Austin Energy’s
District Cooling Plant – 3
Project Site

DANA Presentation
June 21, 2017

Jim Collins, Director                      Carol Stewart, Project Mgr.
AE On-Site Energy Resources      AE On-Site Energy Resources

Carlos Cordova, Consultant           Phil Reed, Architect
AE Marketing Communications    Coterà+Reed
View from Trader Joe’s
View from the Park / Electric Drive
View from 3rd Street
DATE: January 30, 2017
TO: EEA Consulting Engineers
FROM: Ken Dickensheets
RE: DCP-3 Cooling Tower Noise

BACKGROUND
A goal of the cooling tower facility design is for it to produce sound levels which will not exceed a sound pressure level of 70dBA at adjacent residential properties.

The term dBA is a weighted decibel scale which represents the sound pressure level as a single number in which the contribution from each measured frequency band is weighted to reflect the human perception of sound at low to moderate volume levels. It is a scale most often used for reference in municipal noise ordinances.

DISCUSSION
The manufacturer’s sound level data for the cooling towers was used as the basis of the calculations for this report. The levels at 5-feet from the towers are projected to be:

<table>
<thead>
<tr>
<th>ONE TOWER</th>
<th>63Hz</th>
<th>32Hz</th>
<th>125Hz</th>
<th>250Hz</th>
<th>500Hz</th>
<th>1kHz</th>
<th>2kHz</th>
<th>4kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBA</td>
<td>Inlet</td>
<td>83</td>
<td>77</td>
<td>71</td>
<td>65</td>
<td>61</td>
<td>57</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>Top</td>
<td>83</td>
<td>76</td>
<td>69</td>
<td>67</td>
<td>63</td>
<td>63</td>
<td>58</td>
</tr>
<tr>
<td>TOWERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inlet</td>
<td>92</td>
<td>86</td>
<td>80</td>
<td>74</td>
<td>70</td>
<td>66</td>
<td>60</td>
<td>54</td>
</tr>
<tr>
<td>Top</td>
<td>92</td>
<td>85</td>
<td>78</td>
<td>76</td>
<td>72</td>
<td>72</td>
<td>67</td>
<td>59</td>
</tr>
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</tr>
</tbody>
</table>
Note that in this report, changes of sound levels are reported as dB while actual levels are referenced to either an octave band (65dB/250Hz) or weighting (70dBA). A change from 70dBA to 65dBA would be a 5dB change.

In an anechoic environment, the sound wave expands spherically, like a ball being filled with air, and the sound pressure levels drop off from the source by 6dB for every doubling of distance (this is called the inverse square law). A level of 80dB measured at 5-feet would be 74dB at 10-feet, 68dB at 20-feet, and so forth.

The cooling tower installation, however, is not being built in an anechoic environment. For this reason, the drop off will be slightly less – 4dB or 5dB for doubling of the distance. This is due to the effects of the ground, nearby hills and buildings and so forth.

Additionally, because the physical dimensions of the tower installation are quite large in relation to the wavelength of sound being produced by the towers, the sound becomes somewhat directional which further reduces the sound level fall off to closer to 3dB or 4dB per doubling of distance, depending on the direction and frequency.

The long axis of the tower installation is general north/south. The nearby residential balconies are from west to northwest of the towers. Other residences are to the north. The parking garage wall is to the west. The sound levels predicted at the balconies will be affected by not only the distance from the tower installation but also by the relative direction from the axis of the towers as well as the shielding provided by the parking garage structure.

Correcting for the line array affect discussed above and the non-anechoic environment as well as the directional character of the sound emitted by the installation, the predicted sound levels at the property line adjacent to the parking garage and at the nearest balconies are estimated to be:

<table>
<thead>
<tr>
<th>PROPERTY LINE</th>
<th>87</th>
<th>81</th>
<th>75</th>
<th>69</th>
<th>65</th>
<th>61</th>
<th>55</th>
<th>49</th>
<th>73dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEAR BALCONIES</td>
<td>71</td>
<td>65</td>
<td>57</td>
<td>55</td>
<td>51</td>
<td>51</td>
<td>46</td>
<td>38</td>
<td>58dBA</td>
</tr>
</tbody>
</table>
In order to meet the sound level criteria at the property line, Austin Energy will install acoustical louvers around the intake portions of the towers. With the installation of the acoustical louvers, the predicted levels will be as follows and as illustrated on the exhibits.

WITH INLET LOUVERS

<table>
<thead>
<tr>
<th></th>
<th>Property Line</th>
<th>84</th>
<th>77</th>
<th>65</th>
<th>59</th>
<th>53</th>
<th>51</th>
<th>47</th>
<th>42</th>
<th>67dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balconies</td>
<td></td>
<td>52</td>
<td>54</td>
<td>39</td>
<td>37</td>
<td>43</td>
<td>42</td>
<td>42</td>
<td>40</td>
<td>49dBA</td>
</tr>
</tbody>
</table>

For comparison, the ambient evening sound levels measured at the site varied between 64dBA and 72dBA, depending on the day of the week with daytime ambient levels as high as 87dBA. Passing trains, depending on the condition of their brakes and shape of their wheels (round vs worn flat), were measured from 88dBA to 96dBA.

**SUMMARY**

The installation of sound control louvers to the intake areas of the cooling towers will reduce the sound level below the target level of 70 dBA at the property line at ground level and up to the upper height of the louvers. Due to radiated fan sound levels out the top of the towers, a portion of the roof of the garage will experience a slightly higher than target level sound level of 73 dBA (see Noise Contours Plan and Section Views). The sound control louvers cannot be extended higher than their current elevation due to the presence of the Capitol View Corridor.

**DICKENSHEETS DESIGN ASSOCIATES, LLC**

Consultants In Acoustics, Noise Control, IT and Audio-Visual Technologies & Systems Design
Proposed Plaza Schematic

- ACCESS DRIVE
  Concrete Pavers

- STEEL PLANTER with yuccas etc.

- Soofa bench with solar charging station

- NEW SIDEWALK - Concrete to match adjacent

- UTILITIES VAULTS

- PLAZA PAVING: different concrete paver
  New fence

- PLANTING AREA: Trees & groundcover, maybe stepping stones
  SEATING: Sculptural concrete bench

- DRINKING FOUNTAIN: Accessible with dog bowl & bottle refill station

Existing Wall

January 20, 2017
Beili Liu is a visual artist who creates material-and-process-driven, site-responsive installations. Oftentimes embodying transience, fragility, and the passage of time, Liu’s immersive installations are engaged with multitiered dichotomies: lightness contrasted with heft; tenuousness countered by resilience; and chaos balanced by quiet order. Working with commonplace materials and elements such as thread, scissors, paper, stone, fire, and water, Liu manipulates their intrinsic qualities to extrapolate complex cultural narratives. Janet Koplos spoke of Liu’s works as “materially simple but metaphorically rich.” (Art in America Review, April 2006)

Beili Liu’s work has been exhibited in Asia, Europe and across the United States. She has held solo exhibitions at venues such as the H & G Game Prestegard, Norwegian National Art and Culture Center (2010, 2011), Hua Gallery, London, UK (2012), Galerie An Der Pinakothek Der Moderne, Munich, Germany (2011), Elisabeth de Brabant Art Center, Shanghai (2009), and the Chinese Culture Foundation San Francisco (2016, 2020). Liu’s work has been showcased in group exhibitions at the National Museum of Women in the Arts, Washington, D.C. (2012), Hamburg Art Week, Germany (2012), the Kunesa Biennale, Lithuania (2011), and the 23rd and 25th Triennale of International Contemporary Fiber Art exhibitions in Como, Italy (2015, 2013), among many others.

Beili Liu is a 2016 Joan Mitchell Foundation and Sculptors Grant Award recipient. Liu has received support from a National Endowment for the Arts Grant for her residency and solo exhibition “China” at the Museum of Southeast Texas, (2014). Liu was the lead visual artist for a Robert Rauschenberg Foundation Artists: Innovation and Collaboration Grant supported public art project “Thirst” at the Lady Bird Lake in Austin Texas, (Institutional grantee: Women and Their Work Gallery, 2013). Liu has been twice named Austin Artist of the Year in 3D media by Austin Visual Arts Association (2009) and Austin Onic’s Table (2010). She received a Distinction award at the Kunesa Biennale Lithuania (2011), and was honored by a San Francisco Major’s Award (2008) for her contribution to cultural exchange.


Born in Jin, China. Beili Liu now lives and works in Austin, Texas, USA. Liu received her MFA from the University of Michigan, Ann Arbor, and is a Professor of Art at the University of Texas at Austin.
The THIRST Tree illuminated at night, photo by Tod Grubbs
Thank you!
For further questions - Please contact

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