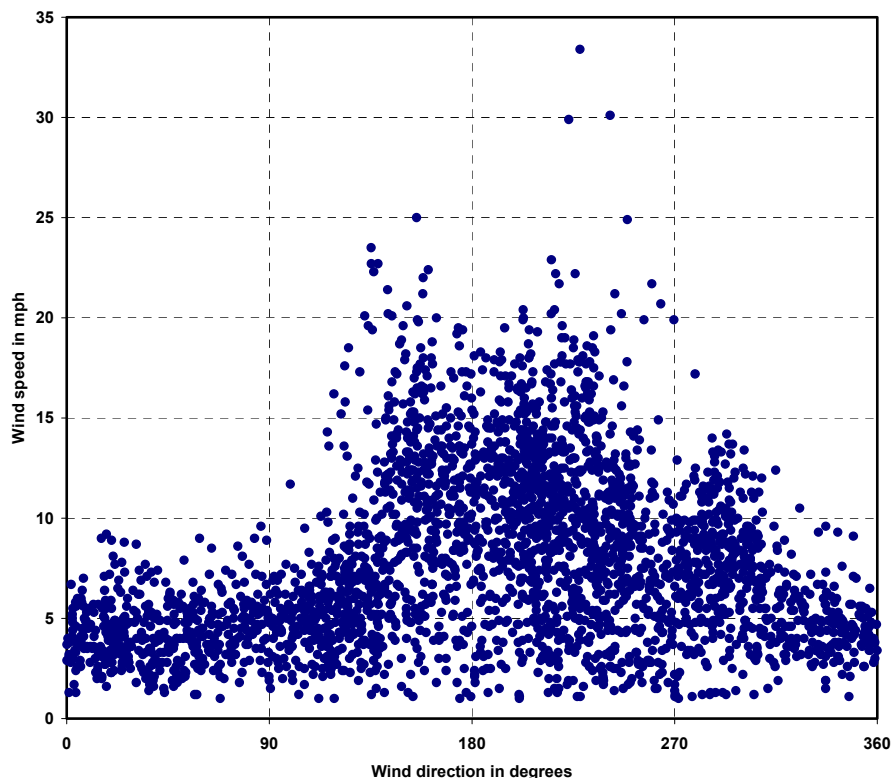


Figure 1 Wind speed as a function of wind direction at East Gate NEWNET station, August 2002

With regard to diffuse sources at TA-21-East, the wind speed/direction pattern suggests that the greatest impact to residents from such a source is likely at the North Mesa residences.

In my opinion, this fact requires a re-evaluation of the AIRNET siting procedure for diffuse sources. Whereas one may argue that the release pattern for stationary sources may be randomly distributed over the year, the time-release function for diffuse source is clearly non-randomly correlated with high wind speed situations. Given this, CAP88 is certainly not a suitable tool for determining whether the potential dose to the MEI at a receptor location exceeds 0.1 mrem/year¹.

In my opinion, the procedure MAQ-238 which allows that "CAP88 or previously derived conservative LANL dose factors" can be used for the dose assessment needs to be corrected.

It is likely very difficult to determine the time-release function of the source term for diffuse sources with reasonable accuracy. Given that and the uncertainties in NSR process and the time it takes to install AIRNET stations, it appears more appropriate to take a cautious approach and install an additional AIRNET station at the Eastern edge of North Mesa residences at this time.

Alpha spectrometry for Pu-238

Owing to its high specific activity, the proper identification of Pu-238 in ambient air samples may pose a problem. In the MAQ-AIRNET, the maximum MDL for Pu-238, equivalent to 0.1 mrem/year annual dose, is reported to be 0.14 pCi per half filter composite. The target MDL for Pu-238 is indicated to be 0.05 pCi per half filter composite.

According to the information on page 55 of the first audit report by the ITAT, the specific activity a particle with 1 μm aerodynamic diameter that consists of pure Pu-238 oxide particles is 2.8 pCi. If such particles would be released from a diffuse source (e.g. from waste materials), the presence of one such particle on a half filter composite would indicate a dose of 2 mrem/year. If said particle were to remain on the half filter composite that is not subjected to alpha spectroscopy, the resulting dose estimate would be 0 mrem/year.

The potential bias would be greater if a larger particle size is assumed. While it may be argued that the activity may be detected because the detection limit for alpha activity of a single filter is 0.5 pCi. However, it is not evident from the procedures in place (MAQ-AIRNET, ESH-17-201, R3) that analysis of the entire filter be performed.

¹ If the projected dose is in excess of 0.1 mrem/year, a new AIRNET station will have to be installed provided that there is no other AIRNET station within the half-sector or 100 m, whichever is larger.

TLD versus EIC

A one-year comparison study² of three methods for measuring environmental radiation comparing thermoluminescent dosimeters (TLDs), pressurized ionisation chambers (PICs), and electret ionisation chambers (EICs) on and around the INEEL site found that exposure rates calculated with EISs correlate much better with PIC data those calculated using TLD data. PICs provide the most accurate measure of environmental dose rates. TLDs were found show a lower response than the PICs. This means that use of uncorrected TLD data underestimates external gamma dose rates. The study authors summarize that "Preliminary results suggests that EICs seem to be an appropriate replacement for TLDs".

In my opinion, use of EICs should be considered for LANL as well if the preliminary results of the INEEL study are confirmed.

I suggest that the ITAT review the above described three issues.

² Moser K D, Walker D W, Paulus L R, Gesell T F. One-Year Comparison study of Three Methods for Measuring Environmental Radiation. Unpublished manuscript Idaho State University/INEEL Oversight Program.