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Sent: Wednesday, February 16, 2011 10:18 AM
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Subject: Response to NJGS Comments on Groundwater Impacts at Salem and Hope Creek Site
Attachments: Rspns_To_NJGS_Cmts_on_SalemHCGS_GrndWtr_2.15.2011.doc

Hi Bo and Leslie—

I am attaching a file containing a response to the NJ Geological Survey's comments on the discussion concerning groundwater impacts in the Salem and Hope Creek License Renewal Environmental Reports. This information is provided to assist the NRC Staff with its environmental review of the Salem and Hope Creek license renewal applications.

The attachments (A through F) referred to in the attached response have file sizes that are too large for email. Therefore, I am not sending the attachments with this email. They will be provided on a CD delivered to Leslie.

Please call if there are comments.

Thanks.
Nancy

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**Response to Comments from the New Jersey Geologic Survey (NJGS)
on the Analysis of Groundwater Impacts
in the Salem and Hope Creek License Renewal Environmental Reports**

1. NJGS Comment: Pages 3-7, 3-9. In the section on Ground Water Usage they indicate the ground water levels in the PRM aquifer system in the plant area are the result of the pumping centers north of the Chesapeake and Delaware Canal. On page 3-8 they reference USGS (2001b) as the report which "...clearly shows that the pumping centers north of the Chesapeake and Delaware Canal influence the levels in the lower PRM in the Artificial Island vicinity." This report according to their references USGS 2001b is Simulation of Ground-Water Flow in the Potomac-Raritan-Magothy Aquifer System Near the Defense Supply Center Philadelphia, and the Point Breeze Refinery, Southern Philadelphia County, Pennsylvania, US Geological Survey Water-Resources Investigations Report 01-4218. The report and model is very specific only to the area around the Philadelphia Navy yard and Camden over **35 miles** NNE of Artificial Island. Therefore this report obviously does not indicate the PRM ground water levels are the result of pumping centers north of the canal.

Response: See Below.

2. NJGS Comment: Then on page 3-9 they indicate that according to USGS (2009) the Delaware withdrawals have reduced the regional water levels and that the information in the report suggests that the decrease in water levels at Artificial Island in the lower and middle PRM are the result of the regional lowering.

Response: See Below.

3. NJGS Comment: According to 3-7 and 3-8 and Table 3.1-3 the Salem and Hope Creek wells are in the upper and middle PRM, not the middle and lower PRM as implied on 3-9.

Response: Site wells PW-5 (840' below ground surface [bgs]), HC-1 (816' bgs) and HC-2 (817' bgs) are screened in the Upper Raritan formation, while site well PW-6 (1138' bgs) is screened in the Middle Raritan formation (Dames and Moore, 1988; NJDEP 1975, 1980, and 1984). Both the Upper and Middle Raritan formations belong to the Middle aquifer of the Potomac-Raritan-Magothy (PRM) aquifer system (USGS 2009a). See Attachment A.

4. NJGS Comment: Also, if USGS (1983) Plate 1 is examined there is a distinct cone of depression, at the plant site (PW 5), in the lower PRM which according to page 12 of the report "...includes essentially all water-bearing zones within the aquifer system below the upper aquifer."

Response: USGS (1983) Plate 1 does show a cone of depression in the Lower aquifer of the PRM beneath the Salem and Hope Creek site in 1978 (Attachment B). However, well PW-5 pumps water from the Upper Raritan formation, which belongs to the Middle aquifer of the PRM, not the Lower aquifer of the PRM. No wells at the Salem and Hope Creek site pump water from the Lower aquifer of the PRM.

USGS (2009a) Plate 7 shows no cone of depression beneath the Salem and Hope Creek site in the Upper aquifer of the PRM in 2003 (Attachment C). Similarly, USGS (2009a) Plate 9 shows no cone of depression beneath the Salem and Hope Creek site in the Lower aquifer of the PRM in 2003 (Attachment F). In the Middle aquifer of the PRM, USGS (2009a)

Plate 8 does show a localized cone of depression in 2003 beneath the Salem and Hope Creek site (Attachment D). Hence, based on USGS (2009a) Plates 7, 8 and 9, it appears that groundwater production at the site may be contributing to a reduction in localized groundwater availability. However, this reduction is limited to a small area within approximately 2 miles of well PW-5 and is not likely to impact other groundwater users.

USGS (2011) reports that groundwater levels have increased in the City of Salem observation well over the past several years, and USGS (2008 and 2009b) indicate that groundwater levels in the area are not decreasing. Although groundwater use conflicts were enough of a regional concern to cause designation of two Critical Areas, the Salem and Hope Creek site was not included within either of the two Critical Areas. The success of the Critical Areas program in allowing groundwater levels to recover suggests that groundwater use conflicts in western Salem County may diminish with time, rather than grow.

5. NJGS Comment: There is no information shown in USGS (1983) for the upper aquifer at the plant site. Table 2 indicates a water level for PW5 in 1978 at -78 feet. The well record for PW5 indicates static water levels of 35' (8/27/74) and 32' (11/4/75). The land surface at the well is about 17' above sea level which would indicate the water level at Artificial Island in 1974-75 was -18 to -15 feet. Three years after the plant started pumping out of the aquifer the water levels dropped to -78 feet or a decline of 60 feet in three years. That indicates the plant is causing the low levels not a pumping center over 10 miles away. USGS WRI 96-4206 Water levels in, Extent of Freshwater in, and Water Withdrawal from Eight Major Aquifers, New Jersey Coastal Plain, 1993, by Pierre J. Lacombe and Robert Rosman, 1997, also shows the same cone of depression on Plate 7 of 8, Middle and undifferentiated Potomac-Raritan-Magothy aquifer. This report has separated the PRM into three aquifers. The water level on the plate is PW5 at -75 feet, the same well as in USGS (1983) Plate 1. The USGS reports above and in USGS (2009) show no wells at Artificial Island as being in the upper PRM. In the USGS reports and in their database lists PW5 as middle PRM and PW6 as being in the lower PRM, not upper and middle respectively. Based on the depths of HC-1 and HC-2 would likely be in the middle and lower PRM respectively. Without having the construction of the other wells on Table 3.1-3 the NJGS can't tell which aquifer each is in, but the USGS (2009) shows pumpage from the upper aquifer at the site.

Response: No well at the Salem and Hope Creek site is screened in the Upper aquifer of the PRM. PW-6 (1138' bgs) is screened in the Middle Raritan formation, while PW-5 (840' bgs), HC-1 (816' bgs) and HC-2 (817' bgs) are screened in the Upper Raritan formation (Dames and Moore, 1988; NJDEP 1975, 1980, and 1984). Both the Upper and Middle Raritan formations belong to the Middle aquifer of the PRM (USGS 2009a). See Attachment A.

Similar to USGS (2009a), which is discussed in previous responses above, USGS (1997) WRI-96-4206 shows a localized cone of depression in 1993 in the Middle aquifer of the PRM beneath the Salem and Hope Creek site. This suggests that groundwater production at the site may be contributing to a reduction in localized groundwater availability. However, this reduction is limited to a small area within approximately 2 miles of well PW-5 and is not likely to impact other groundwater users.

USGS (2009a) Figures 31, 36 and 42 show amounts of groundwater withdrawn per year from the Upper, Middle, and Lower aquifers of the PRM, respectively, in the region surrounding the Salem and Hope Creek site. At the location of the Salem and Hope Creek site, these figures show groundwater being withdrawn only from the Middle aquifer of the PRM (Attachment E).

6. NJGS Comment: Page 4.11, Section 4.5 **Ground-Water Use Conflicts (Plants Using >100 gpm of Ground-Water)**. Here again they indicate PW5 and PW6 are in the upper and middle PRM aquifers, whereas the USGS indicates the wells are in the middle and lower PRM.

Response: PW-6 (1138' bgs) is screened in the Middle Raritan formation, while PW-5 (840' bgs), HC-1 (816' bgs) and HC-2 (817' bgs) are screened in the Upper Raritan formation (Dames and Moore, 1988; NJDEP 1975, 1980, and 1984). Both the Upper and Middle Raritan formations belong to the Middle aquifer of the PRM (USGS 2009a). See Attachment A. At the location of the Salem and Hope Creek site, USGS (2009a) Figures 31, 36, and 42 show groundwater being withdrawn only from the Middle aquifer of the PRM (Attachment E).

7. NJGS Comment: They also indicate the impacts from the pumpage at the current rates at the site are "...SMALL and would not warrant mitigation." Examination of the synoptic data down through the years since PW5 was installed shows the plant has caused a deep cone of depression in the middle PRM which is also now being affected by pumpage from Delaware. If the plant ever pumped at the current diversion approval the affect would be felt in Delaware. The plant is the only diversion within 8 to 10 miles of the plant and yet the water levels in the PMR middle PRM are about -70 feet and the lower PRM are about -45 feet.

Response: USGS (1997) and USGS (2009a) show a localized cone of depression in 1993 and 2003, respectively, in the Middle aquifer of the PRM beneath the Salem and Hope Creek site. This suggests that groundwater production at the site may be contributing to a reduction in localized groundwater availability. However, this reduction is limited to a small area within approximately 2 miles of well PW-5 and is not likely to impact other groundwater users. USGS (2009a) indicates that the depression within the Middle aquifer of the PRM was at approximately 60 feet in 2003.

USGS (2011) reports that groundwater levels have increased in the City of Salem observation well over the past several years, and USGS (2008 and 2009b) indicate that groundwater levels in the area are not decreasing. Although groundwater use conflicts were enough of a regional concern to cause designation of two Critical Areas, the Salem and Hope Creek site was not included within either of the two Critical Areas. The success of the Critical Areas program in allowing groundwater levels to recover suggests that groundwater use conflicts in western Salem County may diminish with time, rather than grow.

8. NJGS Comment: Based on the various synoptic water level measurements from 1978 to 2003 the plant has caused significant water level declines which are reaching out an unknown distance from the plant. There needs to be a detailed study much like USGS (2001b) to determine the impacts of all the pumpage in the PRM around Artificial Island with a cluster of observation wells, offsite in each of the PRM aquifers.

Response: USGS (1997) and USGS (2009a) show a localized cone of depression in 1993 and 2003, respectively, in the Middle aquifer of the PRM beneath the Salem and Hope Creek site. USGS (2009a) Figures 31, 36, and 42 show groundwater being withdrawn only from the Middle aquifer of the PRM at the location of the Salem and Hope Creek site (Attachment E). These figures show no groundwater withdrawals from the Upper aquifer or Lower aquifer of the PRM (Attachment E). The cone of depression beneath the site is localized, and there are no groundwater users nearby. Hence, the impacts to local groundwater use are SMALL, and a detailed study of the PRM aquifers is not warranted.

Attachments

Attachment A: Table 1 from USGS 2009a

Attachment B: Plate 1 from USGS 1983

Attachment C: Plate 7 from USGS 2009a

Attachment D: Plate 8 from USGS 2009a

Attachment E: Figures 31, 36, and 42 from USGS 2009a

Attachment F: Plate 9 from USGS 2009a