Johnson, Kevin

From: Case, Michael
Sent: Thursday, December 20, 2012 1:24 PM
To: mcwe87@hotmail.com
Cc: Dion, Jeanne; Anooshehpoor, Rasool; Richards, Stuart; RidsResPmdaMail Resource; RidsEdoMailCenter Resource; Hogan, Rosemary
Subject: NRC Response to your email on Hydofracking
Attachments: Response_Nelson_Dewey_12_20_12.docx

Dear Mr. Dewey,

I am the Director of the Division of Engineering within the NRC's Office of Research and am responding on behalf of Chairman McFarlane regarding your email sent on November 18th, 2012. Thank you for taking the time to voice your concerns about seismic hazards related to hydraulic fracturing activities. My staff, which consists of experts in the seismic and structural engineering field, have reviewed your email and put together the attached document addressing your specific questions.

If you have any further questions or concerns please feel free to contact our staff Geophysicist, Dr. Rasool Anooshehpoor, at Rasool.anooshehpoor@nrc.gov (301-251-7620).

Kind Regards,
Michael J. Case

Does the hydraulic fracturing drastically change the margin to the DBE?

Drilling and hydraulic fracturing (or hydro-fracking) has not been directly shown to be the cause of significant earthquakes. However, the disposal by deep-well injection of the generated wastewater has been implicated in the triggering of local earthquakes. Open literature sources report that there does appear to be a causal link between the deep-well injection of wastewater and earthquakes at some locations (but not all). Recent, moderate magnitude earthquakes ($3.5 \leq M \leq 5.4$) have been associated with deep fluid injection in Arkansas, southern Colorado, Texas, Oklahoma and Ohio.

Based on observations to-date, the magnitudes of the earthquakes associated with these injection processes in the United States have been about magnitude 5. Earthquakes of this magnitude have historically had little effect on well-engineered structures such as nuclear power plants. Moreover, since the earthquakes associated with the injection process occur within a few kilometers of the injection wells, the region potentially impacted will be confined to the immediate vicinity of the injection activities.

How does the seismic history account for hydraulic fracturing?

All currently operating nuclear power reactors are designed to withstand the effects of natural phenomena such as earthquakes. The NRC requires that safety-significant structures, systems, and components be designed to take into account:

- The most severe natural phenomena (earthquakes) historically reported for the site and surrounding area. The NRC's regulations require additional design margin be added to account for the limited historical data accuracy;
- Appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena; and
- The importance of the safety functions to be performed.

Nonetheless, the NRC continues to monitor the safety of all currently operating nuclear power reactors. This effort includes a request for reactor licensees to re-evaluate seismic hazards as part of the NRC required actions following the March 2011 Fukushima, Japan accident.

Should Hydraulic fracturing be prevented within 100 miles from the nuclear plants, and within 100 miles of a large source of seismic energy—such as the New Madrid seismic zone?

The activities associated with drilling and hydraulic fracturing are not regulated by the NRC. The disposal of the wastewater produced as a by-product of the hydraulic-fracturing process is regulated by the U.S. Environmental Protection Agency via Underground Injection Control (UIC) regulations. Nonetheless, as discussed above, current information indicates that the effects occur close to the injection wells, and nuclear power plants are well-engineered to account for earthquakes.

Did hydraulic fracturing play a part in the North Anna earthquake?

There is no indication that the 23 August 2011 Virginia earthquake (**M**=5.8) was related to hydraulic fracturing. Historically hydraulic fracturing has not contributed to localized earthquakes, however the deep-well disposal of the wastewater has been linked to increases in localized seismic activity. Currently, and at the time of the August 2011 earthquake there were no hydraulic-fracturing or deep-well wastewater disposal activities going on in that area. The Marcellus Shale encompasses a wide area throughout New York, West Virginia and a small portion of Virginia. The Marcellus Shale formation has very limited distribution along the western border of Virginia. The active Marcellus wells nearest to the earthquake's epicenter in Mineral – about 45 miles (73 km) northwest of Richmond – are roughly 100 miles (160 km) away in West Virginia.