Attachment A

REFERENCE: AHSC Cooling Tower # 3 & 4 Upgrades

SUBJECT: Performance Testing of Cooling Towers

DATE: 09/14/2022

This Memorandum serves as a solicitation for proposal for General Air Control to provide testing services for the University of Arizona's AHSC Cooling Tower Cells 3 and 4 located at1515 N. Cherry Ave, Tucson Arizona 85719. Each of the (2) 2,000 nominal ton cells are of counter flow design, induced draft with variable speed 75 HP fans. Each are designed to reduce 6,000 gpm of 95 degree F entering water to 85 degrees F, at a 78F wetbulb temperature. The site is located at an elevation of 2,436 feet above sea level. The towers are being refurbished with new fill and drift eliminator media, new nozzles, and new motor/fan/drive assemblies.

The following shall be required in your proposal as Scope of Work to test **each** of the (2) cells:

- Fan Motors
  - Record of manufacturer's name, model number, frame size, and serial number.
  - Record of motor HP rating and speed.
  - At the final operating condition, record of motor speed and VFD HZ, measured voltage and amperage for each phase.

- Cooling Tower Cells
  - Condenser-water flow to each cell.
  - Entering- and leaving-water temperatures.
  - Wet- and dry-bulb temperatures of entering air.
  - Wet- and dry-bulb temperatures of leaving air.
  - Condenser-water flow rate recirculating through the cooling tower.
  - Fan operating data including speed and airflow.

The University will aid with switching equipment and vary operating conditions of the equipment as necessary. Towers are anticipated to be ready for testing in March of 2023.

UNIVERSITY OF ARIZONA
REQUEST FOR BIDS

Attachment A

AHSC Cooling Tower Upgrades
February 22, 2023

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I GENERAL INTENT

A. Quote Description: The University of Arizona seeks quotes for the repair/upgrade of the Arizona Health Sciences Center (AHSC) Cooling Towers 3 and 4 located at 1515 N. Cherry Ave, Tucson Arizona 85719. The (2) cell tower manufactured by GEA in 2004, is a counterflow design with a nominal capacity of 2,000 tons (each cell), induced draft with variable speed 75HP fans. Each cell of the (2) cell tower is designed to reduce 6,000 GPM of 95-degree F entering water to 85 degrees F, at a 78 wet bulb temperature. The site is located at an elevation of 2,436 feet above sea level.

B. The following components require replacement for each of the (2) cells (Cell numbers 3 and 4):

1. Fill Media
2. Drift Eliminators
3. Water dispersion headers
4. Water dispersion nozzles
5. Drive shafts
6. Fan assemblies
7. Gear boxes
8. Safety Controls
9. Fan motors

C. Base Proposal:

1. Furnish and install the components identified within Section B above.

2. The University of Arizona has first rights to any and all existing equipment/materials removed from this project. It shall be the responsibility of the contractor to remove any equipment/materials not selected by the University for salvage including all existing and new fill media and drift eliminators. The contractor shall be responsible for the recycling/proper disposal of all existing gear oil.
3. Existing tower structure shall be utilized for support of all new components. Any modifications to existing structural components shall be kept to a minimum as to not negatively impact the integrity of the structure.
4. Minor hardware and accessories including but not limited to bolts, washers, nuts, shims, caulking, etc. not specifically identified but required for a complete installation shall be provided within the scope of the contractor's proposal.
5. The cooling tower components shall be manufactured and installed in accordance with the specifications and design conditions outlined within this RFQ.
6. A walkthrough can be scheduled at the contractor's request to observe existing site conditions, limitations, and to document and take measurements of existing components.
7. The contractor shall take into consideration all limitations shown within the RFQ and items observed during the site walkthrough. All exceptions or clarifications to the bid documents shall be clearly identified in the Contractor's proposal.
8. The existing AHSC site is limited in open area. This limited area can be utilized for laydown needs but must not impede the operations of the plant and surrounding building personnel. Coordination of laydown area and component deliveries will be required to take place between the University of Arizona and the awarded contractor.
9. The contractor shall be responsible for the design, fabrication, erection, delivery, and installation of equipment and material at the project site. Documentation requirements, in addition to the proposal package, include post award Engineering Data.
10. The equipment shall be sold FOB destination freight allowed and prepaid. Contractor shall provide warranty, assistance in startup, field commissioning and operator training for all components provided.

D. Add Alternate Proposal:

1. Furnish and install a tower fan deck mounted, 1,000 lb rated capacity electric hoist with components identified within Section X-1.10 below. Note that power to hoist will be by others.

II REQUEST FOR BID

A. Minimum Submittal Requirements: A separate quote shall be compiled and submitted in electronic format. Each quote shall be assembled and labeled with model numbers. Incomplete submittals will be rejected in their entirety. Each quote shall include the following components:

1. Equipment manufacturer's model number for each component proposed.
2. Include a list of five references for projects with similar scope. A current reference shall be provided for each installation and shall include names, titles, and phone numbers (FIVE TOTAL).
3. Proposal Data: The information contained within the attached Proposal Pricing Form shall be included within the proposal. Proposals shall include freight and transportation permits to the jobsite. Freight by motor carrier shall be included in the proposal. Rigging, offloading, and installation at the site shall be performed by the contractor.
4. Payment Schedule: Submit in writing any alternate payment plan proposals in lieu of payment schedule proposed herein. Provide an additional Proposal Pricing Form for any alternate payment plan.
5. Provide electrical motor catalog data. Provide fan performance data.

Manufacturer Requirements:

Fan Motor: Severe duty motor. Inverter duty motor per NEMA MG-1 Part 31. Include shaft grounding provisions.
Fan Gear Reducer: Amarillo

B. Project Schedule and Method: Submit in writing project schedule to include time frames for the following items after the owner's purchase order is received:

1. Engineering Submittal Data
2. Materials shipment
3. Equipment shutdown
4. Duration of work (tower downtime)
5. Equipment Start Up

C. Deviations and Exceptions: Contractor shall clearly include within the proposal any deviations or exceptions of the RFQ whether they be more or less than specified herein, and the reasons for these deviations and/or exceptions.

III EVALUATION AND SELECTION

A. The award will be made to the responsive and responsible proposal that is determined by the owner to be the most advantageous to the University of Arizona.

IV POST AWARD ENGINEERING DATA

A. Engineering data covering all equipment and fabricated materials to be furnished under this specification shall be submitted to the owner for review. This data shall include drawings and descriptive information in sufficient detail to show the kind, size, arrangement, and operation of component materials and devices; the external connections, anchorages, and supports required; performance characteristics; and dimensions needed for component replacement, and correlation/coordination with other materials and equipment.

B. All submittals shall be identified with the name and number of this contract, the component manufacturer's name, and references to applicable specification paragraphs. Each submittal shall indicate the intended use of the item in the work. When catalog pages are submitted, applicable items shall be clearly identified. The current revision, issue number, and date shall be indicated on all owner provided documentation and other descriptive data.

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The owner's review of the data submitted by the Contractor will cover only the general conformity to the drawings and specifications. This review does not indicate a thorough review of all dimensions, quantities, and details of the material, equipment, device, or item shown. The owner's review of submittals shall not relieve the Contractor from responsibility for errors, omissions, or deviations, nor responsibility for compliance with the contract documents.

V TOWER TESTING AND PERFORMANCE

A. The Cooling Tower Contractor shall guarantee that the cooling tower will meet the specified thermal and drift emission performance conditions when the tower is installed in accordance with the project specifications and operated in accordance with the cooling tower manufacturer's instructions.

B. The cooling tower's performance shall be verified by a thermal performance test within 12 months of operation. Testing shall be contracted by the University of Arizona.

C. If the tower fails to perform within the limits of test tolerance, the cooling tower contractor shall correct the deficiency within the limits of services, equipment and materials supplied on this contract and the contractor shall retest the tower at his expense. If the cooling tower then fails to perform within the limits of test tolerance, the contractor shall refund a mutually agreed percentage of the tower contract price proportional to the thermal performance deficiency.

VI PAYMENT

A. Payment will be made to the awarded contractor on the following schedule:

1. 30% within 30 days of approval of ENGINEERING DATA.
2. 40% within 40 days after delivery of materials to the site.
3. 20% during installation as progress payments.
4. 10% within 30 days after successful completion of the start-up.

B. Cooling Tower Contractor is encouraged to provide an alternative payment schedule that is more beneficial to the Owner along with a proposed modification to proposal price.

VII SCHEDULE

A. Project Schedule Requirements

Award Contract	March 2023
Equipment Submittals	March 2023
Owner Review/Approval	April 2023
Delivery of Materials	October 2023
Installation of Cooling Tower and Accessories	November 2023
Complete Start up and Commissioning (Estimated)	November 2023

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VIII WARRANTY

A. Upon substantial completion, the Cooling Tower Contractor shall issue a written guarantee duly signed, covering the following components:

1. The PVC fill drift elimination system shall be guaranteed against unserviceability for a period of five (5) years after substantial completion.
2. Remaining components shall carry a warranty of two (2) years after installation.

B. Warranty shall include labor and materials. All requests for service by the owner under the warranty provisions must be responded to within 8 standard working hours. The start date for the warranty shall be the date of substantial completion of the complete operating unit.

IX STORAGE

A. Storage of Material and Equipment

1. Contractor shall off-load material at the storage site and provide protection of the material and accessories from environmental elements. Contractor shall be responsible for protection of cooling tower components and accessories during outdoor storage period.
2. Areas on the site will be dedicated as contractor laydown. See accompanying site plan or locations and sizes.

X COOLING TOWER TECHNICAL SPECIFICATION

1.01 REFERENCE SPECIFICATIONS:

A.	ASTM D-570	Test Method for Water Absorption of Plastics
B.	ASTM E-84	Test Method for Surface Burning Characteristic of Burning Materials (Flame Spread Rating)
C	ASTM D-638	Test Method for Tensile Properties of Plastics
D.	ASTM D-695	Test Method for compressive Properties of Rigid Plastics
E.	ASTM D-790	Test Method for Flexural Properties of Un-reinforced and Reinforced Plastics and Electrical Insulating Materials
F.	ASTM D-883	Definition of Terms Relating to Plastics

1.02 FILL MEDIA SYSTEM:

A. The fill media shall be fabricated from rigid, corrugated PVC sheets that are designed specifically for cooling tower saltwater service and is UV protected. The media modules shall be resistant to rot, fungi, bacteria and inorganic / organic and alkalis commonly found in cooling towers. The PVC sheet shall be prime, rigid PVC conforming to ASTM D1784: 12454B.

B. The fill media shall be bonded or mechanically fastened into rigid packs that are self-supporting. The fill pack shall be bottom supported on existing fill beams and capable of a concentrated bearing capacity of 300 lbs/ft^2 to handle temporary maintenance traffic on the fill surface. Alternate layers of fill shall be stacked at 90-degree angles.

C. The fill design shall be high performance PVC film fill with a minimum flute size to be specified. The fill should be resistant to fill fouling by incorporating offset vertical flutes that provide directional changes in air and water. The fill pack is to be designed for a maximum operating temperature of 120 degree F without damage.

D. The thickness of the PVC sheet material shall be 15 mils minimum after forming to provide long structural life of the fill packs and to resist erosion from water spray.

1.03 DRIFT ELIMINATOR SYSTEM:

A. The drift eliminators shall be minimum of 3 pass design utilizing a series of sinusoidal-shaped corrugations bonded to mating sinusoidal waves to form closed cells that force the air to make three distinct changes in direction.

B. The cellular design shall be fabricated from PVC corrugated sheet 15 mil (.38 mm) and stiffener sheet 15 mil (.38 mm) thickness. The drift eliminator packs should be designed to nest together to eliminate air by-pass.

C. Maximum guaranteed drift rate shall not exceed 0.0005% of the tower flow rate.

D. A walking grating system shall be provided at the top of the drift eliminators to facilitate access between the fan deck access hatch to the gear reducer/fan assembly. The grating system shall prevent damage that would otherwise occur when walking to the center rotating components. A system shall be provided for each cell.

1.04 FAN MOTORS:

A. The fan motors shall be NEMA rated Design B, TEFC type, premium efficiency, corrosive or severe duty, constant speed, variable torque with normal starting torque. Motor shall have copper windings, cast iron frame, end covers and weatherproof electrical connection boxes. The motors shall be coated at the factory with an epoxy coating for corrosion resistance.

Motor Voltage:	460 Volt AC	Inverter Duty:	Yes
Frequency:	60 Hz	Number of windings:	One
Service Factor:	1.15	Frame:	405T
Phase:	3	Noise Level at 1 meter	85dbA
Insulation:	Class F	Ambient Temp. Rise	115 Degree C

Power:	75 HP	Constant duty, inverter duty, grounding ring	
Temperature Rise:	Class F		

B. Each motor shaft shall be equipped with a shaft grounding device. The contact brushes shall be brass or stainless steel. The grounding device shall be approved by the motor manufacturer, and no field modifications to fit the device to the shaft shall be required

C. Motors shall be in compliance with NEMA MG-1-1998 Part 31 for use with VFDs.

1.05 GEAR REDUCERS

A. The speed reducers shall be right angle gear type, designed specifically for cooling tower service. Spiral bevel/helical gears shall be designed in accordance with the Cooling Technology Institute and AGMA with a minimum service factor of 2.0 based on motor nameplate horsepower. The gear reducer must have a thermal rating equal to or greater than the maximum ambient temperature expected during actual operation.

B. The gear housing shall be grey iron casting for effective noise damping and vibration. The spiral bevel gears shall be precision machined from nickel alloy steel, case hardened and lapped in pairs to provide long life and minimum gear noise. The helical gears shall be precision machined from nickel alloy steel, case hardened and finish ground to AGMA class 10 tolerances. The fan output thrust bearing shall be designed for minimum bearing life of 100,000 hours. The minimum means of lubrication shall be a splash system. Both the input and output shafts shall be sealed by dual spring-loaded, double lipped type seals to keep outside contamination from entering the gearbox. The output shaft shall also include a labyrinth type plate mounted to the shaft to adequately protect the gearbox from contamination that may enter through gravity water flow.

C. The gear reducer provided shall be suitable for forward operation for short intervals unless otherwise specified. New stainless steel oil fill and vent lines shall be provided and be extended outside the fan stack. Dual lines shall be provided for each gear box. An oil level sight glass gage shall be provided to facilitate routine inspection and maintenance. A permanently mounted oil sight gage shall also be provided on the gear reducer for direct measurement of lubricant at the gear directly. The gear reducer shall be protected from rust and corrosion by a factory applied epoxy coating.

D. Gear reducer shall be manufactured by Amarillo.

E. All necessary oil/lubrication fluids shall be provided under this RFP.

1.06 DRIVE SHAFTS:

A. Power shall be transmitted from the motor to the speed reducer by means of a full floating composite tubular drive shaft supported by non-lubricated flexible couplings at both ends. The shaft and couplings shall be selected for cooling tower service with a minimum service factor of 2.0. Stainless steel driveshaft guards shall be provided at the gear end and FRP guards shall be provided at the motor end. Hubs and other hardware shall be 316 SS.

1.07 FANS

A. The fans shall be adjustable pitch, multi-blade, axial flow, propeller type selected to deliver the required design airflow at a maximum efficiency and provide long life when handling saturated air at high velocities. The blade material shall be fiberglass-reinforced polyester of vinyl ester resin. An FRP air seal disc shall be provided to prevent recirculation of the air at the fan hub. The fan hub shall be hot dipped galvanized after fabrication. The fan hardware shall be galvanized bolts, nuts, and washers. The leading edges of the fan blades shall include a leading edge protection system to prevent erosion from entrapped water and solid particles in the airflow. The fan shall be designed with a maximum tip speed of 11,000 feet per minute to minimize fan noise.

B. Fan shaft bearings shall be self-aligning ball or roller type with moisture proof seals and premium, moisture resistance grease suitable for temperatures between minus 20 and plus 300 deg F. Bearings shall be designed for an L-10 life of 50,000 hrs.

1.08 SAFETY / SHUTDOWN CONTROLS:

A. The tower fan drive equipment shall be provided with the following safety shutdown control devices.

a. Metrix Vibration Switch - Model 5550-011-01 (SPDT contacts) with Remote Electrical Reset Switch. The vibration switch shall be mounted on the gear reducer and disengage the fan motor on vibration levels above set point.
b. Murphy Model EI-150-EX Low Oil Level switch shall be mounted on the gear reducer. The switch shall disengage the fan motor on low oil level.

B. The vibration and oil level switch shall be wired in series with the fan motor starter controls on each tower cell.

1.09 WATER DISTRIBUTION:

A. The tower distribution system shall be designed to evenly distribute the inlet hot water over the fill media based on the flows specified.

B. The distribution laterals shall be fabricated from PVC SDR-35 pipe and the laterals shall be restrained in both the horizontal and vertical directions. The nozzles shall be screw in type with large orifices to minimize plugging. The nozzle adapters shall be mechanically fastened to the PVC laterals by stainless steel hardware. Nozzles shall have similar capacity and pressure performance as existing nozzles.

Attachment A

1.10 ELECTRIC HOIST: ADD ALTERNATE SCOPE OF WORK

A. The structural design, material provision, and installation of a 1,000 lb electric davit crane is to be included within this proposal. The hoist will be utilized during maintenance operations and is to be located on the south-west corner of the cell 3 fan deck.

B. Structural members are to be designed and installed as appropriate by the awarded contractor to facilitate the crane requirements.

C. Power to the crane will be provided by others.

END OF SECTION

Attachment A

XI PROPOSAL PRICING FORM

Provide and install components for the upgrade of the University of Arizona's AHSC cooling towers. The scope will be complete including equipment and accessories as described herein.

Design duty, performance and minimum technical specifications are as indicated herein.

Design, fabrication, delivery and installation of equipment and material to the project site.

Documentation requirements, in addition to the proposal package, include Engineering Data, installation manuals, operator training material, operation and maintenance manuals and warranty. The equipment shall be sold FOB destination freight allowed and prepaid. Awarded Contractor shall provide warranty, start up, and training.

Total Price, including tax, for equipment and services as specified in Request for Quote dated February 17th, 2023.

$_____

Total Add Alternate Price, including tax, for provision and mounting of electric hoist.

$_____

Number of days from receipt of purchase order to submittal of ENGINEERING DATA to University of Arizona

_____

Number of calendar days from receipt of approved ENGINEERING DATA to shipment of cooling tower materials, equipment, and accessories

_____

Number of calendar days from receipt of cooling tower materials, equipment, and accessories to complete installation of cooling tower materials, equipment and accessories.

_____

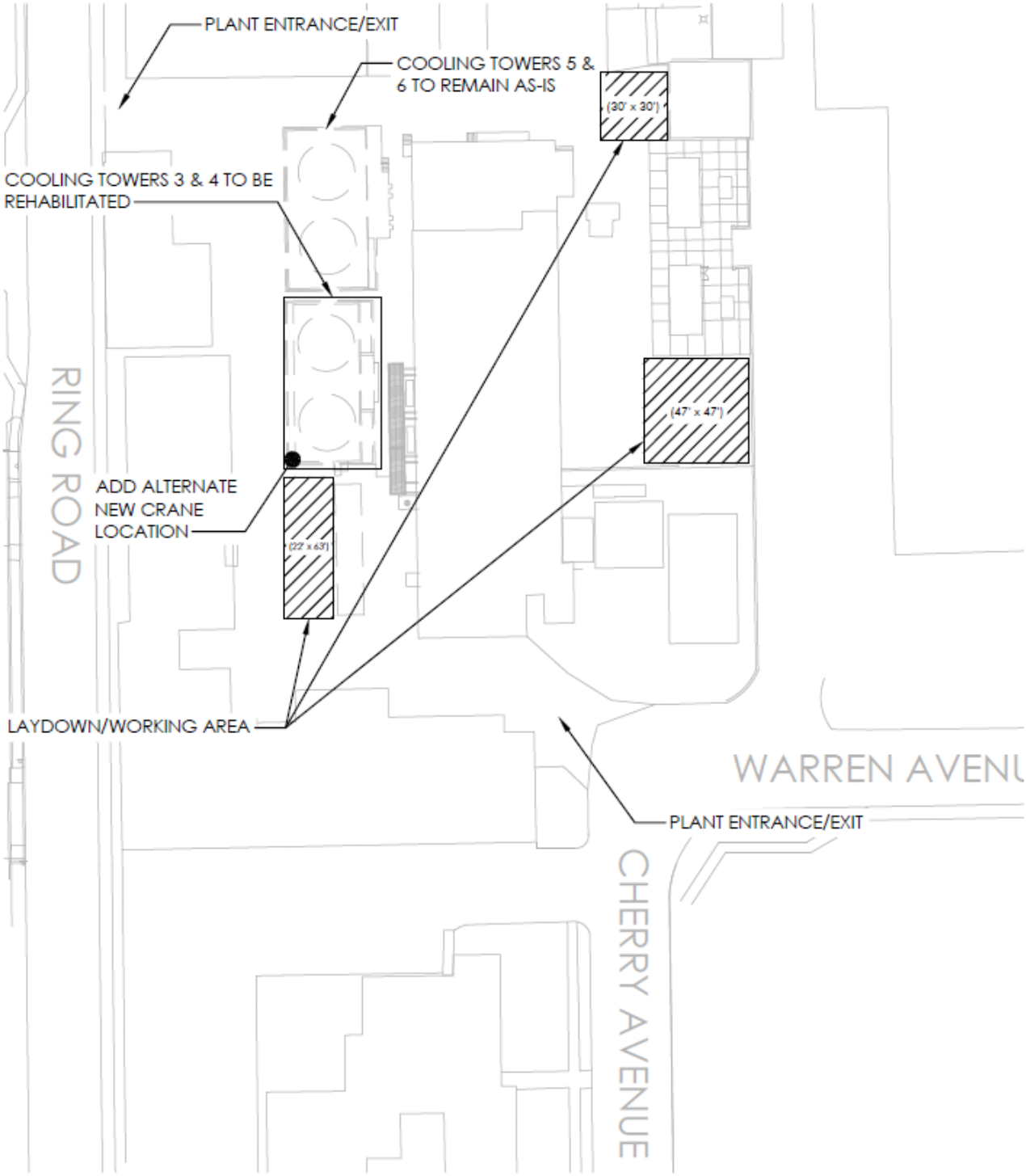
Number of calendar days that cooling tower cell #'s 3 and 4 will be out of service.

_____

XII AHSC Site Plan

See Next Page.

Attachment A



1 **AHSC PLANT SITE PLAN**
SCALE: N.T.S.

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AHSC COOLING TOWER 3 & 4 REFURBISHMENT

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