TO: RAC and Mike Vaughn

FROM: T.C. 10.5

DATE: May 1, 2006

SUBJECT: Response to 11/4/05 RAC comments on the first submission of RTAR 1435, "Optimizing Blast Freezer Effectiveness"

QUESTION 1:
The revised RTAR will need to match the 2005-2006 Society year format, particularly with regard to the Society's strategic plan for research. Estimate duration of project.

RESPONSE 1:
We have used the most recent RTAR format to submit this time, including moving information on the compliance with the Society's strategic plan from the *Justification and Value to ASHRAE* section to the front. We have also added project duration under estimated cost of 18 months.

QUESTION 2:
Do we have to optimize this? If there are a manageable set of alternative designs, then maybe analyzing each using current methods/procedures is adequate. Is there any new knowledge expected to be developed, or "more accurate" predictions will become possible due to putting together the information that is available in the ASHRAE handbook? Where is the research component in this project? It is difficult to tell whether the scope is adequate for the stated level of funding.

RESPONSE 2:
While many of the component design methods exist, the research will provide an integrated design method incorporating the best of all these as well as optimization tools. Most members of the committee have observed many examples of sub-optimal freezers because design engineers either did not have all the design knowledge or did not have the time or experience to work through the design in sufficient detail to improve it. The problem is not trivial due to the large number of trade-offs so the best solution is definitely not obvious.

QUESTION 3:
What simulation programs are available in this area (including modeling for the component subtasks)" Also, give more thought to how the models will be validated against data for a number of existing blast freezer installations. Even mature and detailed models for much simpler facilities are recognized to provide mainly comparative information between alternative modeled scenarios and to require calibration to specific buildings. There are so many potentially uncontrolled variables in a real facility (such as insulation deteriorated by moisture, as one example), that it will be very difficult for field data to provide any meaningful validation of the models, unless you are able to vary

parameters at a given installation and see whether the relative change is consistent with the model's relative change.

RESPONSE 3:
Simulation programs exist for freezing time prediction, air flow (CFD) and refrigeration system and component design. However, no integrated program exists and the appropriate level of complexity required to get realistic solutions is not obvious. In a blast freezer most, if not all, of the uncontrolled variables have minor impact on freezer performance. If an uncontrolled variable has significant impact then its variation will be explicitly incorporated into the methodology so that the design can be risk assessed. Extensive validation across a wide range of freezers will not be possible. However, retrofit of validation facilities to improve their performance will provide clear tests of the models ability to predict relative changes in performance.

QUESTION 4:
The field measurements required for validation can be costly so obtaining sufficient high quality data in "a number" of existing installations may well be difficult within the stated budget.

RESPONSE 4:
Comments 2 and 3 & 4 are inconsistent. The issues are tractable but non-trivial providing a significant research problem. The desire to validate using field data means that costs can be significant even if only a few facilities are studied.