Natural Resources Canada | Ressources naturelles Canada

Le 30 juin 2006

Monsieur Dominic Cliche
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Ottawa Ontario K1A 0H3

Objet: Projet Rabaska – Implantation d'un terminal méthanier à Lévis – Commentaires de Ressources naturelles Canada aux réponses du promoteur

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Monsieur,

Veuillez trouver ci-joint les commentaires de Ressources naturelles Canada aux réponses du promoteur (CA-014 à CA-037) contenues dans le document intitulé *Complément à l'étude d'impact sur l'environnement – Réponses aux questions et commentaires des agences réglementaires* (mai 2006).

Veuillez prendre note que plusieurs commentaires sont en anglais. Veuillez m'indiquer s'il est nécessaire de les traduire en français.

Si vous avez des questions, n'hésitez pas à communiquer avec moi au (613) 995-2848 ou par courriel à lmichaud@rncan.gc.ca.

Veuillez agréer, Monsieur Cliche, l'expression de mes sentiments les meilleurs.

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Commentaires de Ressources naturelles Canada aux réponses du promoteur (CA-014 à CA-037) contenues dans le document intitulé : Complément à l'étude d'impact sur l'environnement – Réponses aux questions et commentaires des agences réglementaires (mai 2006).

Commentaires sur l'aspect sismique:

General: Though we are waiting for the site specific seismic hazard report, most of the items have been satisfactorily handled.

Specific Comments: The consequences of the future changes in EN1473 with respect to the return period of the SSE could be addressed in the site-specific seismic hazard report. NRCan would consider carefully any suggestion that the SSE be taken as the 1 in 5000 year ground motions (as suggested for the circa 2007 version of EN1473) instead of the current EN1473 SSE as the 1 in 10 000 year ground motions, provided safety is not compromised. Other Canadian LNG plant in the planning process have proposed to use standards such as CSA Z276 and NFPA 59A but with 1 in 5000 year ground motions for the SSE design. If the level of performance from EN1473 using the 1 in 5000 year ground motions is comparable to those designs, it could be considered acceptable.

Question	Topic	comment	status
CA-014	Emergency plans	An "earthquake" plan will be devised	Accepted
CA-015	Relative seismic hazard assessment of considered sites	Acceptable response but waiting for the seismic hazard study	Pending
CA-016	Seismic damage to pipeline		Accepted
CA-017	Faults on the site		Accepted
CA-018	Foundation material	Acceptable response, will be further addressed by the seismic hazard study	Accepted
CA-019	CNB values for the site		Accepted
CA-020	Site specific hazard	Waiting for the seismic hazard study	Pending
CA-021	Design standard	See comment on standards	Accepted, but see comment above on standards
CA-022	Control room on soil	Will be addressed by site specific study CA-020	Accepted
CA-023	Type of engineering design		Accepted
CA-024	Slope failure under seismic shaking	Addressed by CA-032	Accepted

Commentaires sur l'aspect hydrogéologique

CA-025 à CA-028 (incl.)
Les réponses du promoteur sur les questions portant sur l'hydrogéologie sont satisfaisantes. Toutefois, nous avons des commentaires additionnels suivants concernant le rapport *Hydrogeological Characterisation at two Proposed Excavation Sites – Rabaska Project* par SNC Lavalin – Environnement (May 2006) :

The promoter presents a hydrogeological study for two selected sites: Access road (A) and LNG Storage tanks (B). The objectives of the study are not clearly stated. The applied comprehensive methodology consists of field work (drilling of test and observation wells, groundwater sampling, pumping tests), laboratory analyses, interpretation of pumping tests, and groundwater flow modelling. The linkage between the pumping tests and the numerical simulations is not well explained. Several maps important for the comprehension of the study are not presented. The effects of the planned pumping on the domestic wells along the 132 Rd. are poorly discussed.

Specific comments:

- Chapter 1, page 1: The objectives of the study are not clearly stated. It seems that the objectives are: to estimate the effects of the water withdrawal at sites A and B on the water table and neighbouring domestic wells; and to estimate the infiltration rates.
- Chapter 3.2, page 16: Surficial sediments play a major role in the recharge of the regional aquifer units (bedrock). Depending on the nature of the surficial sediments, they may constitute an aquifer unit or confine the groundwater flow. The promoter should present a map of the surficial sediments in both study areas.
- Chapter 3.3, page 17: The drillers' logs database indeed consists mainly of rock wells. The promoter should give a map with the spatial distribution of domestic wells in study areas (160 wells in a radius of 5 km). The reported yields and drawdowns (dynamic water level) in this database could be used as a first estimate of the aquifer transmissivity.
- Chapter 3.3, page 18, 19, 20: The promoter should give a map of the actual potentiometric surface based on the conducted groundwater measurements and static water levels (depth to water) reported in the drillers' logs database.
- Chapter 3.3, page 18: A bedrock surface model has been built by Teratech. The promoter should present this model in the report. Was this surface used to define the top surface of the rock layer?
- Chapter 3.3, page 20: The surface waters (streams) influence largely the direction of the groundwater flow. Is this a possible reason for the observed southward flow of the groundwater at site B?
- Chapter 4, page 31: The transmissivity is log-normaly distributed and the geometric mean is the best estimate of the average transmissivity. Storage coefficient, however, tends to be normally distributed and because of this, the arithmetic mean should be reported. This parameter has a major role in the transient flow simulations.
- Chapter 4: Was there any influence of the water withdrawal during the pumping tests on the neighbouring domestic wells? What was the reason for the duration of the pumping tests of 72 hours?
- Chapter 5, page 36: The promoter states that the interference between the pumping and anticipated drawdowns at sites A and B are very low. However, along the 132 Rd. (Boulevard de la Rive Sud), where most of the domestic wells are located, the simulated drawdowns are

approximately 3.5 (pumping at site A, Figure 5.3) m and 1.5 m (pumping at site B, Figure 5.4). The joint effect will thus result in a drawdown of approximately 5 m. The promoter should state what are the groundwater levels along this portion of the 132 Rd. What are the average depths of the pumps in the domestic wells?

- Chapter 5: For both sites, the boundary conditions were defined as imposed head at the northern and southern boundaries, and as no flow zone along lateral, east and west boundaries. In addition, a recharge flux was imposed on top of the model. In this way the southern boundary has a major impact on the simulated drawdowns. Imposed head boundary is generally used to simulate hydraulic contact with surface water body which can provide 'indefinite' water quantities to the model. It would be more appropriate to simulate the southern limit : a) as an imposed flux boundary (the flux can be estimated with a simple flow net analysis or used from the initial simulation – natural flow conditions without any additional pumping), in this way the modeller has the control over the water quantity entering the system from the south; or simply as a no flow boundary posed along existing natural surface water divides assumed to superimpose the limits of the shallow (~40 m) groundwater flow which was actually simulated by the numerical model.
- Chapter 5: Figure 1.2 indicates that there are surface water bodies in the proximity of both sites. How were they taken into account by the numerical model?
- Chapter 5.2: The promoter should present a map with the used finite elements grid, the imposed boundary conditions, and at least the topographic information as background.
- Chapter 5: The recharge rate was assumed in reasonable ranges (0, 50 and 100 mm/y/m^2). What was the reason to assume uniform recharge rates over large portions of the model? Was it possible to correlate the recharge rate with the nature of the surficial sediments?
- Chapter 5: What is the model sensitivity to the variation of recharge? What will be the variation of the drawdowns along the 132 Rd if the recharge rates were lower or higher, or spatially distributed? In addition, the simulations were conducted under transient conditions. The recharge is also transient process. What will be the impact of transient recharge on the simulated drawdowns? As most of the inflow was computed for the beginning of the dewatering period, what will be the optimal time to start with the excavation work?
- Chapter 5: The numerical model was calibrated against the 'actual static water level conditions in the study area'. The promoter should give the calibration results in a chart with axes representing the measured and calibrated groundwater levels. It is not clear why the pumping tests were conducted!? Since pumping rates and drawdown-time relationships are available, the promoter should also calibrate the model against the observed drawdowns in the tested and observation wells. This should be done particularly because the model predictions for the infiltration rates in the excavations are simulated under transient conditions.
- Chapter 5: The promoter should also present a map of the simulated groundwater levels (depth to water) under natural conditions.
- Chapter 5: The infiltration rates in the excavations were estimated with average measured hydraulic conductivities. Two extreme cases were also considered: 0.1K and 10K. What is the impact of these scenarios on the domestic wells?
- Chapter 5: The storage coefficient was assumed constant. The storage coefficient has important influence on the simulated drawdowns. If the pumping well is installed in an aquifer with higher S, the well shows lesser drawdown. What will be the variation of the drawdowns along the 132 Rd. if the storage coefficients were lower or higher?

Commentaires sur les mouvements de terrain

CA-029
Il était demandé de préciser la nature des mouvements de terrain pouvant se produire dans les secteurs concernés par le projet. Chaque fois qu'il est question de mouvements de terrain, il faut indiquer clairement s'il s'agit de chutes de blocs, de glissements rotationnels affectant des dépôts argileux, de glissements rotationnels affectant le roc altéré, de coulées argileuses ou éventuellement d'étalements latéraux.

CA-030
Voir les commentaires à la question CA-032

CA-031
La réponse est confuse. La question ne portait pas sur les facteurs pouvant déclencher un mouvement de terrain mais sur l'inconsistance entre la carte de la figure 4 (annexe A, tome 4, volume 2) et la mention concernant les chutes de blocs à la section 5.1.3 du tome 3, volume 2, annexe F1.Si des chutes de blocs peuvent se produire au niveau du bâtiment des pompes de surpression, il faut que cela apparaisse sur la carte. Par ailleurs, que signifie la dernière phrase de la réponse "les mouvements de terrain n'ont pas été identifiée comme étant la cause la plus probable" ? La cause de quel phénomène ?

CA-032
Il faut préciser les conditions de chargement dynamique qui ont été retenues lors de l'analyse pour arriver à la conclusion que le secteur ne peut être affecté par des mouvements de terrain.

CA-033
La question portait sur l'emprise des glissements rotationnels pouvant affecter les zones de franchissement des rivières Etchemin, Chaudière et Beaurivage. Le promoteur fournit une réponse appropriée. Cependant, la coulée argileuse qui s'est produite à la mi-avril 2006 le long de la rivière des Couture à St-Romuald rappelle qu'il faut également considérer ce type de mouvement de terrain fortement rétrogressif, et non seulement les glissements rotationnels d'emprise relativement faible. Cette coulée argileuse a une largeur d'environ 100 m et est caractérisée par une distance de rétrogression d'approximativement 60 m, la rétrogression ayant été probablement limitée par la remontée du substratum rocheux.

Le promoteur devrait par conséquent évaluer si les conditions locales (topographie, géologie, propriétés mécaniques des sols, présence d'argiles sensibles, etc.) au voisinage des zones de franchissement sont propices à l'initiation de coulées argileuses. Si tel est le cas, l'emprise possible (largeur et surtout la distance de rétrogression) devrait être indiquée sur les cartes présentées aux figures A2 à A4. Dans le cas contraire, il faudrait mentionner explicitement, en exposant les arguments appuyant l'analyse, que ce type de mouvement de terrain ne peut pas se produire ou que la probabilité d'occurrence est suffisamment faible pour ne pas en tenir compte.

CA-034
La liquéfaction d'une couche de sable lors d'un séisme peut induire des déplacements le long de surfaces peu inclinées sur des distances pouvant atteindre plusieurs centaines de mètres (voir par exemple Bartlett et Youd, 1995). Il n'est pas seulement question ici de glissements rotationnels qui peuvent directement affecter les berges des cours d'eau au niveau des zones de franchissement. La possibilité que les secteurs à l'arrière des zones de franchissement soient mobilisés par des étalements latéraux doit être considérée. Le cas échéant, les emprises potentielles devraient être indiquées sur les cartes présentées aux figures A2 à A4 (voir commentaires à la question CA-033).

CA-035
Voir les commentaires à la question CA-034. Les cartes disponibles dans les schémas d'aménagement des MRC ne peuvent être considérées tout au plus que comme des documents indicatifs dans le cadre de ce projet.

CA-036
Voir les commentaires à la question CA-034. Un phénomène d'étalement latéral provoqué par la liquéfaction de niveaux sableux peut exercer un effort tranchant sur les pieux.

Commentaires sur l'aspect géologique

CA-037
La réponse du promoteur est satisfaisante dans le sens où le dépôt des rapports de Terratech fournit une réponse aux préoccupations que nous avions exprimées.

Référence citée:

Bartlett, S.F. and Youd, T.L., 1995, Empirical prediction of liquefaction-induced lateral spread: Journal of Geotechnical Engineering, ASCE, v. 121, No. 4, p. 316-329.