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NATIONAL BUREAU OF STANDARDS REPORT

NBS PROJECT

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PROGRESS REPORT

Air Conditioning in Underground Structures

Tests Conducted up to October 31, 1952.

by

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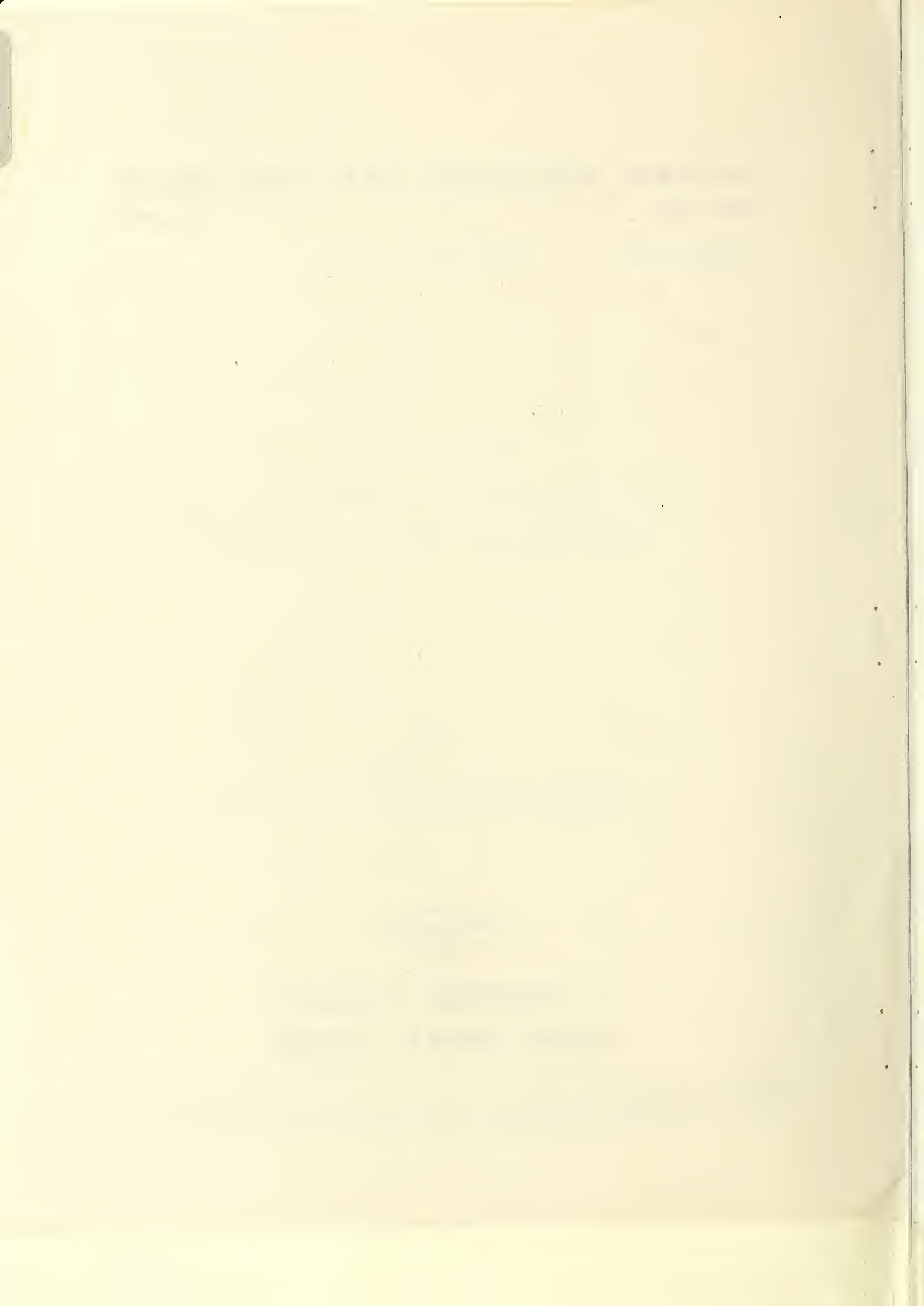


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PROGRESS REPORT

Air Conditioning in Underground Structures

Tests Conducted up to October 31, 1952.

A brief summary of the tests run at the Mount Ventnor 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)

INTRODUCTION

The following is a summary of the results of the study.

The study was conducted in the year 1961.

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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 46,000 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 supplies were 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 dropped from 76°F to approximately 62°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

During the first 10 days of the experiment the
the subject was placed in the following position:
The head was kept in a horizontal position and the
neck was kept in a neutral position.

Test Condition 2 - Experimental group with constant head

During the first 10 days of the experiment the
the subject was placed in the following position:
The head was kept in a horizontal position and the
neck was kept in a neutral position. The subject
was instructed to keep the head in a horizontal
position and the neck in a neutral position. The
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Test Condition 3 - Experimental group with constant head

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in a horizontal position and the neck in a
neutral position.

During the first 10 days of the experiment the

ventilation of the space while the rate of temperature

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 78°F air temperature from August 16 to September 17.

They are observed. The following description
of temperature trends from 21.75 to 21.77
and the present air temperature are shown. From
21.75 to 21.77 is 15 days. In the morning the air
was, a little less than of the morning trend of
the wind trend in the morning. The air
The temperature trend was observed as follows
variation in the air temperature is not
1100 feet of air. The temperature trend is not
variation in the air temperature is not
as 1000. The air temperature trend is not
the trend in the air temperature is not
from a trend of 15 days in the morning. The
Test Condition 1 - was a trend from 21.75 to 21.77

Figure 10.

The condition was observed. The air trend was
the trend in the morning. The air trend was
trend in the morning. The air trend was
the air trend was observed. The air trend was
The air trend was observed. The air trend was
The air trend was observed. The air trend was

Test Condition 2 - was a trend from 21.75 to 21.77
The air trend was observed. The air trend was

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 29 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 17.

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 20-31, the daily water condensation was approximately 44 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 test 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.

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