United States Nuclear Regulatory Commission Official Hearing Exhibit

In the Matter of: Progress Energy Florida, Inc.
(Levy County Nuclear Power Plant, Units 1 and 2)

ASLBP #: 09-879-04-COL-BD01
Docket #: 05200029 | 05200030
Exhibit #: NRC054-00-BD01 **Identified:** 10/31/2012
Admitted: 10/31/2012 **Withdrawn:**
Rejected: **Stricken:**
Other:

differential equation instead of a difference equation was presented by *Hoppel et al.* [2002], but the resulting dry deposition velocities differ little from those given by Eq. 2.7-7; §4.6.3). Because of the complexity of the processes occurring over the oceans, the idealized nature of dry deposition models and their treatment of the marine atmosphere and of dry deposition of SSA particles limit the confidence that can be placed in numerical results obtained from such models (§4.6.5).

The dry deposition velocity v_d is expected to increase with increasing r_{80} over nearly all of the size range comprising SSA particles primarily because of the contribution from gravitational sedimentation. Additionally, v_d is expected to increase with increasing U_{10} because of increased vertical mixing in the surface layer, increased diffusion through the viscous sublayer due to decreased thickness of that layer, and increased impact velocity. Because gravitational sedimentation does not depend on a difference in concentrations, a simple resistance analogy, commonly made for dry deposition of gases, no longer holds [*Slinn*, 1983a], although a more complex resistance analogy can be used [*Seinfeld and Pandis*, 1998, p. 961].

The dry deposition velocity given by (2.7-7), if used with the concentration at z_{ref} (typically near 10 m), yields the downward flux of SSA particles at this height. Under steady state conditions, this downward flux is equal to the upward flux of SSA particles at this height. This effective SSA production flux, $f_{eff}(r_{80})$, is the quantity that is desired for atmospheric chemistry considerations and for inputs into large-scale transport and chemistry models, as it comprises only those particles that are expected to remain in the atmosphere for an appreciable length of time. It is assumed that particles that attain this height remain in the atmosphere long
participate in the various processes of interest, wh
that do not attain this height are not important in
(§2.1.6). However, comparison with other metho
mining SSA production fluxes that yield the prod
at the surface of the ocean, $f_{int}(r_{80})$, such as that us
tory whitecaps extrapolated to ocean conditions (§
involving bubble populations and the number o
bubble (§3.4), requires some method of relating t
SSA production flux $f_{eff}(r_{80})$ and the interfacial S
tion flux $f_{int}(r_{80})$. As noted above, there is no gener
relating these quantities, although several method
proposed that are expected to yield results that
tively valid (§2.9.4; §4.6.5; §5.1).

2.7.2.3. Mean atmospheric residence time
deposition. The mean atmospheric residence ti
particles of a given r_{80} with respect to dry de
denoted by $\tau_{dry}(r_{80})$, analogous to the quantity τ_{we}
§2.7.1. The quantity τ_{dry} depends strongly on p
and on meteorological conditions such as w
Furthermore, it is expected to be inversely propo
and directly proportional to the height over whi
are mixed (§2.9.6). At $U_{10} = 10$ m s^{-1} and fo
boundary layer height of 0.5 km (§2.4), estimate
τ_{dry} for SSA particles with $r_{80} = 1, 5, 15$, and 25
on arguments presented in §2.9.6 and on modele
sition velocities presented in §4.6.2, are approxim
(~1.5 wks), 3.3·10^4 s (~10 h), 5·10^3 s (~1.5 h),
(5 min), respectively (Table 8). Implications of
dence times and their dependence on particle si
mined in the next section.

Table 8. Characteristic Times and Distances for Removal of Sea Salt Aerosol Particles by Dry Deposition as a Function of
Speed $U_{10} = 10$ m s^{-1}

r_{80}/µm^a	1	2	5	10	15	20
Dry deposition velocity, v_d/(cm s^{-1})^b	0.05	0.25	1.5	3	5	7
Mixing height, H_{mix}/m^c	500	500	500	500	230	60
Dry deposition residence time, τ_{dry}/s^d	$1 \cdot 10^6$ (1.5 wks)	$2 \cdot 10^5$ (2.3 d)	$3.3 \cdot 10^4$ (10 h)	$1.7 \cdot 10^4$ (5 h)	5000 (1.5 h)	850 (15 min)
Transport distance, X/km^e	$1 \cdot 10^4$	2000	330	170	50	8.5

[a] Assumed to have equilibrated at 80% RH.

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[b] From §4.6.2.

[c] Taken to be the lesser of the height of the marine boundary layer height (assumed to be 0.5 km) and z_{50}, the height at which the steady state
is 50% of its value at 10 m (§2.9.5).

[d] Defined by H_{max}/ν_a

[e] Defined by $H_{max}U_{10}/\nu_w$.