Once the material is on the ground, it will be recycled into the atmosphere and inhaled by man. The chapter demonstrates that resuspension physics is so poorly defined that much research is needed.

One problem is that resuspension coefficients have not been adequately defined. One resuspension coefficient relates airborne concentrations to local surface-contamination levels, but does not describe either the vertical flux from resuspension or the total downwind flux. Any calculation using an "average" resuspension factor must be qualified as uncertain within 2 to 3 orders of magnitude because resuspension factors, which cannot be predicted, have ranged 2 to 3 orders of magnitude even in a single field experiment. The second resuspension coefficient describes the fraction of material resuspended per unit time. Using this coefficient, if the surface contamination level is known, the vertical flux from resuspension is the product of resuspension rates and source concentrations. Resuspension rates measured for both wind and mechanical stresses indicate that mechanical stresses can cause more material to be resuspended at one time than can wind, but that effect is short-lived because mechanical stresses usually last over less time and space.

Deposition and resuspension research results are equally applicable to pollutants from both nuclear and nonnuclear energy sources. Differences in these air-surface mass-transfer processes cannot be distinguished as a function of chemical properties. Dry deposition can be predicted as a function of particle size, but resuspension cannot.

Experimental deposition and resuspension research results are needed to define these transport and mass-transfer processes more adequately. In future studies of these processes, the experiment conditions and experimental techniques must be controlled and defined, and theoretical interpretation of the results validated. Model and experimental validation are the crux and requirement for future research of air-surface mass-transfer processes.

INERT TRACER WIND RESUSPENSION AS A FUNCTION OF WIND SPEED, ATMOSPHERIC STABILITY, AND INITIAL TRACER PARTICLE SIZE

G. A. Sehmel and F. D. Lloyd

Wind-caused resuspension rates are being determined in three different, long-term, inert-tracer field experiments. Chemical results were recently received from an accumulated backlog of air filter samples. Resuspension rates are yet to be calculated from these data.

Wind and mechanical stresses can resuspend respirable pollutant particles from environmental surfaces. Subsequently, resuspended pollutants can become a concern downwind. Although resuspension is known to occur, resuspension physics cannot be adequately described, either for predictive resuspension rate models or for airborne concentration at breathing height above a resuspension source. General predictive models describing physics for environmental surfaces would be even more complex than models describing resuspension of a single particle from a smooth, uniform surface. Environmental surfaces can be described as being generally nonuniform. Resuspension rates are thus required that represent an integrated value over the geometry and vegetative cover of many different, reasonably uniform terrain types.

The present study is directed toward determining resuspension rates averaged over 7.5- to 30-m resuspension fetches at three locations at the Hanford site (Sehmel and Lloyd 1978). The resuspension tracer at each location is an inert tracer, calcium molybdate, which has been deposited at a controlled surface contamination level. Subsequently, wind-resuspended tracer is collected in particulate air samplers located on sampling towers. In each experiment, particulate air-sampling equipment is placed in locations to permit calculation of a resuspended tracer mass balance. From this mass balance, resuspension rates are determined as a function of wind speed increments.

In two experiments, the sampling tower is located at the centers of two circular

areas of 23- and 30-m radii upon which tracer has been deposited. For these experiments, particulate air samplers are always pointed into the wind by wind vanes. At these two sites, resuspended tracer is sampled as a function of wind speed.

The effects of both wind speed and atmospheric stability on resuspension rates are being determined in a third experiment. In this experiment, isokinetic air sampler inlets are fixed towards a 225° direction. These isokinetic air samplers are activated only when the wind direction is within a wind sector of 225±35°.

Additional experiments have been completed at the two circular tracer areas. Chemical analyses have been completed for the tracer content on each filter for these two experiments as well as for a backlog of air filter samples from previous experiments. Chemical analytical results were recently received. However, there has not been sufficient time to analyze these data. Resuspension rates will be reported at a later time.

The third experiment measuring resuspension rates as a function of atmospheric stability, wind speed, and wind direction is being conducted near the Hanford meteorological tower. To date insufficient air sampling time has been accumulated with the required atmospheric stability, wind speed, and direction to expect a detectable tracer content on the sampling filters.

Since data are still needed to predict the effects of atmospheric stability on resuspension, a radionuclide analysis of filter samples from the third experimental site is being considered. The 225±35° wind sampling direction locates the sampling array downwind of the 200-West area during many high-wind speed conditions. This option for measuring detectable radionuclides seems viable since previously airborne plutonium-239 was measured even from the top of the 125-m Hanford meteorological tower (Sehmel 1978d). In that experiment, particulate air samples were collected independent of wind speed and direction.

If this option for radionuclide analysis of the filter samples is exercised, effects of atmospheric stability on airborne concentrations downwind from controlled contaminated areas can be measured as a function of real-time stability. These measurements are preferable to the questionable validity of predicted downwind airborne concentrations from derived diffusion coefficients and atmospheric transport models. Although radionuclide analyses would not permit direct calculation of resuspension rates, the relative airborne radionuclide concentration measured at each wind speed and atmospheric stability would give the relative effects of these parameters on resuspension from the Hanford site.

Results from the present option could be directly related to surface contamination levels if contamination levels and resuspension rates were known or assumed. This modeling effort would require that resuspension rates and contamination levels be determined and model predictions be matched with observed vertical airborne radionuclide profiles at this third experimental site.

Decisions for analyzing filter samples for either tracer or radionuclides will be based in part upon the amount and types of winds experienced this fall at the experimental site. The airborne mass-loading as a function of atmospheric stability and wind speed will always be determined for these data.