From: Edward Helvenston
Sent: Wednesday, August 2, 2023 5:11 PM
To: Rusty Towell; Lester Towell; Benjamin Beasley; Tim Head; Jordan Robison; Alexander Adams
Cc: Richard Rivera; Zackary Stone (He/Him/His); Michael Wentzel
Subject: ACU MSRR Section 2.3 Audit Questions (Batch 2)

Dear Dr. Towell,

Below are questions the NRC staff has prepared for Abilene Christian University (ACU) related to the ACU Preliminary Safety Analysis Report, primarily Section 2.3, "Meteorology." The NRC staff would like to discuss these questions within the scope of the ACU construction permit (CP) application review Audit Plan for Chapters 2 and 3 (see audit plan dated 3/2/2023, ML23065A048), and I am providing in advance to facilitate discussion during an audit meeting. We will add this email, with the questions, to public ADAMS. If you have any questions, please let Richard, Zackary, or I know.

Thank you,

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Item #	Question
2.3-2	PSAR Section 2.3.1.1 discusses, and PSAR Table 2.3-1 lists, the fifteen heaviest snowfall events presumably occurring at Abilene, TX, since 1950. The NRC staff notes that the data are attributed to NOAA via a National Centers for Environmental Information (NCEI) website (PSAR Ref. 2.3-1), but there are multiple, official climate observing stations in the Abilene area. It is not clear to the NRC staff whether the data are attributed strictly to Abilene or based on measurements within a 50-mile radius of Abilene as other text indicates. Therefore: (i) confirm whether the data on maximum snowfall events occurred only at Abilene and/or at other stations within 50 miles of Abilene; (ii) in either case, on the basis of the above, confirm that the conditions are representative of those expected at the ACU MSRR site; (iii) please clarify statements in the text and PSAR Table 2.3-1 including identifying the names and locations of any other stations used relative to the ACU MSRR site.
2.3-3	PSAR Section 2.3.1.1 states that rainfall, temperature, and humidity are measured hourly at Dyess Air Force Base (AFB) and are summarized in PSAR Figures 2.3-1 to 2.3-3. (i) The titles of PSAR Figures 2.3-1, 2.3-2, and 2.3-3 indicate the data are for Abilene. The NRC staff notes that this appears to be inconsistent with the text of PSAR Section 2.3.1.1 as it is attributed to Dyess AFB. Please clarify. (ii) Please clarify and confirm the accuracy of PSAR Section 2.3 references relevant to PSAR Section 2.3.1.1. For example, PSAR Section 2.3.1.1 appears to indicate that data in PSAR Figures 2.3-1, 2.3-2, and 2.3-3 are from NOAA, but the actual figures cite different references for this data. Additionally, please clarify and confirm that the data available through the "Climate Explorer" website is traceable to NOAA. (iii) It is not clear to the NRC staff if the maximum daily rainfall amounts by month in PSAR Figure 2.3-1 and the maximum and minimum daily (dry-bulb) temperatures by month in PSAR Figure 2.3-3 are fully representative of the ACU MSRR site area. The NRC staff notes that, for example, a 12-hour total of 26 inches of rain fell at a location about 43 miles northeast of Abilene in Shackleford County as a result of the remnants of Hurricane Amelia in 1978 (this does not appear to be mentioned in the PSAR). The NRC staff notes that data for a single location may not necessarily be representative of a wider geographical area and consider extremes that could occur in this area. Please discuss why the data on rainfall and temperature extremes in PSAR Figures 2.3-1 and 2.3-3 is sufficient to characterize the MSRR site area meteorology.
2.3-4	PSAR Section 2.3.1.1 states that humidity data for Dyess AFB are summarized in PSAR Figures 2.3-1, 2.3-2, and 2.3-3. PSAR Section 2.3.1.2 states that monthly average humidity data are summarized in PSAR Figure 2.3-4. (Audit Question 2.3-1 separately addresses possible dry-bulb temperature and/or atmospheric moisture indicators related to HVAC and other cooling system design considerations.) (i) The NRC staff notes that PSAR Figures 2.3-1, 2.3-2, and 2.3-3 do not appear to include humidity data as indicated in PSAR Section 2.3.1.1; please clarify. (ii) PSAR Section 2.3.1.2 and Figure 2.3-4 do not appear to clearly indicate the location for the data in PSAR Figure 2.3-4; please clarify.
2.3-5	(i) The historical wind gust and mean wind speeds for Abilene in PSAR Section 2.3.1.3 are attributed to NOAA's National Climatic Data Center but are otherwise unreferenced. Please provide citation(s) to the appropriate source(s). (ii) The wind gust speed referenced in PSAR Section 2.3.1.3 is indicated to have occurred in June 1983. It is not clear to the NRC staff whether this value represents a fastest-mile wind speed (which was typically used by the National Weather Service (NWS) and industry prior to about 1988), a 3-second gust speed, or a value measured over some other duration. Also, the measurement height does not appear to be indicated and the NRC staff notes this may have changed over time. Please

	clarify. (iii) Confirm the reference cited at the bottom of PSAR Table 2.3-4, which provides various ranges of maximum wind speeds and the number of damage reports within those ranges. The table indicates the source of the data is PSAR Ref. 2.3-1. However, the NRC staff checked this reference and noted that for the indicated city and time series, only precipitation and temperature statistics (not statistics related to wind) appear to be available. Please clarify the source (including the location(s) and time series (including whether the data represent conditions in Abilene only or reports and measurements within a certain radius of the MSRR site)) of the data in PSAR Table 2.3-4. (iv) In PSAR Table 2.3-4 a total of 25 events are attributed to an "Unknown" wind speed range that is not further explained in the text or table. The NRC staff notes that it is not clear what limits of the "unknown" range could be (e.g., if they could be greater than the upper limit of the 91-100 mph wind speed range). Also, it is not clear whether the indicated wind speeds in PSAR Table 2.3-4 represent sustained or gust wind speeds. PSAR Section 2.3.1.3 indicates a maximum wind gust speed of 78 mph, and the staff notes that wind gusts are typically greater than sustained winds. Therefore, without further explanation of what the ranges in PSAR Table 2.3-4 represent, including the range labeled as "Unknown," it is not clear whether the maximum wind gust in Section 2.3.1.3 is valid. Please clarify PSAR Section 2.3.1.3 and/or PSAR Table 2.3-4 accordingly.
2.3-6	(i) Please verify that the data available for each type of event through the "USA.com" website, as summarized in PSAR Figure 2.3-6, is traceable to NOAA. If not, please specify the respective source(s). (ii) A check of the "USA.com" link indicates that the frequency labeled in PSAR Figure 2.3-6 as "Thunderstorms" appears to be mislabeled and corresponds to the frequency of thunderstorm wind events. Please clarify the information related to the data presented in PSAR Figure 2.3-6. (iii) The NRC staff notes that the frequencies of thunderstorm wind events and hail events in PSAR Figure 2.3-6 could represent an overestimate of those event types for the ACU MSRR site area. Please clarify if PSAR Figure 2.3-6 is a composite of the number of "events" recorded at various places from the same storms within 50 miles of Abilene as the cited resource suggests. If so, please discuss whether the PSAR should be revised to indicate the frequencies of thunderstorm days and hail events at various identified stations in the ACU MSRR site area.
2.3-7	PSAR Section 2.3.1.5 indicates that the period of record (POR) for the hurricane tracks illustrated in Figure 2.3-8 is from "1930 to the present." The NRC staff verified the cited online resource (i.e., the NOAA Office for Coastal Management) and noted that the database includes events prior to 1900. PSAR Figure 2.3-8 includes a track for an unnamed storm designated as occurring in "1886". Please clarify the range of the POR for the data discussed in PSAR Section 2.3.1.5 and associated PSAR Figure 2.3-8, and if needed, resolve any discrepancies.
2.3-8	(i) Please verify that the data available through the "USA.com" website, as summarized in PSAR Figure 2.3-9, is traceable to NOAA, the National Severe Storms Laboratory, or other credible resource. If not, please specify the respective source. As necessary, please clarify the description for Reference 2.3-9 in PSAR Section 2.3.3 accordingly to establish that linkage. (ii) PSAR Figure 2.3-9 on "Tornado Magnitude and Distance from Abilene, 1950 – 2010" presents this data utilizing bubbles to plot various EF-scale magnitudes of tornadoes in the ACU MSRR site area. Please clarify the significance of the color variation in PSAR Figure 2.3-9 for illustrating events with the same magnitude and discuss whether updates to the figure and/or corresponding text in PSAR Section 2.3.1.6 are necessary. (iii) The NRC staff notes that operational use of the Enhanced Fujita (EF) scale of tornado intensity by the NWS began in February 2007. The EF-scale replaced the original Fujita scale of tornado intensity which was used since 1971. Most, if not all, of the markers (or bubbles) for tornado events in PSAR Figure 2.3-9 are shown to have occurred prior to 2007 and so would have been classified under the original Fujita scale. Please explain if any pre-2007 events had their Fujita-scale numerical ratings revised when transitioning to only the EF scale as presented in PSAR Figure 2.3-9. (iv) PSAR Section 2.3.1.6 indicates that the year range of tornadoes considered in developing PSAR Figure 2.3-9 extends "between 1946 and 2014," however, the figure itself indicates a POR from 1950 to 2010. Further, PSAR Section 2.3.1.6 highlights two EF3 and one EF2 tornado events that occurred presumably at the city of Abilene between "1950 and 2013," but does not mention the two EF4 events included in Figure 2.3-9. Please clarify the POR and tornado events considered for the tornado risk analysis and discuss whether updates to Figure 2.3-9 (and/or Figure 2.3-10) and the corresponding text in PSAR Section 2.3.1.6 and Section 3.2.2.1 (which cross-references PSAR Section 2.3.1.6 to state that the largest tornado reported in Abilene was an EF3) are necessary. (v) The staff notes that it is not clear if "bubbles" for the same year, but different distances, in PSAR Figure 2.3-9 correspond to individual tornado events or reports of the same tornado segments at different locations in the vicinity of Abilene over the POR, or if they are truly separate events that occurred during the same year. The staff notes that, in the former case, the frequency of occurrences of tornadoes may be overestimated. Please discuss.
2.3-9	PSAR Section 2.3.1.6 discusses a variety of tornado characteristics around Abilene, Texas, beginning in 1950. PSAR Figure 2.3-10 illustrates tornado tracks in the vicinity of Abilene within a rectangular area extending about 20 miles to the north and south, about 23 miles to the east, and about 27 miles to the west. PSAR Section 2.3.1.6 states that tornado probabilities were calculated considering a 1-degree latitude/longitude square, which the NRC staff notes appears to be inconsistent with the size of the area illustrated in PSAR Figure 2.3-10. Please clarify this apparent discrepancy and confirm the size of the area used for probability calculations. Also, please confirm that data for PSAR Table 2.3-10, which are attributed to the source "Homeland Infrastructure Foundation-Level Data" (PSAR Reference 2.3-10), can be traced to the NWS Storm Predication Center or other reputable source.
2.3-10	PSAR Section 2.3.1.6 summarizes the calculation of probabilistic areas and probabilities of site impact for EF2 through EF5 tornado events for various percentiles of tornado lengths and widths related to these intensities. The results are listed in PSAR Table 2.3-5. The NRC staff notes that there appears to be an error in the equation presented in PSAR Section 2.3.1.6 for the calculation of probability of tornado impact per century. As

	written, the terms for the “Area of Abilene Cell” appear to cancel out. Further, PSAR Section 2.3.1.6 states that “a value of 360 tornado days per century is used,” and that “the expected number of tornadoes per century (360)” is applied to the calculation for tornadoes rated EF2 or stronger. Please confirm the equation and the application of the conditions described for this equation and discuss whether updates to PSAR Section 2.3.1.6 are necessary.

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