NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

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CERTIFIED MAIL - RETURN RECEIPT REQUESTED

September 28, 2011

Colonel David Hornyak
Base Commander
377 ABW/CC
2000 Wyoming Blvd. SE
Kirtland AFB, NM 87117-5606

John Pike
Director, Environmental Management Section
377 MSG/CEANR
2050 Wyoming Blvd., Suite 116
Kirtland AFB, NM 87117-5270

RE: REPLACEMENT PAGES, QUARTERLY PRE-REMEDY MONITORING AND SITE INVESTIGATION REPORT FOR JANUARY–MARCH 2011, BULK FUELS FACILITY SPILL, SOLID WASTE MANAGEMENT UNITS ST-106 AND SS-111, MAY 2011
KIRTLAND AIR FORCE BASE, EPA ID# NM9570024423
HWB-KAFB-11-008

Dear Colonel Hornyak and Mr. Pike:

The New Mexico Environment Department (NMED) has reviewed the document *Replacement Pages, Quarterly Pre-Remedy Monitoring and Site Investigation Report for January-March 2011, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111*, dated May 2011, with cover letter dated July 22, 2011 (hereinafter referred to as the Replacement Pages). Review of the Replacement Pages reveals several concerns related to water-level maps and geophysical logging. These concerns are expressed in the following comments.

Comments on Water-Level Maps

1. The U. S. Air Force (Permittee) submitted revisions of Figures 5-2 through 5-4 (Groundwater Level Contours) as part of the Replacement Pages without providing an explanation for the revisions. Table 5-2 (Historical Groundwater Level and Liquid Measurement Data) appears to be the same in both the original report and the Replacement Pages (other than a pagination change). However, not all data posted on the figures match their corresponding data in the table. For example, in March 2011 the water-level elevation for monitoring well KAFB-10614 is shown as 4857.11 ft in Replacement Pages Figure 5-4, as 4856.91 ft in Figure 5-4 of the original report, and is listed as 4856.62 ft in Table 5-2 (the cited figures and table are reproduced here in part as

Figures 1 and 2 and Table 1 of this letter). In fact, there are numerous other examples of such inconsistencies between the figures and the table, indicating that the water-level map shown in Figure 5-4 (of the original report and the Replacement Pages) and/or the data in Table 5-2 may be replete with errors, and thus, are unreliable. The Permittee must correct the figures or the table, or both, as necessary and resubmit the corrected information to the NMED. Also, Figures 5-2 and 5-3 must also be corrected, as they have problems similar to those described above for Figure 5-4. Furthermore, any changes in the figures or table would probably necessitate changes to Figure 5-5 (Groundwater Gradient March 2011), also resubmitted in the Replacement Pages. If so, Figure 5.5 must also be corrected and must also be submitted to the NMED.

2. As discussed with the Permittees and their contractor at a technical meeting held on July 12, 2011, the Permittees submitted a water-level map in the document *Stage 2 Abatement Program for Nitrate Contaminated Groundwater (Site ST-105) Fourth Annual Groundwater Monitoring Report, June 2011* (this map is reproduced here in part as the lower map in Figure 3 of this letter). On this map, the water-level elevation near the intersection of Perimeter and Connor Streets is about 5 ft lower compared with that shown on Figures 5-2 through 5-4 of the Replacement Pages (and the same figures in the original report) for a similar time period. Taking into consideration the water-level elevation for KAFB-0510 (as presented in the nitrate report), the geometry of the water table on the east side of Bulk Fuels Facility could be considerably different from that presented in the Replacement Pages and other reports for the Bulk Fuels Facility Spill, and, as a consequence, the groundwater flow direction and gradient for this area could be markedly different from that previously determined. The Permittee must correct the figures for the Bulk Fuels Facility Spill quarterly report as necessary and submit the corrected figures to the NMED. The Permittee must also correct any figures that are erroneous in the aforementioned nitrate report and must submit the corrected figures to the NMED Ground Water Quality Bureau, with a copy to the NMED Hazardous Waste Bureau.

3. NMED notes a water-level contour constructed with a bend at nearly a right angle, specifically the 4856.0-ft contour near KAFB-10619 on Figure 5-4 of the Replacement Pages (reproduced here in part as Figure 1 of this letter). Typically, such sharp angles would not be expected as a component of the contours that model the water table of an unconfined aquifer in an unconsolidated basin-fill environment. NMED also notes the odd, contorted 4857.0-ft contour that nearly completely surrounds KAFB-106062 (see Figure 1 of this letter) and questions whether this odd geometry is related to survey error or other error. The Permittee must justify such unusual components of the model of the water table, or revise the model to be consistent with that expected for natural conditions.

Comments on Geophysical Logs

Section 5.2.5.1 of the Groundwater Investigation Work Plan states:

> Geophysical logs will show results of induction logging (medium and deep) in milliohms per meter, neutron logging in American Petroleum Institute (API) neutron units, and gamma logging in API-calibrated counts per second.

This indicates that geophysical logging tools are to be calibrated to known standards; thus, two different logging instruments should yield similar values for a particular geophysical parameter for the lithologic units encountered in a given well, provided conditions in that well have remained constant. The geophysical logs of the first mobilization (29 existing wells) were generated by the contractor Colog and were submitted in the report for the 4th Quarter of 2010. A second series of logs were generated during the first quarter of 2011 by Jet West Geophysical Services (Jet West) and submitted in the Replacement Pages. As indicated above, both sets of logs were to be calibrated well logs. NMED finds that this is not the case as discussed below in the following examples.

Example 1: The geology of one well, KAFB-10624 was logged by both Colog and Jet West; the long normal (deep) induction logs for KAFB-10624 are shown in Figure 4 of this letter. For about half of the well logs, the resistivity values in the Colog data are about 2 to 4 times higher in magnitude compared to the Jet West data. In other areas of the well logs, the Colog resistivity values are less than the Jet West resistivity values. Because the well environment did not change, these data show that at least one set, and possibly both sets, of the logging instruments that generated the logs were not properly calibrated to a known standard (ohmmeters).

Example 2: Both logging contractors produced two gamma logs each for KAFB-10624; one each associated with the induction tool and one each associated with the neutron tool (see Figure 5). While 3 of the 4 logs match up reasonably well, the gamma log generated by Colog on the neutron tool is considerably different in magnitude (API units) than the other three logs suggesting that one or more of the logging tools was not properly calibrated.

Example 3: Figure 6 (and Figure 5) illustrates the importance of having calibrated logs to evaluate the lateral characteristics of a given lithologic unit. Figure 6 shows the logs for the well cluster including wells KAFB-10627, KAFB-106044, and KAFB-106045. The log for well KAFB-10627 produced by Colog exhibits very different resistivity values compared to the logs for KAFB-106044 and KAFB-106045 that were generated by Jet West -- even though the wells are only a few tens of feet apart. These discrepancies are not likely caused by changes in lithology, but instead, are caused by a lack of proper calibration of one or more of the logging tools. Furthermore, Figure 6 (and Figure 5) suggest both the Colog and Jet West logs were generated using instruments that were not properly calibrated.

Example 4: The Section 5.2.5.4 of the Groundwater Investigation Work Plan for the Bulk Fuels Facility Spill states "Neutron logs map porosity by emitting high energy neutrons… The porosity can be calculated in real-time or post- logging." The Permittee

has also argued in meetings with the NMED that neutron logs can be used and are to be used to measure porosity for the Bulk Fuels Facility Spill.

Both contractors generated neutron logs from the logging of well KAFB-10624. Colog produced both near and far neutron logs and Jet West produced a single neutron log for the well. There is a difference of an order of magnitude between the two sets of neutron logs produced by the two contractors (see Figure 7 of this letter).

As demonstrated by these examples, the geophysical logs submitted to the NMED so far are not calibrated logs, and, thus have limits on their acceptable use. These logs allow for qualitative comparison within a given borehole and between nearby boreholes, but do not allow for quantitative comparisons across the site, the latter being the goal of a calibrated logging program. Uncalibrated geophysical logs cannot be used reliably to interpolate or extrapolate physical properties, such as hydraulic conductivity.

The NMED also questions the reliability of estimating porosity values from neutron logs exhibiting such markedly different API counts as discussed in Example 4 above. NMED has no confidence in the accuracy of either the Colog or Jet West neutron logs based on the information presented in Figure 7 and the issues related to calibration of the other log types discussed in this letter. For this reason, the Permittee must respond in writing to this comment by stating how it will obtain porosity values from the logs, that it will repeat the neutron logging with properly calibrated tools, or propose another method to measure porosity for the Bulk Fuels Facility Spill project. Porosity data are needed both for saturated conditions throughout the project site and also for the vadose zone in the vicinity of the former fuel offloading rack and perhaps for other source areas that may be present at the Bulk Fuels Facility.

Other Comments about Geophysical Logging

1. Figure 8 of this letter shows the gamma logs from two groundwater monitoring wells (KAFB-1064 and KAFB-10612) situated about 300 feet apart, with a soil-vapor monitoring well (KAFB-106139) located between them. There is a significant difference between the logs generated for the groundwater monitoring wells and that for the soil-vapor monitoring well. The soil-vapor well exhibits many gamma peaks and an overall higher background count than the nearby groundwater monitoring wells. Given the proximity of the three wells, these differences may be related to well construction and not to lithologic differences. However, the gamma peaks do not necessarily correspond to the well construction details. Similarly, the neutron logs also exhibit different characteristics between the groundwater monitoring wells and the soil-vapor well. Provide an explanation, if possible, as to why the logs differ.
2. In addition, NMED notes that the short normal induction log for KAFB-10618 (see Figure 9 of this letter) is unusual in shape, suggesting a failure of the instrument or other error. While the Permittee's contractor verbally mentioned there was a problem inherent with that specific well at the July 12 meeting, the Permittee must provide a discussion of what the Permittee has done to identify the problem, correct the problem, and acquire reliable information from that well.

The Permittee must respond in writing to the above comments and submit the corrected figures and table and other information by **November 8, 2011**.

Should you have any questions, please contact Mr. William Moats of my staff at (505) 222-9551.

Sincerely,

John E. Kieling
Acting Chief
Hazardous Waste Bureau

Enclosures: Figures 1-9, Table 1

cc: W. Moats, NMED HWB
W. McDonald, NMED HWB
S. Brandwein, NMED HWB
S. Reuter, NMED PSTB
J. Schoeppner, NMED GWQB
L. Barnhart, NMED OGC
B. Gallegos, AEHD
R. Shean, ABCWUA
L. King, EPA-Region 6 (6PD-N)
File: KAFB 2011 and Reading

UNIQUE DB ID	LOCID	MEASUREMENT DATE	MEASUREMENT TIME	DEPTH TO NAPL	DEPTH TO WATER	MEASURED NAPL THICKNESS	FLUID ELEV. (ft)	GW ELEV. (ft)	GROUNDWATER ELEV CORR FOR NAPL (ft)	MP ELEV
KAFB-106014	KAFB-10614	2/24/2011	1015		493.31	0	4856.49	4856.49	4856.49	5349.8
KAFB-106014	KAFB-10614	3/30/2011	1400		493.18	0	4856.62	4856.62	4856.62	5349.8
KAFB-106014	KAFB-10614	4/28/2011	855		493	0	4856.8	4856.8	4856.8	5349.8
KAFB-106019	KAFB-10619	2/23/2011	1617		498.61	0	4855.95	4855.95	4855.95	5354.56
KAFB-106019	KAFB-10619	3/30/2011	917		498.63	0	4855.93	4855.93	4855.93	5354.56
KAFB-106019	KAFB-10619	4/25/2011	1121		498.35	0	4856.21	4856.21	4856.21	5354.56

Table 1. From Replacement Pages, Table 5-2. Note water-level elevations of 4856.62 ft for KABB-10614 and 4855.93 ft for KAFB -10619. Compare these water-level elevations with those shown in Figures 1 and 2.

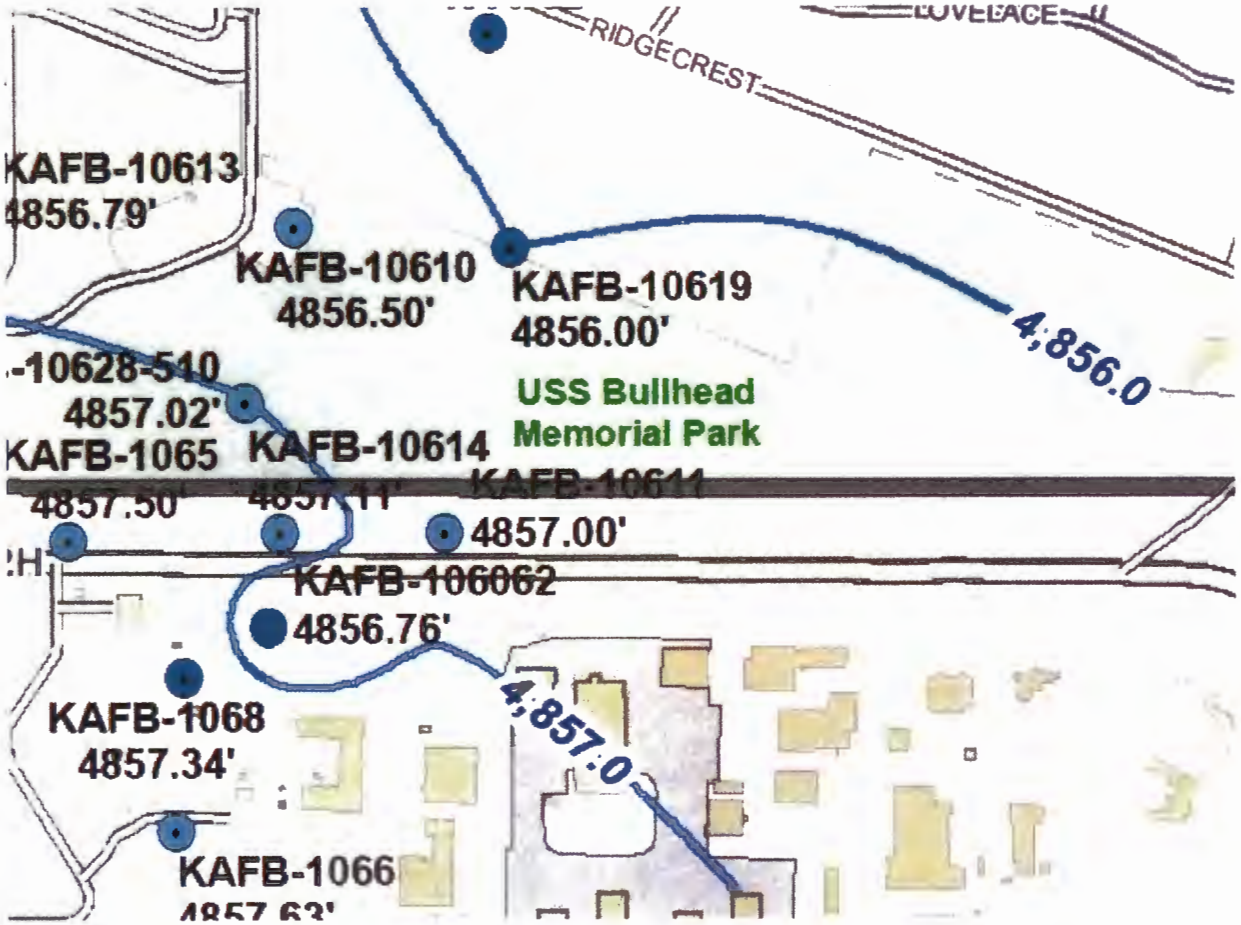


Figure 1. From Replacement Pages, Figure 5-4, Groundwater Level Contours March 2011. Note water-level elevations of 4857.11 ft for KABB-10614 and 4856.00 ft for KAFB-10619. Compare these water-level elevations with those shown in Figure 2 and listed in Table 1.

Also note water-level contour constructed at nearly a right angle, specifically the 4856.0-ft contour placed near KAFB-10619, and odd contorted 4857.0-ft contour line constructed nearly completely around KAFB-106062.

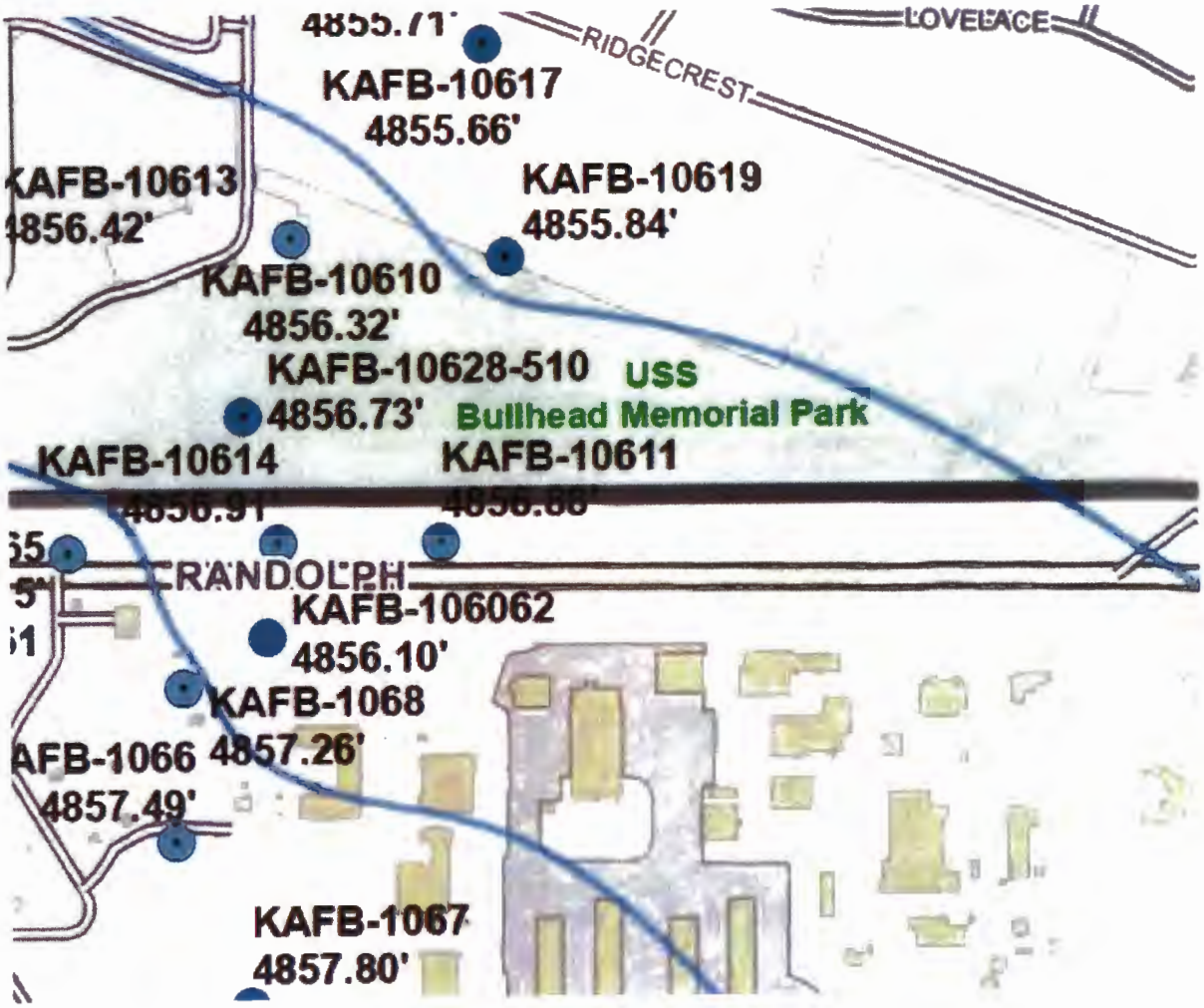
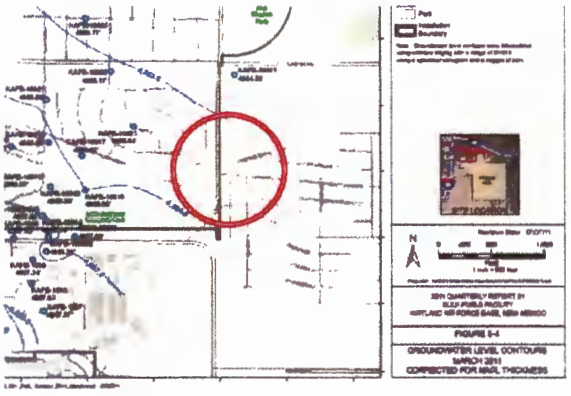


Figure 2. From original report, Figure 5-4, Groundwater Level Contours March 2011. Note water-level elevations of 4856.91 ft for KABB-10614 and 4855.84 ft for KAFB -10619. Compare these water-level elevations with those shown in Figure 1 and listed in Table 1.



Replacement Figure 5-4 Note the water level elevation
near Perimeter and Connor Streets is approximately 4855.5 ft.

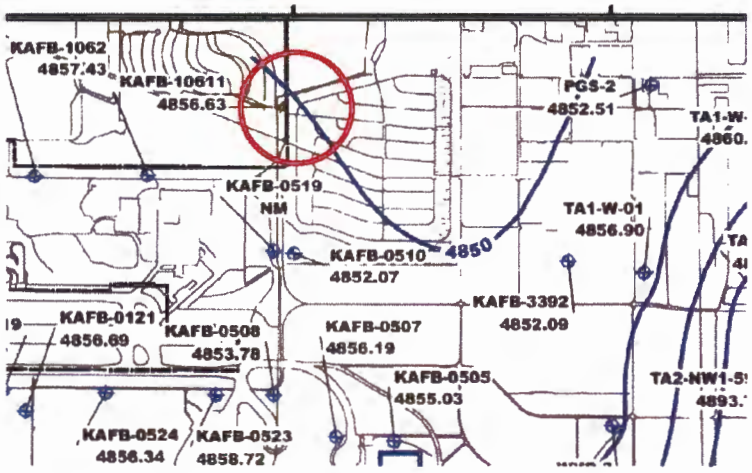


Figure 3-4 of the Stage 2 Abatement Program for Nitrate-Contaminated Groundwater (Site ST-105)
Fourth Annual Groundwater Monitoring Report. June 2011.
Note the water level elevation near Perimeter and Connor Streets is about 4850 ft.

Figure 3. Comparison of two water-level maps submitted by the Permittee, one from Figure 5-4 of the Replacement Pages, and one from Figure 3-4 of the *Stage 2 Abatement Program for Nitrate-Contaminated Groundwater (ST-105) Fourth Annual Groundwater Monitoring Report*. The water levels shown on these maps differ by about 5 feet on the east side of the Bulk Fuels Facility Spill site, suggesting one or both maps are inaccurate.

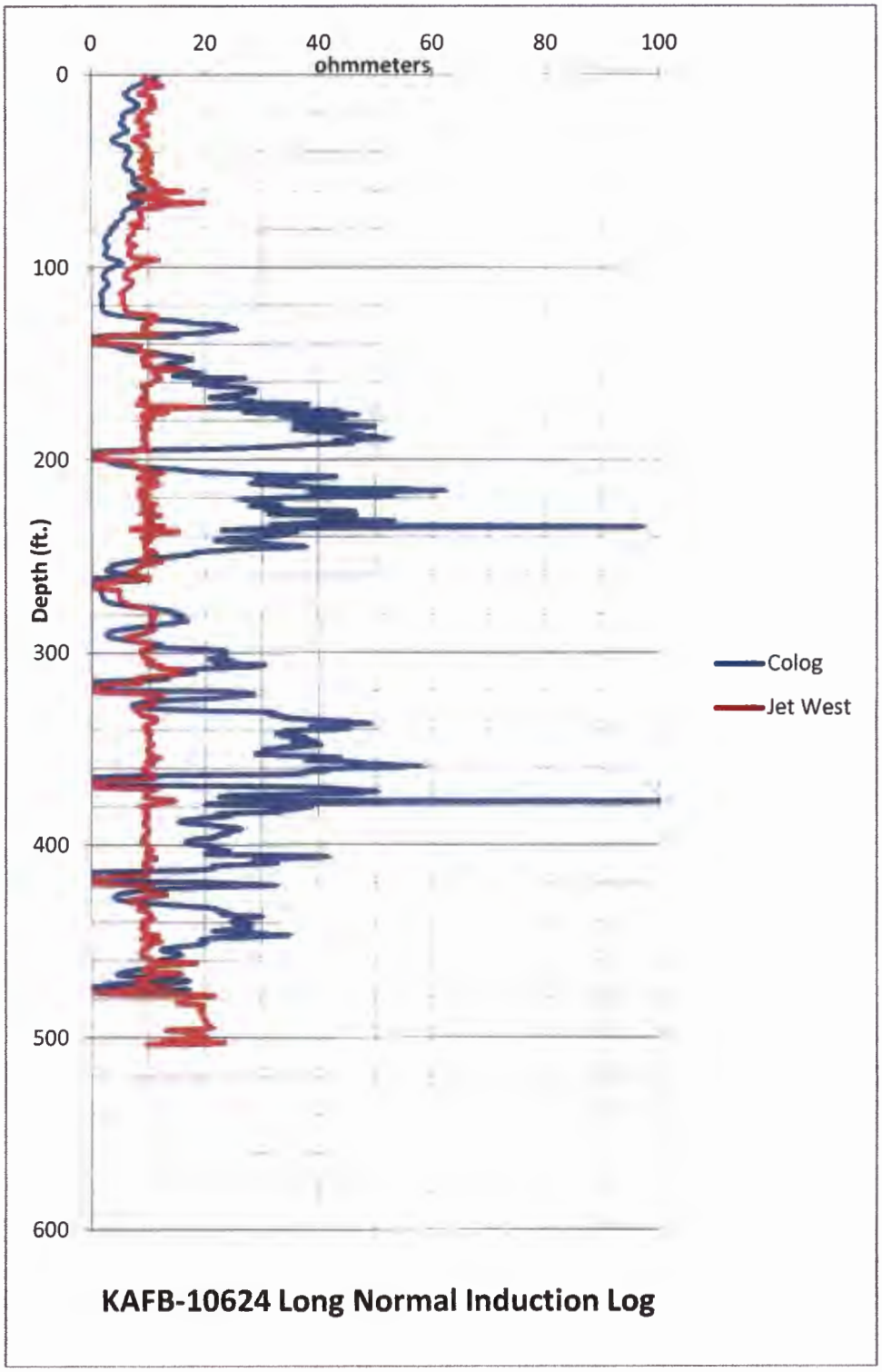


Figure 4. Comparison of Colog and Jet West Long Normal (deep) Induction Log at KAFB-106

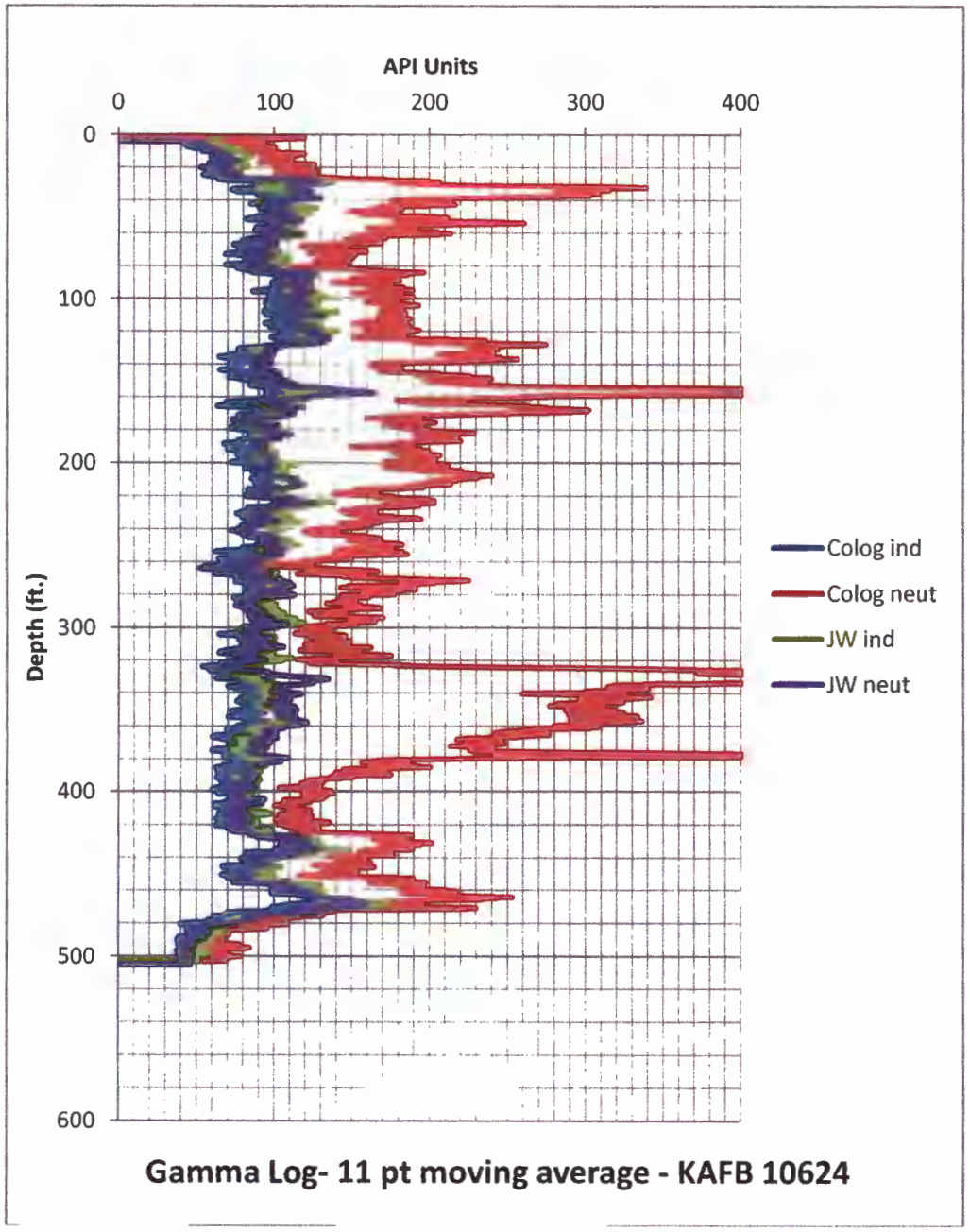


Figure 5. Comparison of Gamma logs generated by Colog and Jet West at KAFB-10624. In each case the gamma tool was run with another tool, either the neutron or the induction tool, as noted in the legend.

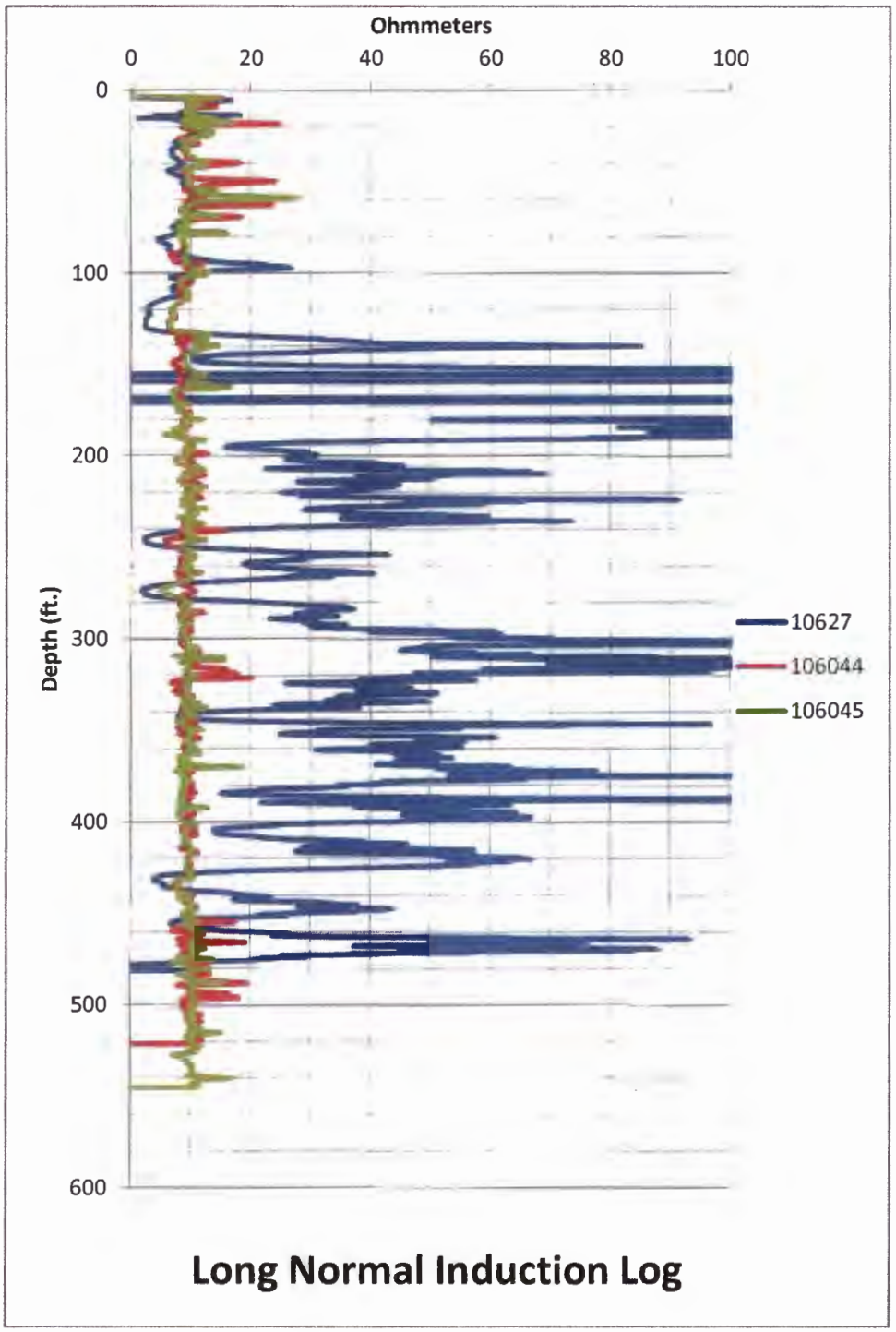


Figure 6. Comparison of Long Normal (deep) Induction Log between three wells in one cluster, with one of the wells logged by Colog (10627) and the other two wells logged by Jet West (106044 and 106045).

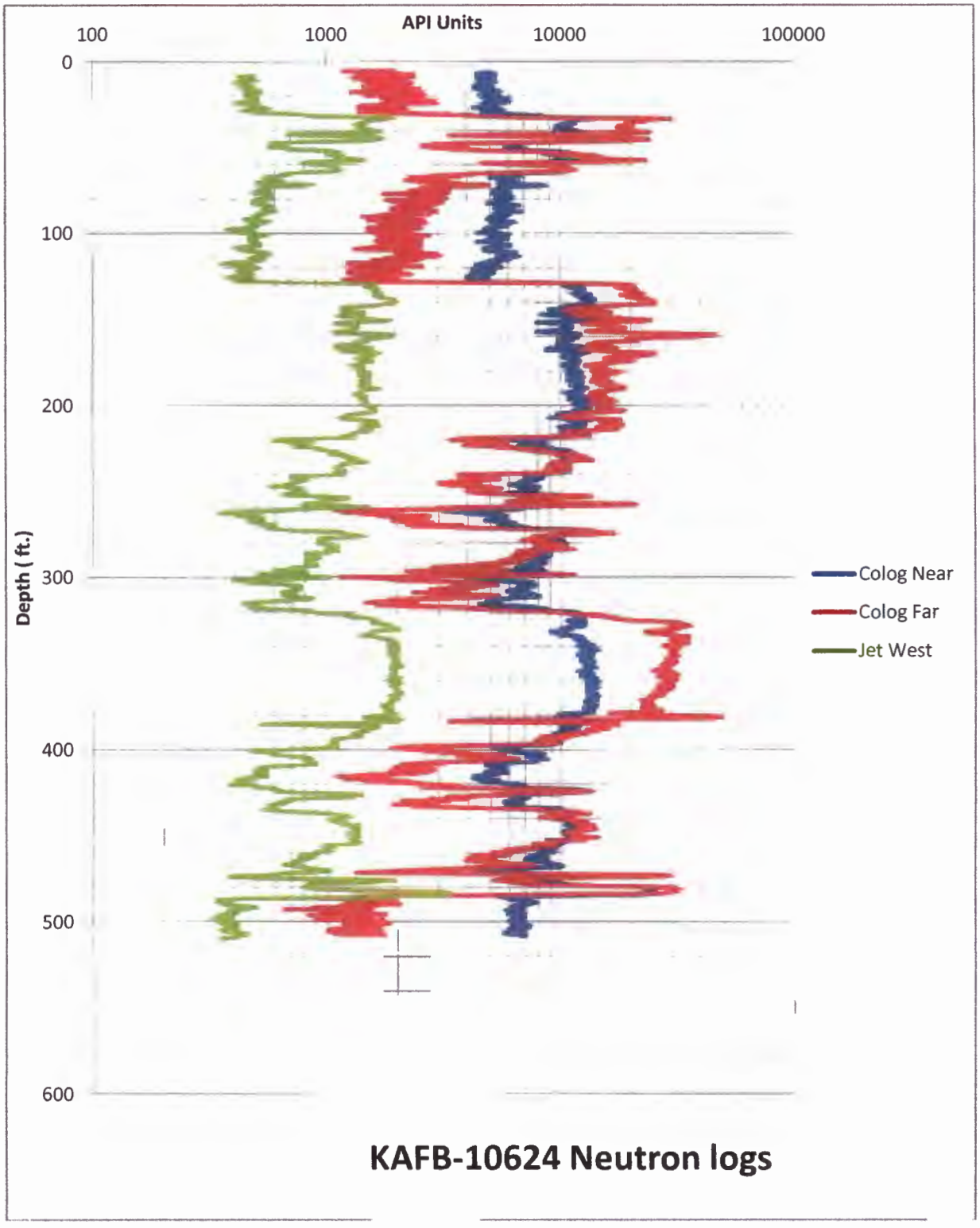


Figure 7. Comparison of neutron logs generated by Colog and Jet West at KAFB-10624.

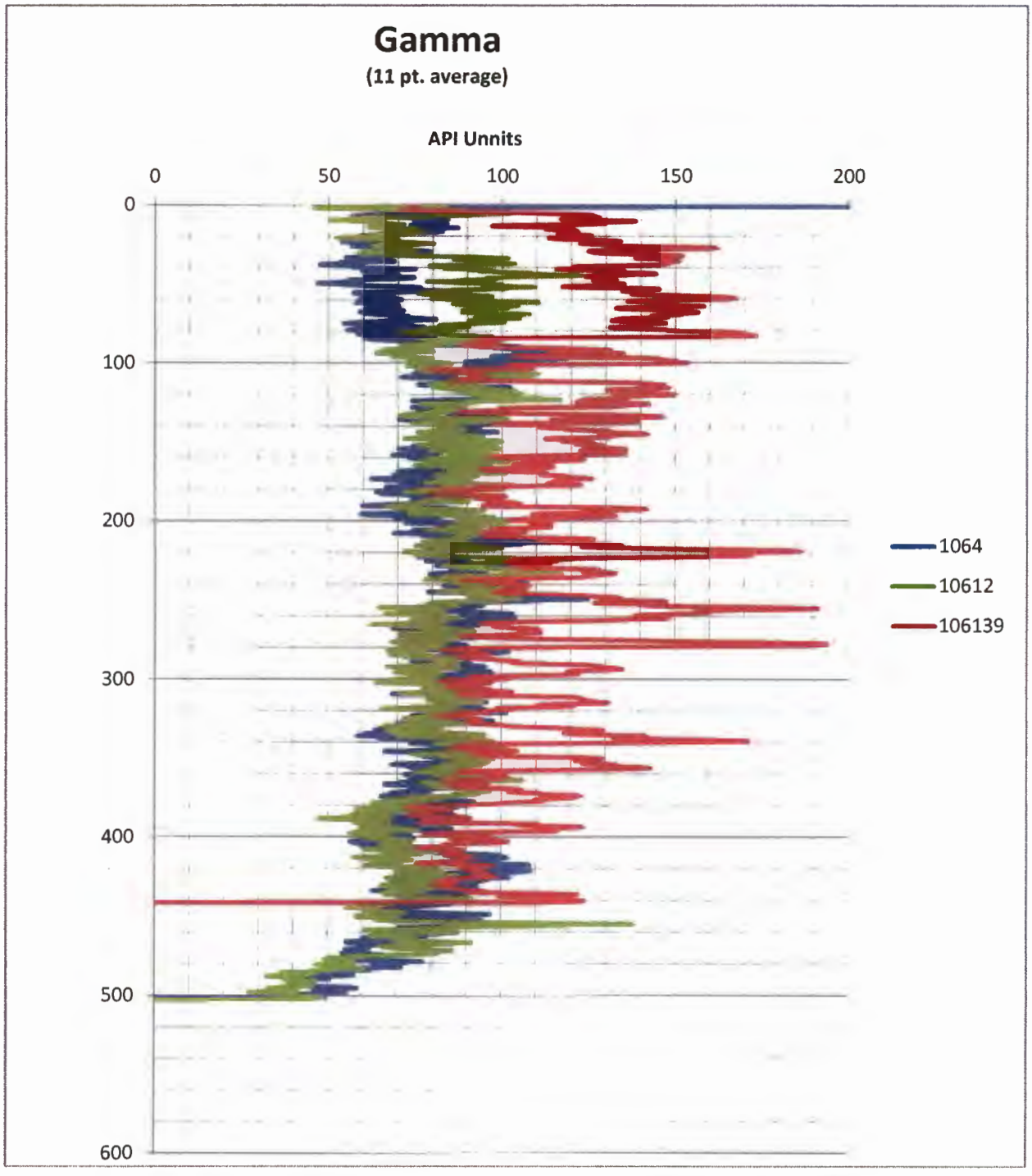


Figure 8. Comparison of gamma logs from three nearby wells - two from groundwater monitoring wells (KAFB-1064 and KAFB-10612) and one from a soil-vapor monitoring well (KAFB-106139). Note the marked difference in gamma response in the log for the soil-vapor well compared to the groundwater monitoring wells

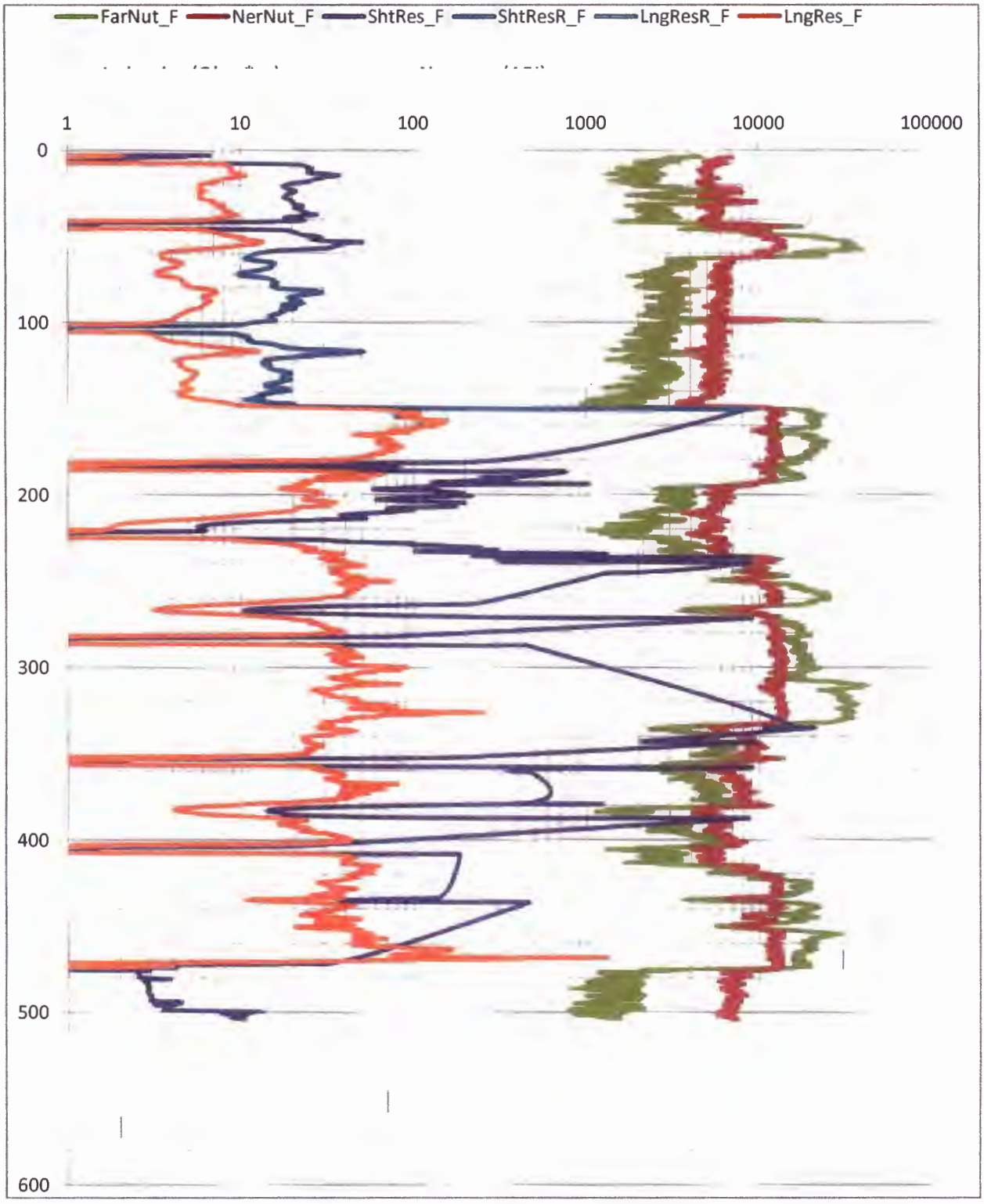


Figure 9. Induction and neutron logs from KAFB-10618. Note unusual characteristics of the short normal induction log (labeled ShtRes_F).