OL Review

J. Kane
Rec'd 9/8/80
from Jeff Kimball

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MEMORANDUM FOR: Ai Schwencer, Chief
Licensing Branch No. 3, DL

THRU: James P. Knight, Assistant Director for
Components and Structures Engineering, DE

FROM: Robert E. Jackson, Chief
Geosciences Branch, DE

SUBJECT: REGULATORY STAFF POSITION ON SEISMOLOGICAL INPUT PARAMETERS IN RELATION TO MIDLAND 1 & 2

Based on our review to date the Geosciences Staff has adopted the attached position with respect to seismological input parameters for Midland 1 & 2. This position is necessary to resolve differences between the applicant and NRC on seismological issues and to provide guidance for inputing vibratory motion in evaluations of liquefaction potential and soil amplification. The Geosciences Branch has met with the Hydrologic and Geotechnical Engineering Branch to discuss various methods that could be used to generate a response spectra for Midland that would account for site specific problems. We are aware that the applicant is in the process of reanalyzing the Category I structures to account for cracked conditions and soil settlement problems, and that they have made some comparative analysis of their current response spectrum (Modified Housner) and Reg. Guide 1.60 both anchored at .12g (being monitored by the Structural Engineering Branch). It is suggested that the applicant adopt this staff position and implement the recommendations.

Robert E. Jackson, Chief
Geosciences Branch
Division of Engineering

Enclosure:
As stated

cc: w/enclosure
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361.0

Geosciences Branch

361.8,
(2.5)
(RSP)

The Michigan Basin (the region within which the site is located) is considered to be a tectonic province by the applicant. The Geosciences Branch staff practice is that the Central Stable Region (CSR) cannot be subdivided into separate tectonic provinces. The current regulatory staff position specifies a controlling earthquake from the CSR which differs from that suggested by the applicant and addresses soil amplification problems.

The controlling earthquake to be required for seismic design at the Midland site is similar to those occurring in Anna, Ohio (March 1937), and has a body wave (mbLg) magnitude of 5.3. Nuttli, using an alternative method, has also suggested that this magnitude is the "maximum" when using residual events (those left over after seismic zones such as Anna, Wabash Valley etc., are removed) for the Central United States (State-of-the-Art for Assessing Earthquake Hazards in the United States, Report 12, Credible Earthquakes for the Central United States: Misc. Paper S-73-1, U. S. Army Engineer Waterway, Exp. Station, 1978).

1. Representative real time histories for $M = 5.3 \pm .5$, $R < 25$ km at soil sites should be collected for input into seismic design. This collection could come from Lawrence Livermore data (Seismic Hazard Analysis 1979) but it is suggested that you update this data set.

Franz questioned adoption of this level

2. The 84th percentile (mean plus one standard deviation) response spectra (from real time data set) should be used as input at the top of the upper glacial till unit which consists of very stiff to hard cohesive soils. Above this till is a sand layer which is highly variable in density and has compacted fill. The effect of soil amplification above the upper glacial till unit should be addressed in appropriate soil-structure interaction studies which will establish the imposed vibratory motion at the various structural foundation levels. The NRC staff would welcome the opportunity to discuss with you the reasonableness of the results from the completed amplification studies.

3. The NRC staff is aware that you are reanalyzing the Category I structures to account for cracked conditions and soil settlement problems, and that you have made a comparative analysis of your response spectra (Modified Housner) and Reg. Guide 1.60 both anchored at .12g. The input for this comparative analysis was at the foundation level whereas the established staff position for this site is to require the acceleration at the top of the natural glacial till unit. You should assess the significance of this difference and provide additional response spectra comparisons at the various structural foundation levels.

Please type on plain bond paper
(one copy only)

1 of 2
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Subject: Seismic input for Midland Project.

Input for seismic design

1. Address range of max. horizontal ground acceleration values between 0.12g to 0.19g. (Based on adoption of range in magnitude 5.0 to 5.5 earthquakes at a distance of 10 to 20 Km from the plant site.)

2. Midland's seismic design approach will likely be site specific rather than current criteria in R.G. 1.60. Examples of ~~representative~~ strong motion records that are considered appropriate for use as time history input include:

Location	Date	Magnitude	Distance (Km)	Recording Site
San Francisco	3/22/57	5.3	15	Alexander Building, San Francisco
San Francisco	3/22/57	5.3	17	State Building, San Francisco
Northern, Calif	3/9/49	5.3	29	Hollister Public Library
Ferndale, Calif.	10/3/41	(5.7?)	29	Ferndale City Hall

Factors that should be considered in the selection of earthquake records included:

(1.) Comparable magnitude earthquake at similar epicentral distances.

(2.) Records of strong motion that would produce a broad response spectra with a wide range in frequency content. These records have been observed to generally give higher cyclic shear stresses with depth.

(3.) Comparable foundation conditions (e.g. depth to bedrock, soil types etc.) and similar shear wave velocity profiles.

~~Additional~~ Strong motion records, in addition to the four suggested earthquakes should be selected when evaluating the stability of Midland fill and foundation soils under dynamic loading using the above consideration factors.

4. Amplification of the vibratory motion because of specific soil foundation conditions unique to the Midland site should be investigated. An acceptable method would be to calculate the ~~proper~~ time history and design level of acceleration for consideration in liquefaction analysis by using the SHAKE program in the manner indicated in NUREG 75/072, Section 5.2.3, report by Shannon and Wilson Inc. and Agbabian Associates (1975). An appropriate suite of rock outcrop records (Appropriate records to be identified by the NRC staff) scaled to 0.12g peak acceleration should be transferred to the top of rock surface for propagation of motion up through the representative soil column.

3. Variation of fill and foundation soil properties (shear modulus) should be investigated in soil response sensitivity studies as suggested in Standard Review Plan, Section 2.5.2.

Subject: Comments on strong motion time histories selected for Midland project

3/22/57
San Francisco, Alexander Bldg. - Do not know Vs profile w/depth. Depth of soil is 115' vs. 300' for Midland. Does not have wide range of frequency content.

San Francisco, State Building 3/22/57 - Do not know Vs profile w/depth. Depth of soil is 200' & appears to be all sand. Would not expect velocity contrast similar to Midland fdn. conditions. Better range of frequency content than Alexander Bldg.

San Francisco, Southern Pacific Building 3/22/57 Do not know foundation soils or Vs profile. Narrow frequency content range.

Eureka Federal Bldg. 9/4/62 Depth of soil is 200' to 400'. Do not know Vs profile with depth. Time history not observed.

Hollister Public Library 3/9/49 Do not know foundation soils or Vs profile. Fair frequency content range. High max. accler. = 0.197g

Hollister Public Library 1/19/60 Do not know foundation soils or Vs profile. Narrow frequency content range

Lytle Creek 9/12/70 Indicated to be rock site. Do not know fdn. conditions or Vs profile. Time history not observed