Attachment 22: Heat Load Sensitivity with HVC-ACU1A(B) Aligned to SWP

The actual Main Control Room (MCR) heat load was determined in RBS-ME-16-00003 (Reference 8.26) as 59,871 Watts. The total normal operations heat load used in ENTR-078-CALC-004 (Reference 8.25) (excluding operator heat load) is 105,637 Watts. The heat load from Reference 8.25 is highly conservative as it results in a significantly faster MCR heat-up transient than was observed on the 3/9/2015 event. This is due to the fact that the heat load in Reference 8.25 is a design heat load; in reality the heat generating equipment would not be operating at 100% capacity for the duration of the transient. The heat load developed in Reference 8.26 is divided by the heat load used in ENTR-078-CALC-004 to determine a reduction factor that is applied to the heat loads for Attachment 1 case in ENTR-078-CALC-004. This reduction factor is determined below. The reduction factor is applied evenly to all of the heat loads in this analysis except for operator heat loads, which are kept the same.

$$Heat\ Load\ Reduction = \frac{59{,}871\ Watts}{105{,}637\ Watts} = 0.567$$

The sensitivity in this attachment evaluates the effect of this lower actual heat load on the MCR heatup transient on the Attachment 1 case from Reference 8.25. Additionally the assumed time to re-start HVC-ACU1A(B) aligned to the service water system (SWP) is delayed from one hour to six hours. The internal heat rate in the control panel thermal conductors is turned off to provide a more realistic heat-up transient. The internal heat rate in the control panel thermal conductors was used to initialize these conductors to a high temperature so that the sensible heat that would potentially be released to the MCR from these conductors is included. Based on the fact that this sensible heat from the control panels would be released during steady-state period, the measurements recorded in RBS-ME-16-00003 would include this heat load as part of the total heat load. Therefore, initializing these control panel thermal conductors to an elevated temperature would be redundant in terms of addressing the heat from the control panels. Additionally, no loads are shed throughout the analysis and the heat rate to the air from electrical equipment is constant. The results of the sensitivity are compared to the results from Attachment 1 of Reference 8.25 in the table below.

Case	1 hr T_{avg} (°F)	2 hr T_{avg} (°F)	4 hr T_{avg} (°F)	24 hr T_{avg} (°F)	Maximum T_{avg} (°F)	Maximum Cell Temp (°F)
ENTR-078-CALC-004, Attachment 1	110.0	105.0	106.1	107.8	110.0 (1 hr)	115.1 (1 hr)
Attachment 22	95.2	100.6	107.9	104.0	113.1 (6 hr)	117.2 (6 hr)

Figure 1 and 2 compare the average and maximum local temperature of the lower MCR for this sensitivity to Attachment 1 of Reference 8.25. Figure 1 and 2 show that the heat-up transient is slower for this sensitivity due to the reduced heat load. The maximum average and maximum local temperature are greater in this sensitivity due to the 5 hour delay in re-starting HVC-ACU1A(B) aligned to SWP (from one hour to six hours). After HVC-ACU1A(B) is started, the average temperature is approximately 4°F less than the average temperature in Attachment 1 case of Reference 8.26, reflecting the effects of the lower MCR heat loads. Figure 3 compares the relative humidity in the horseshoe area of the MCR to Attachment 1 of Reference 8.25. The relative humidity is slightly higher for this sensitivity due to the reduced temperature.

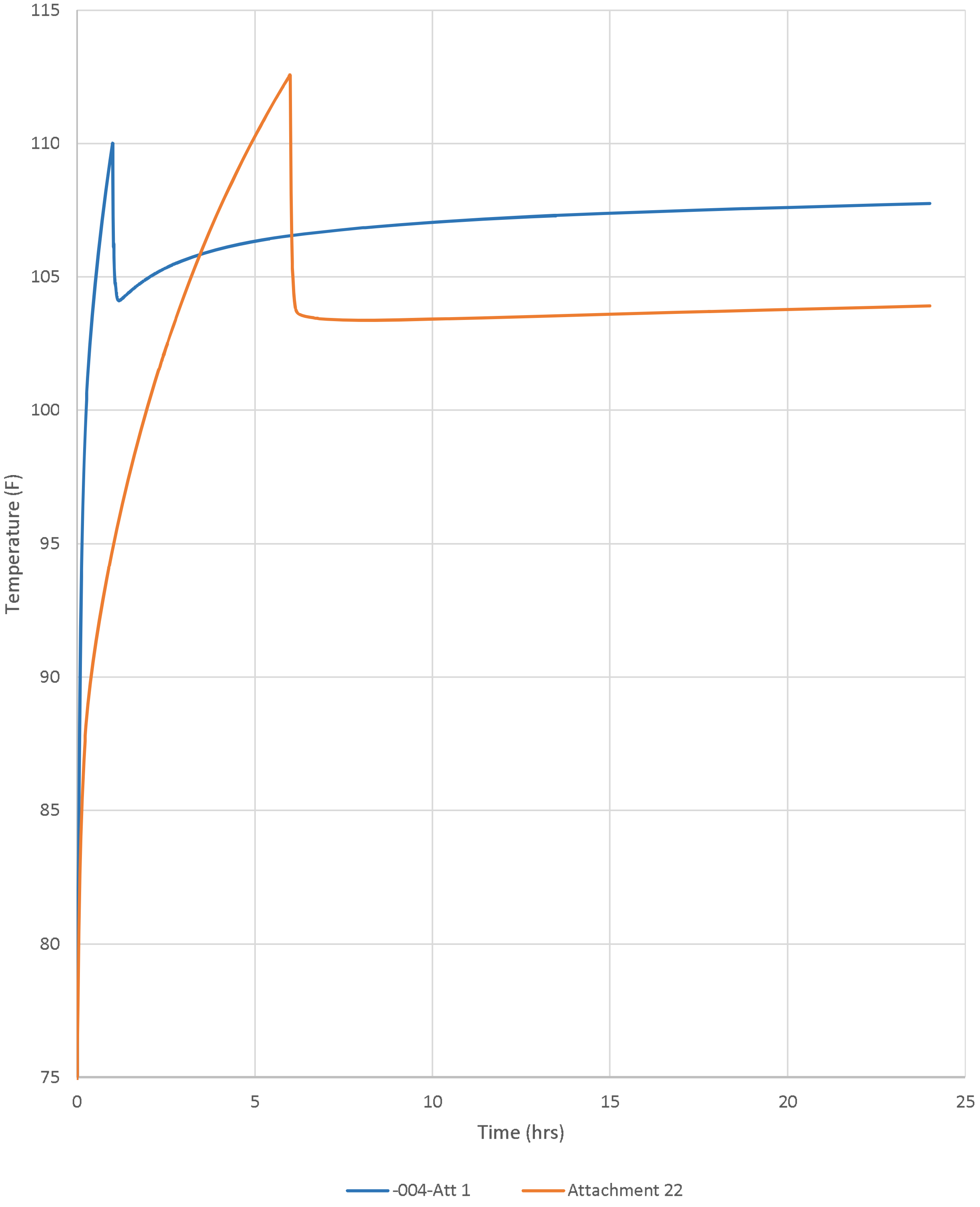

Figure 1: Average Temperature of the MCR for Attachment 22

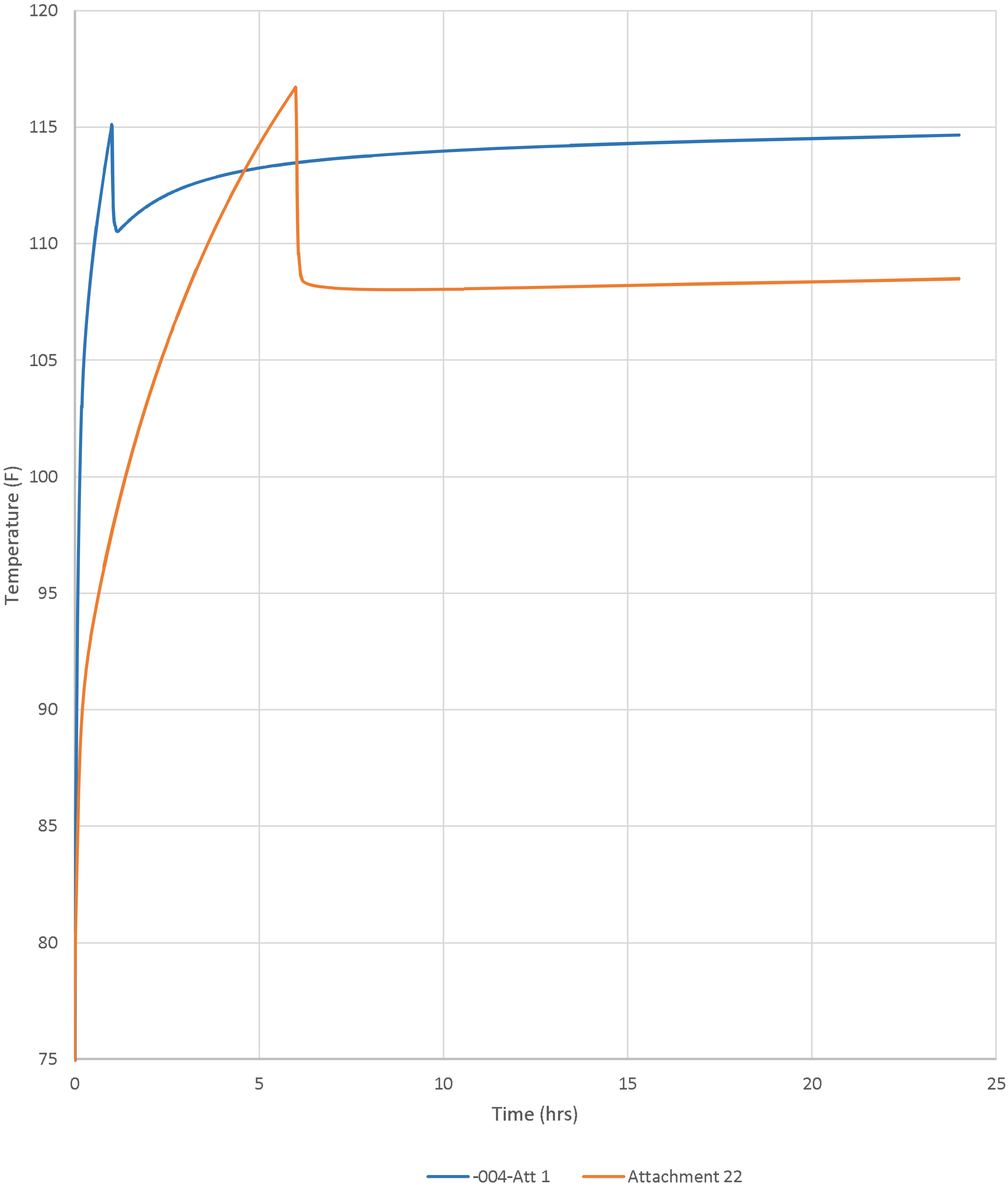

Figure 2: Maximum Local Temperature of the MCR for Attachment 22

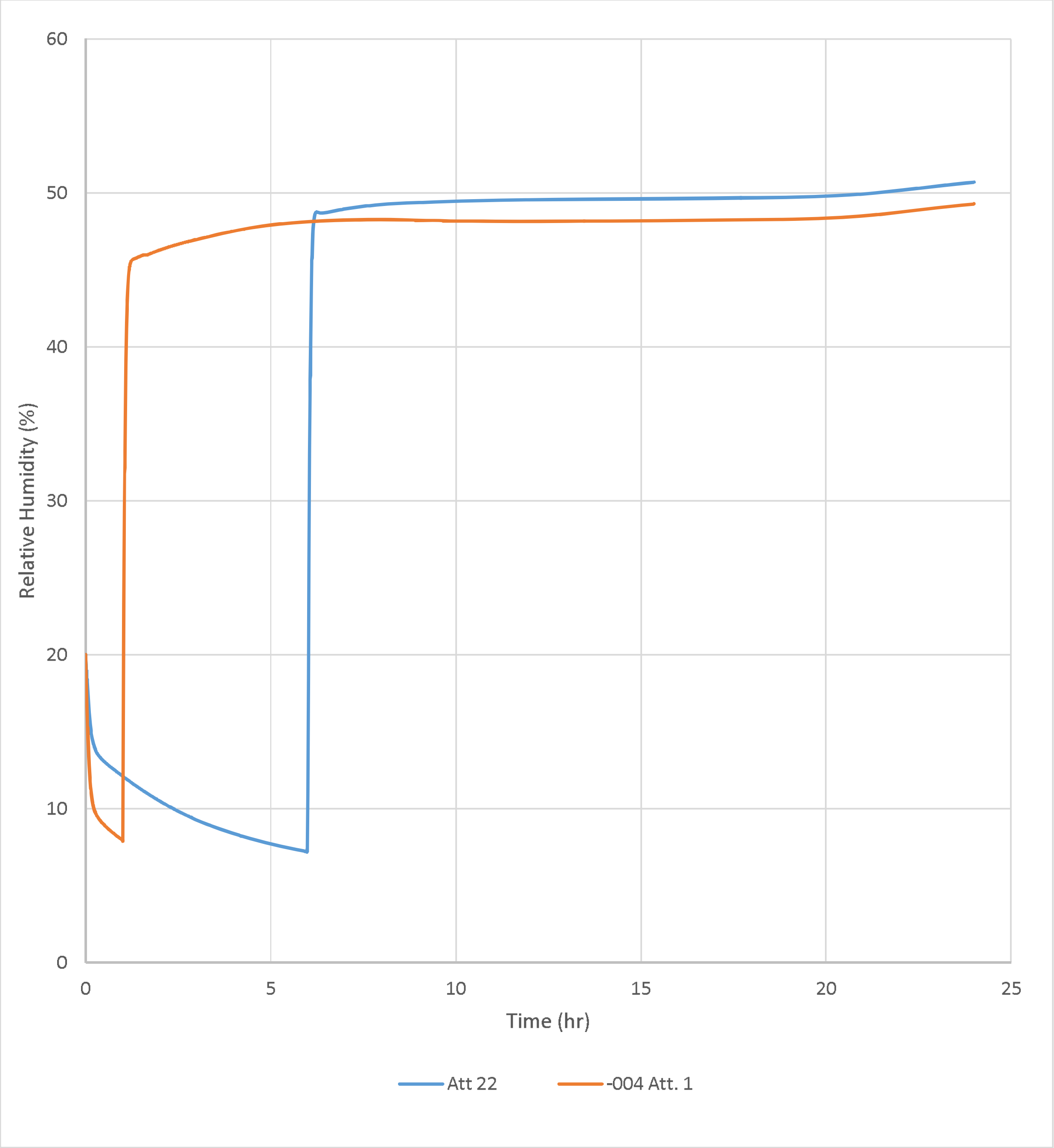

Figure 3: Relative Humidity of the MCR for Attachment 22