The Following are excerpts from the relevant literature pertaining to sleep inertias as it relates to sleep stage prior to waking.

Tassi, P., & Muzet, A., Bruck D, Pisani DL, Bonnet, M. H.

Multiple Universities

Tassi, P., & Muzet, A. (2000). Sleep inertia. *Sleep Medicine Reviews, 4*, 341–353.

Sleep inertia is a transitional state of lowered arousal occurring immediately after awakening from sleep and producing a temporary decrement in subsequent performance. Many factors are involved in the characteristics of sleep inertia. The duration of prior sleep can influence the severity of subsequent sleep inertia. Although most studies have focused on sleep inertia after short naps, its effects can be shown after a normal 8-h sleep period. One of the most critical factors is the sleep stage prior to awakening. Abrupt awakening during a slow wave sleep (SWS) episode produces more sleep inertia than awakening in stage 1 or 2, REM sleep being intermediate.

It has been often described that awakening in stage 1 or 2 produces no substantial decrement on subsequent performance (i.e. no SI effect) [17, 18]. In a short-term memory task, where subjects were presented a word list 1 min after arousal from different sleep stages, Stones (1977) found that memory performance after arousal from stage 1, 2 or REM was so high as to be indistinguishable from that obtained under the no-sleep condition (0% of decrement in the number of category recalled and 8.5% of decrement in the number of items recalled per category) [17].

Bruck D, Pisani DL. The effects of sleep inertia on decision-making performance. J Sleep Res 1999; 8: 95–103.

Sleep inertia can be described as a rising trend in alertness, reflecting a wake-up effect. This occurs despite the fact that the sleep from which a person has awoken may have fully dissipated their sleep need (Folkard and Akerstedt 1992).

Research on sleep inertia has generally been based on the assumption that the stage prior to awakening is a very important consideration (Dinges *et al*. 1985). A number of studies have found that sleep inertia was significantly more severe when subjects were awoken from non-rapid eye movement (NREM) sleep, especially SWS, as opposed to rapid eye movement (REM) sleep (Bonnet 1983; Dinges *et al*. 1985; Akerstedt *et al*. 1989; Broughton 1989; Dinges 1989, 1990; Stampi 1989; Pivik 1991; Mullington and Broughton 1994).

The most important finding from this study is that sleep inertia reduces decision-making performance for at least 30 min.

The initial effects of sleep inertia during the first 9 min are significantly greater after SWS arousal than after REM arousal, but this difference is not sustained beyond the first 9 min. This finding of a difference related to pre-awakening sleep stage is consistent with most of the literature (see Introduction) but to our knowledge, this is the first to show differential effects over time. It is possible that a stronger SWS sleep inertia effect (and hence a sustained performance difference compared with REM arousal) may have been maintained if the SWS arousal had been from the first sleep cycle rather than from the second.

Bonnet, M. H. ~1983!. Memory for events occurring during arousal from sleep. Psychophysiology, 20, 81–87.

Many instances exist of significant memory loss for events during brief awakenings from sleep. The present experiment sought to determine whether such memory loss was attributable to depth of pre-awakening sleep or to length of awakening. Fourteen young adult subjects performed a standard memory task after being awakened from stage 2 or stage 4 sleep. Subjects either remained awake for 8 min or returned to sleep immediately after the learning task. Both short and long term memory were significantly worse when awakenings were made from stage 4 (deep) compared with stage 2 (light) sleep and when learning occurred immediately after being awakened. No significant effects were found when the length of the period awake after learning was lengthened. It was concluded that memory for events occurring during brief awakenings was affected by the prior stage of sleep. The effect was discussed as an example of state dependent learning.