

## Exhibit A

# Pre-Engineered Monolithic Concrete Dome -Salt Storage-

## Article 1 -- General Provisions

### I.01 General Provisions

- A. The work included in this section of the proposal consists of furnishing detailed plans, construction drawings and specifications, together with all labor, equipment, materials, required to construct a clear span Monolithic concrete dome for a salt storage.
- B. The storage shall be able to contain approximately \_\_\_\_\_ tons of salt or sand/salt mixture. The net capacity shall be calculated based upon the following:
1. Salt or sand/salt mixture, with a bulk density of \_\_\_\_\_ lbs per cubic foot, and with a \_\_\_\_\_ degree angle of repose.
  2. A flat pile with a maximum depth of \_\_\_\_\_ feet -or- A cone shaped pile with the top of the cone at the apex of the dome.
  3. Deduct 150 tons from the gross volume to allow for interruption of the sand/salt pile at the doorway.
- C. The subgrade and aggregate base course (is/is not) part of this contract.
- D. The 6 inch reinforced floor (is/is not) a part of this building contract.

Tolerances — The vertical height of the dome shall not vary more than plus or minus two feet. All dimensional tolerances should be considered in the design of the dome.

### I.02 Structural Design

- A. The structure shall have no internal supports to hamper loading and unloading of salt.
- B. Structural design calculations and detailed construction drawings and specifications must be either prepared under the direction of, and certified by a registered professional engineer or architect specializing in structural engineering.
- C. Basic Design Criteria:
1. Snow Load: \_\_\_\_\_ psf
  2. Wind Load: \_\_\_\_\_ mph
  3. The dome structure shall sit on and be supported by a reinforced concrete ring beam footing.
  4. The base of the dome wall shall have a minimum thickness of \_\_\_\_\_ of reinforced concrete to the height of 4 feet.

D. Entry way and Door: The entry way shall accommodate a \_\_\_\_\_ ft. by \_\_\_\_\_ ft. door and shall extend \_\_\_\_\_ ft. from the edge of the ring beam foundation. One \_\_\_\_\_ ft. by \_\_\_\_\_ ft. (roll-up/swing type) door shall be furnished and installed. The door should include locks and (manual/automatic) openers. One locking 3 ft. x 6 ft. 8 in. man door shall also be furnished and installed in the entry way.

E. The dome shall have \_\_\_\_\_ fill openings approximately 30 inches by 30 inches. Each opening will be fitted with a water tight removable cover. The location of the fill openings in the dome shell will be determined in the field by the owners authorized agent.

### **I.03 Drawings and Specifications**

A. Each prospective bidder shall submit a copy of the manufacturer's descriptive literature, proposal drawings, capacity computations and a cross section through the proposed structure indicating the shape of the salt pile. Award of the Contract will be contingent upon approval of this material by the Owner.

B. The lowest acceptable (responsible) bidder will subsequently be required to furnish \_\_\_\_\_ copies of the final construction drawings and specifications, signed and sealed by a registered engineer or architect specializing in structural engineering.

1. Construction documents shall be prepared in accordance with these performance specifications and conform to all governing federal, state and local building codes and regulations.
2. The owner shall be responsible for obtaining all required building permits, as well as obtaining inspections and approvals of all state and local regulatory agencies having jurisdiction.

### **I.04 Quality Assurance**

A. Vendor Qualifications: (invitation to bidders)

1. The Vendor must be able to demonstrate a successful completion record as a pre-engineered dome supplier or manufacturer. The Owner may request project client references, experience and organization information, and a financial statement.
2. Erection Subcontractors must have adequate previous experience in the specialized work, and be certified by the Vendor as a qualified erector.

### **I.05 Delivery and Protection of Materials**

A. Delivery, protection, and acceptance of materials at work site is Vendor's responsibility, including any losses due to theft, vandalism or accidental damage.

### **I.06 Submittals**

A. The successful Vendor shall furnish the following items to the Owner upon request for approval:

1. Complete final construction drawings and specifications: \_\_\_\_\_ copies.
2. Product Information: \_\_\_\_\_ copies
  - a. Roof Membrane.
  - b. Concrete.
  - c. Foam.

3. Contract Items: \_\_\_\_\_ copies.
  - a. All required insurance certificates.
  - b. Performance bonds.
  - c. Signature authorization.
  - d. Vendor's qualifications if requested.

### **I.07 Warranty**

A. The Contractor shall provide a written warranty in accordance with the manufacturer's standard coverage. From the date of final acceptance, any defects in materials and/or workmanship shall be promptly repaired or replaced at no cost to the owner for the following minimum periods:

1. All building components and equipment - One year
2. Structural integrity of the dome - 5 years

### **I.08 Patent Infringement**

A. It is expressly agreed that the Contractor shall defend, save harmless and indemnify the Purchaser, and the dome against any and all claims against the Purchaser, on rights, trademarks or trade secrets with respect to equipment, machinery, or material purchased or manufactured by the Contractor and used in the construction of the dome (excepting claims arising out of equipment, machinery, or material supplied to the Contractor by the Purchaser, or the use, sale or disposition thereof) and against all costs, expenses, charges, and damages which the Purchaser of the dome may be obligated to pay by reason thereof, including expenses of litigation, if any.

## **Article 2 -- Materials and Methods**

### **II.01 Materials and Methods**

A. Ring Beam Concrete: Transit mixing per ASTM C 94. Foundation thickness determined by structural design for height selected, superimposed loads, and allowable bearing pressure, but not less than 8".

1. Minimum 28 day compressive strength -- 3000 psi.
2. Portland Cement:
  - a. ASTM C 150, Type I or II with a minimum mix design requirement of 6.0 sacks per CY.
3. Maximum course aggregate size = 1"
4. Air Entertainment = 6.5% (+ or - 1.5%)
5. Approved concrete admixtures may be used in accordance with DOT Specifications.
6. Slump = 2" minimum to 4" maximum at point of discharge.

B. Reinforced Concrete Floor by Owner: A 6" thick concrete floor shall be installed reinforced with 1/2" diameter rebar 18" on center both directions. (Cement content; 564 lbs/cu. yd. slump 3", air entrainment 6 + or - 1%, wet curing should be provided for at least 7 days. Surface shall be screeded and floated. (No working of the concrete with bleedwater on the surface will be permitted.)

### C. Shotcrete

1. This Section covers the mixing, placing, finishing and curing of shotcrete shall be composed of Portland Cement, sand, 3/8" minus aggregate and water as specified or approved. The required proportions shall be assembled, well mixed, placed, finished and cured as hereinafter specified. It shall be uniformly dense and sound, free from faults, cracks, voids, rebound and other imperfections.
2. Definitions: Shotcrete is a mixed mortar of cement, sand, 3/8" minus aggregate, and water projected at high velocity onto a surface. The force of the jet impacting on the surface compacts the material. A relatively dry mixture is used so that the material supports itself minimizing sagging or sloughing, even when used for vertical and overhead applications.

The cement, sand, aggregate, and water are mixed by suitable means, and then pumped through a hose by a specially designed concrete pump. The high velocity impact is developed pneumatically by injecting compressed air at the nozzle.

#### 3. Materials:

- a. Portland Cement shall meet the requirements of Type I, II, III, IV or V as specified by Portland Cement Association. Type used to be as required by job --- usually I or II.
- b. Fine aggregate shall meet the requirements set as previously specified in this section and shall meet the following gradation requirements:

Sand: A well graded sand may be used for shotcrete applications. Sand shall generally consist of the following gradation:

<b>Sieve Size</b>	<b>% Passing by Weight</b>
No. 4	95-100
No. 8	80-90
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100-200	10-10

The fineness modulus shall fall between 2.70 and 3.00.

Aggregate: A 3/8" minus aggregate should make up 10% to 30% of the mix design. Coarse aggregate may be left out of final finish coat for smoother surface.

- c. Rebound: Rebound is defined as aggregate mixed with some cement which rebounds off the surface during the application of shotcrete because of collision with the hard surface, reinforcement, or with the aggregate particles themselves, which amount varies with the position of the work, air pressure, cement content, maximum size and grading of aggregate, amount of reinforcing and thickness of layer. Rebound materials may not be reused in any form for shotcrete work and shall never be worked into the construction by the nozzleman.
- d. Water: Water shall be clean, and potable.
- e. Admixtures: Admixtures may be used, provided they do not impair the density of the shotcrete or are corrosive to steel and concrete. All admixtures must be approved by the Engineer prior to their use.

#### 4. Proportioning:

- a. General: The mix shall under no circumstances be leaner than 752 lbs. of Portland Cement to each cubic yard of concrete, (100 lbs. cement may be substituted for 100 lbs. of fly ash).
- b. Shotcrete Strength: Shotcrete strengths of 28 days shall be no less than 4000 psi.

#### 5. Testing of Shotcrete Samples:

- a. The dome concrete shall be tested on a periodic basis with a Windsor Test Probe. Tests should occur at 7, 14, and 28 days as directed by the owners representative. The dome contractor shall conduct the tests with his equipment, and tests shall be observed by the owner's representative.
- b. Alternative Testing at the discretion of the owner, cubes may be sawed or cores having a minimum diameter of 2 inches and an L/D of 1 or greater may be drilled from test specimens whether prepared specially for testing purposes or actually taken from the structure under construction. Results must be corrected to L/D=2 as described in ASTM C 42.

Shotcrete specimens shall be shot on a plywood form in one continuous operation to the required height of the block. The site of the blocks shall be such that 9 test cubes or cylinders can be made from each block.

One shotcrete test specimen shall be made during each day's operation. Four cubes or cylinders shall be cut or cored from each shotcrete block seven (7) days after its application. Two cubes or cylinders shall be tested for the seven-day strength. The other two shall be tested at 28 days.

The remainder of the shotcrete blocks shall be cured and stored until after the 28 day test has been made and until the Engineer has informed the Contractor in writing that no additional tests are required. All shotcrete specimens shall be properly numbered and dated, and a record shall be made by the Contractor as to the relative location of the work for which these samples were prepared. All cubes or cylinders shall be dense and free from sand pockets.

The cost of cutting, coring and testing the cubes by a recognized reputable testing laboratory shall be borne by the owner.

#### 6. Shotcrete Equipment:

- a. Batching equipment shall be capable of proportioning the cement and aggregate to the degree of accuracy required by these Specifications.
- b. Mixing equipment shall be capable of thoroughly mixing the aggregate, the sand and cement in continuity, shall be self-cleaning and capable of discharging all mixed material without any carry-over from one batch to another. The equipment shall be inspected and cleaned at least once a day, and more often if necessary, to prevent accumulations of batched material.

#### 7. Placing and Finishing:

- a. General: Shotcrete shall be applied in a steady, uninterrupted flow. Should the flow become intermittent for any cause, the nozzleman shall direct it from the work until it again becomes constant or shot off the flow of materials.
- b. Position of Pneumatic Nozzles: The nozzle shall, as much as possible, be held at approximately right angles to the surface and shall be kept at the proper distance from the type of application, type of

nozzle and air pressures employed. Any nozzleman found making a habit of not directing his nozzle at right angles to the surface may be removed from the job without notice. However, when encasing reinforcing steel, the procedure of shooting under right angles may be modified in order to better direct the material around the bars. Whenever shooting of shotcrete on around, through, and behind reinforcing steel is required, the nozzleman shall apply the material at the wettest possible consistency and at least wet enough that minimal shotcrete build-up will take place on reinforcing steel when shooting through this layer of steel. Shooting through two curtains of steel will not be permitted. The steel for the second curtain shall not be placed until the first curtain has been embedded in shotcrete.

- c. Shotcreting More Than One Layer: Sufficient time shall be allowed for each layer of shotcrete to set up so it may take the next layer without sagging.
- d. Wall Construction: Every precaution shall be taken to remove rebound from the bottom areas and corners of the wall as fast as it develops. The material shall be applied sufficiently wet so that a proper flow of shotcrete into the corners may be expected.

To insure proper filling of corners and recesses the initial coats shall be applied as wet as possible but shall still be dry enough that minimal sagging will occur.

#### 8. Curing of Shotcrete:

- a. Interior shall be kept closed to prevent water vapor loss for 7 days. During hot dry weather the building may be kept closed longer up to 30 days as needed until concrete reaches 4000 psi.

#### D. Shell Reinforcement

##### 1. For conventional reinforced concrete design:

- a. Meet or exceed ACI building code requirements for temperature and shrinkage steel.
- b. Deformed Bars: ASTM A615, A616, or A617 grade 60 (60,000 psi yield strength).
- c. Maximum spacing between the bars shall not exceed 18" or five times the shell thickness.
- d. All reinforcement bars shall be of grade 60.

##### 2. For prestress concrete design:

- a. Meet or exceed ACI Building Code Requirements
- b. Only epoxy grouted or other approved bonded cables will be used.

##### 3. Accurately place reinforcing as shown on final approved drawings.

- 4. Fibers: In addition to the reinforcement bar or tensioning cables required by the ACI Code, fibers may be used as a surface crack control, but are not required. If fibers are used, they shall not be considered as replacement for any of the ACI required reinforcement.

E. Miscellaneous Steel: At the entrance opening, furnish and install Two (2) of the following jamb protection devices: one each at the outside corners of the entry way.

1. Standard 6" (schedule 40 black steel) diameter steel pipes, 8'-0" above grade, solidly set in and filled with concrete
- F. Insulation: In order to reduce the thermal gradient in concrete, polyurethane foam shall be installed over the outside surface of the concrete dome meeting the following requirements: Thickness: 2 inches, Density: 2 lbs./cubic foot, K factor: .12, Permeability: 3.0 perms, Compressive strength: 30 psi, 90% closed cells, Flame spread: less than 75, Smoke development: Less than 450.
- G. Exterior Surface Covering: The exterior surface shall be single ply fabric roofing: 28 oz./sq. yd., grab tensile 700/700 lbs., strip tensile 515/515 lbs./in., trapezoid tear 85/85 lbs., tongue tear 275/275 lbs., hydrostatic resistance 500 psi.
- H. Interior Concrete Protective Treatment: In order to protect the reinforcement bar from chemical attack, the interior concrete surface of the dome and the floor shall be treated with two coats of boiled linseed oil after the concrete has cured at least 4 days. The oil treatment may be applied with mops, brushes or spray. The first coat shall be diluted 50% with turpentine or kerosene to enhance surface penetration. The first coat shall be allowed to dry at least 24 hours before application of the second coat.
- I. Anchors and Accessories: Manufacturer's standard units. Use items for units built into exterior wall, complying with ASTM A 153.
- J. Painting: Exterior Metal: One prime coat and one coat of exterior oil base alkyd, full gloss enamel.
- K. Execution: All materials shall be installed and completed in a workmanlike manner. The owner reserves the right to direct, in writing to the Trade Contractor, the removal and replacement of any items which do not present reasonable appearance. Such removal and replacement shall be at the Trade Contractor's expense.