

**APR1400**  
**Feedback on Draft Response to RAI 255-8285, Question 03.08.05-9**  
**Prepared September 2, 2016**

Item (1)

Acceptable because the response indicates that the explanation for static and dynamic differential settlement is discussed in RAI Question 3.8.5-7, and the staff will evaluate it there. Note that this issue, on differential settlement, is also currently addressed in RAI Question's 3.8.5-16 & 17.

KHNP INPUT

There are no action items.

NRC Feedback

None

Item (2)

The response indicates that the construction sequence analysis is deferred to RAI Questions 3.8.5-7 and 18. This is acceptable. Regarding the markup for COL Item COL 3.8(8) that was provided in this RAI response, it does not address the monitoring of differential settlement related to angular distortion. This issue was identified in RAI Question 3.8.5-18. The COL Item should identify the criteria for monitoring differential settlement associated with tilt (i.e., the 1.5 inch per foot currently identified in the DCD and technical report) and the differential settlement associated with angular distortion (as discussed in the original RAI Question 3.8.5-18). The acceptance criteria for differential settlements associated with angular distortion can be obtained from the settlement contours calculated beneath the basemat. Also, explain why the monitoring program is to be developed in accordance with Regulatory Guide 1.160, since the regulatory guide does not provide such guidance.

KHNP INPUT

COL Item COL 3.8(8) will be revised to incorporate differential settlement related to angular distortion and tilt. Angular distortion is foundation criterion that is needed to prevent damage to a building founded on soil. So, for buildings, angular distortion will be limited to 1/750 in accordance with Reference 1. In case of tilt induced by differential settlement is conservatively calculated as the criteria of differential settlement [0.5 in per 50ft ( $0.5/50=1/1200$ )] due to a rigid body behavior.

COL 3.8(8) The COL applicant is to provide a site-specific monitoring program and to monitor differential settlement, tilt, and angular distortion are bounded by following values during construction and plant operation.

Allowable differential settlement associated with tilt: 1/1200

Allowable differential settlement associated with angular distortion: 1/750

#### Reference

1. EM 1110-1-1904, Engineering and Design Settlement Analysis, US Army Corps of Engineers, September 30, 1994.

#### NRC Feedback

The applicant is referred to the latest NRC feedback on RAI Question 03.08.05-7 on the issue of developing appropriate maximum vertical settlement, tilt settlement, differential settlement between structures, and angular distortion. On that basis, the above KHNP response and COL 3.8(8) should be revised to address all four settlement types. As one example for revision, the angular distortion of 1/750 (identified above) should not be selected based on industry good practice or empirical data, perhaps intended to avoid cracking of the concrete structure, but rather a value from the calculated basemat deformation profile obtained from the structure being analyzed under gravity loads. The value of 1/750 would only be acceptable if the design of the basemat and superstructure were shown to be adequately designed for the magnitude of angular distortion of 1/750 for gravity loads in addition to the other design loads everywhere in the basemat.

#### Item (3)

The response is acceptable; however, as agreed to in the NRC audit during the week of 6/20/16, the applicant will capture the effect of varying soil types in the other RAI(s) related to settlement and will also address this in COL Item 3.8(8) for site-specific settlement to be confirmed by the COL applicant (see Item (2) above).

#### KHNP INPUT

The feedback regarding to effect of varying soil types is already updated response of RAI 255-8285 Question 03.08.05-7. The feedback on COL Item 3.8(8) refers to the response of Item (2) above.

#### NRC Feedback

None

#### Item (4)

Acceptable because the response indicates that (1) the issue of stiff and soft soil spots, and potential loss of cement from mud mat will be addressed under RAI Question 3.8.5-7 (and COL Items provided therein), and (2) the issue of stiffness modeling of the soil subgrade will be

addressed under RAI Question 3.8.5-8.

KHNP INPUT

There are no action items.

NRC Feedback

None