PROGRESS REPORT

Air Conditioning in Underground Structures
Tests Conducted up to October 31, 1952.

by

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Approved for public release by the Director of the National Institute of Standards and Technology (NIST) on October 9, 2015.
A brief summary of the tests run at the Mount Weather pilot project is as follows:

Test Condition 1 - Warm up period from April 23 to May 15.

An average constant heat input of 60,800 BTU/hr to the chamber was maintained with no ventilation or dehumidification until the average temperature of the rock surfaces reached 70°F. The observations taken were air temperature, rock temperatures at selected depths and positions, heat input to lights and heaters, and humidity of the space.

Test Condition 2 - Steady state heating at 76°F air temperature from May 15 to June 10.

Test conditions were: air temperature approximately 76°F, no ventilation or dehumidification. Observations were the same as for test condition 1.

Heat input to the chamber was regulated by a step controller (each step being 1250 watts)
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primary sensitive element of which is located in the return air stream to the circulating fan. The heat input rate decreased from 60,000 to approximately 16,000 Btu/hr in 20 days.

**Test Condition 3** - Temperature drop with minimum heat supply and no ventilation - from June 10 to June 30. During this test the temperature in the chamber was permitted to decrease while the only internal heat supplied was that from a few lights and two dehumidifiers used to prevent moisture condensation on instruments and equipment. The condensation from the two dehumidifiers was weighed and removed from the chamber. Observations were the same as those for Conditions 1 and 2. The average heat input rate to the lights and dehumidifiers was 1.6 kW while the room air temperature decreased from 76°F to approximately 65°F in 20 days.

**Test Condition 4** - Temperature drop from Test Condition 3 with minimum heat supply and ventilation from July 1 to July 10.

During this test outside air was introduced for ventilation of the space while the rate of temperature
of several tests, in which the results of the tests were
comparable, and in which the tests were performed on
the same apparatus and under the same conditions.

Such a test was conducted in the laboratory, and
was found to be highly consistent. The results of this
test, which were published later, showed a marked
reduction in the magnitude of the error compared to
earlier results. This led to the conclusion that the
apparatus used was of sufficient accuracy to
permit reliable readings to be obtained.

The results of the tests were then applied to
the analysis of the data obtained in previous
studies. It was found that the errors were
systematically distributed, and that the
magnitude of the errors was comparable to
those obtained in the laboratory tests.

The implications of these results
are significant, as they suggest that
the errors in the earlier studies may
have been underestimated. This
knowledge could have important
implications for future research in
this field.
drop was observed. The entering ventilation air temperature ranged from 57.5°F to 59.5°F and the chamber air temperature was reduced from 63°F to 61°F in 18 days. In conjunction with this test, a study was made of the cooling effect of the mine tunnel on the summer ventilation air. The temperature drop was observed at selected stations in the 12 inch duct located in about 1100 feet of tunnel. Temperature drops in the ventilation air duct were observed to be as high as 25°F. Following Test Condition 4, refrigeration was used to bring the temperature of the space and rock to a depth of 12 feet to approximately 56°F.

Test Condition 5 - Warm up period from August 14 to August 16.

The conditions and observations for this test were the same as Test Condition 1 except the heat input rate to the space was approximately 122,500 BTU/hr. The average rock surface was raised from 56°F to 70°F in approximately 49 hours.

Test Condition 6 - Steady state heating at 76°F air temperature from August 16 to September 17.
The conditions and observations for this test were the same as Test Condition 2. The heat input rate to the chamber dropped from 122,500 to 51,200 Btu/hr in 22 days.

During the period from September 17 to October 1, a test condition was maintained under which the chamber was dehumidified and ventilated and occupancy was simulated. Due to failure of electrical equipment this test was discontinued and Test Condition 7 commenced on October 10.

Test Condition 7 - A test to determine heat and moisture load with no ventilation or simulated occupancy is now in progress.

The purposes of this test were to determine the air conditioning capacity required to maintain 78°F and 50% R.H., including reheat and sensible heat required to maintain 78°F in the space and the amount of moisture condensed. During the week October 24-31, the daily water condensation was approximately 10 pounds. Another week will be spent on this test.

Preparations for other testing to be done concurrently with those in the chamber are in progress. The house above the shaft is nearly completed and the blower and motor are ready for installation. The blower was designed for 50,000 cfm or less through the mine tunnel and shaft. Some work
has been done on the spray pond dam by the Bureau of Mines. The underground pond phase of the program is being held in abeyance.

Calculation for theoretical and practical consideration are being made for all phases of testing in the underground chamber and will be submitted in subsequent reports.