Tank Insulation Requirements

- Some work was done in the past by the Thermal Modeling Subtask (Armando Ferrero and Bob Ristinen, leaders) but this needs to be updated.
- Current requirements allow some freezing, based on studies (see J. Harton talk) which should continue in order to characterize the Northern Site.
- The new understanding is required to determine the lowest cost, most reliable thermal insulation system for tanks that will meet our needs.
- The Thermal Modeling Subtask needs to be reconstituted for both modeling and, if possible, to participate in the needed experimental studies.
- This can begin as a largely computational effort since startup funding for the North is limited.

Insulation Possibilities for Polyethylene Tanks.

Peter O. Mazur

For the Auger North Meeting

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Polyurethane Foam Insulation

- There is one full-sized tank installed in Millard County for thermal studies with 100mm of polyurethane foam insulation with a polyurea overcoat. (There is also one at Fermilab with similar insulation and an acrylic overcoat.)
- This insulation is very effective and would certainly be sufficient. But, is it the lowest cost and most reliable option?
- We could easily add the step of applying the polyurethane foam to the tanks in SE Colorado if desired. The factory equipment is less than $25K to buy.
- The cost of this insulation could be about $1K/tank.

Polyurethane Foam Insulation

- The foam is stiff enough to risk fracture or detachment from the tank if the tank is severely distorted by being installed on very uneven ground, for example. More studies of the limits and potential problems of this sort of insulation need to be done. My guess: It is probably OK, within limits to be specified on surface preparation (which may add cost.)
- The foam protects the tank itself from UV and also provides great stiffness, allowing the use of lower cost tank resins for some cost improvement.

Polyethylene Foam Insulation

- There is a standard technique in the rotomolding industry of molding polyethylene foam inside the tank during tank manufacture.
- This technique is used regularly worldwide and adds little to the cost of the tank. The molding process takes longer, so we might need more ovens working on the tanks, wherever they are made.
- There is no external foam to be damaged, and the insulation is flexible and very tightly bonded to the inside of the tank, making delamination impossible.

Polyethylene Foam Insulation

- The tanks will look just like out present tanks, not sort of lumpy like the polyurethane tanks would be.
- The tank interior will be smoothly uneven, with small amplitude, smooth variations in the interior surface: Liner will not be damaged.
- The limitations of polyethylene foam are
  - Thickness is limited to 40 or 50mm.
  - Thermal conductivity is larger than that of polyurethane foam.
- The advantages are cost, ease of manufacture (in the same process as the tank manufacture already done) and durability.

Foam Development

- Rotoplastyc in Brazil, one of our tank manufacturers, will make (for free) some test pieces 40-50mm thick to show me on our next visit.
- Rotoplastyc wants to participate in our R&D effort, and is willing and able to make tanks for us, either for shipment to Colorado or Malargüe. (They have a mold for our tanks, after all.) Shipping to USA is expensive due to bulk, and the tanks can’t fit into a container.
- Funding source for development work is unknown.