Before Tour

Paperwork required to enter TOTO facilities

0:00 Start Tour

TOTO Lakewood Facility

1800 Murphy Ave SW

0:00 – 0:10

Sign-in

Review of factory safety information

Welcome and Introduction to Tour Guide and overall facility operations background and history

- Indicate experience with factory production, including how long with ceramic manufacture
- Provide history of facility, from initial construction to current operation

0:10 – 0:20

Provide some initial information on ceramic making process

Define:

- Ceramic
- Porcelain
- China

Describe clay as slurry

Describe clay to ceramic process (broadly)

- Review details of plaster (or bench) casting process

Clay types:

- Tennessee ball clay
- China clay

0:20-0:40

Introduce processes in clay preparation lab

Show and describe clay powder, and describe the process from powder to slurry and semisolid

Show aging tanks, and describe mixing process of ball clay and china clay

Show particle size sifter, while describing the importance of achieving very consistent mixtures

Show rock tumbler and describe its process and function

Describe mixing of slip with virgin material

1992 TOTO

Bench casting vs pressure casting

4 hours to cycle, 2 per bench cast before cast needs to be dried

Storage

White/green ware

0:40-0:50

Observe and describe decasting process

Describe life-cycle aspects of the plaster casts:

- Relatively low embodied energy per cast (compared to casting technique we will observe in Morrow)
- 80-100 cycles per cast

0:50-0:55

See glaze department, describing its function and operations

0:55-1:10

See shuttle kiln, describing its function and operation

View kiln wash

Describe how temperature is a central part of porcelain production, describing the concept of the "temperature curve", and how maintaining this proper curve is a primary aspect of how production is approached.

Oven operating temperature of 2200 degrees F

1:10-1:20

Describe concept of “Brand” Police, and how they are responsible for maintaining quality across production

Observe inspections and describe what each inspection guards the consumer against

1:20-1:30

Recap Lakewood facility operations

Quantify the number of staff at the plant (approx. 85-90, specific number is better)

- Describe positive benefits from operations in Lakewood
    - Local jobs
    - Reduced impacts from distribution
    - Manufacturer participation in regional economy

1:30-1:55 Travel from Lakewood to Morrow

Q&A with tour guide for Lakewood facility

- Applications for porcelain fixtures
- Lakewood facility operations
- Plaster casting process

1:55-2:05

Describe pressure casting basics, and contrast with plaster casting (from Lakewood)

- Production equipment needs

Show innovation wall, listing key production innovations which have allowed for reduced life-cycle impacts.

Describe production stages at Morrow, referencing visual diagram:

- Materials preparation
- Product molding
- Drying and white body inspection
- Spraying glaze
- Firing
- Final inspection

2:05-2:25

Visit casting department, describing how 24 molds work in automated function.

Describe hydraulic fluid (soy-based), and mention that this helps reduce the life-cycle impacts

Watch mold drying process, describe how this rapid drying allows for continuous operation of molds (contrasted with plaster molds which had to be dried with heat after ever 2 uses)

Porous resin molds last for approximately 20000 cycles

Pressure casting process allows for 1/1000 inch tolerances, it is 1/4 inch tolerance for bench (plaster) casting

- Nature of the cast (porous resin vs. plaster)
    - Cycle times
    - Cost
    - Life
    - Sophistication

Watch assembly of pieces, and describe use of bonding slip

Show employees manually finish the pre-dry toilet with 3 sponges

2:25-2:35

Observe 16 dryers

- Drying is important for glaze adhesion and readiness for firing cycle
- 32 hour drying process
- Result is 99% moisture free

Describe reason for Personal Protective Equipment for inspectors

Observe batches for repair and recycle, and describe how these materials reenter the supply chain

Describe application of specialty coating (Sanigloss), and how that results in a super hard, super smooth, ionized (kills bacteria) surface

Show kiln furniture are racks, and describe their use during firing process (approx. 2,100 F) so that the toilets and other products can be supported

Contrast the 100 meter kiln in Morrow vs the 60 meter kiln in Lakewood

2:35-2:45

All fired products are inspected

Indicate yield from kiln (72%), and describe how that compares to industry averages

Observe the sound test (ringing the china), and describe how this is useful when performing quality control

Discuss visual inspection, and describe what inspector is looking for

Describe the foot check, to within 1mm

Show air leakage test, and describe why that is important for toilets

2:45-3:00

Observe the addition of hardware and describe the individual parts which are added to the porcelain

Show flush test, final quality check

Show how finished toilets are boxed, and how the packaging is "L" shaped and nests to take up less room on the pallet. Results in life-cycle and cost savings for the manufacturer.

Show how vacuum machine grabs boxes

Describe how fired scrap (which cannot be reprocessed into fresh body slip) is repurposed to another organization in Tennessee which uses it to make tile.

3:00-3:15

Describe how all waste from operations, even including recyclables brought in from employee homes are collected, stored, and recycled from the Morrow facility.

- Only facility waste that can't be repurposed is employee food waste (from home). This facility has relationships with others to put all other waste back into the supply chain.

Describe 5 S program

3:15-3:20

Walk to lab area, describe complexity of maintaining proper temperature curves

Point out 10 clay silos

Describe onsite wastewater treatment

- Wastewater reused and sent back to utility 3m gallons per month
- Saved 1m per month

3:20-3:35

Describe aging tanks, and explain importance of proper mixing time.

Clay and glaze data is collected by scientists, who continually monitor and control the production and delivery of the slurry throughout the facility.

Describe function and need for select tools:

- Spectrophotometer
- Sedigraph
- Others

Show standard tiles for color matching, describing how very consistent color is critical when producing kitchen and bathroom products that might have multiple porcelain components that need to be of visually identical color to meet the needs of designers. Even single piece units need to have a very specific color, as many designers use multiple different porcelain products within a space and want them of a uniform color.

Describe function of feeding tanks, and why they are maintained under pressure

3:35-3:45

Visit Technology Center

Observe several finished products

- Sinks
- Dryers
- Showers
- Toilets

Discuss WaterSense testing process, and how more advanced testing processes (such as with miso paste) better simulate actual working conditions than the ANSI method involving plastic beads.

3:45-4:00 Q&A

4:00 End educational tour