CHAPTER 1
GENERAL

1-1. Purpose.

The purpose of this manual is to provide criteria and guidance for design of utility systems for military facilities in arctic and subarctic regions. Only design criteria unique to cold regions (the Arctic and Subarctic) are provided. Where conventional practice is acceptable, appropriate references are given.

1-2. Scope.

This manual applies to all U.S. Army and U.S. Air Force installations in the Arctic and Subarctic. Topics covered include water supply, wastewater collection, treatment and disposal, fire protection, utility distribution systems and the thermal calculation techniques needed for their cold regions design.

1-3. References.

Appendix A contains a complete list of references for this manual. The bibliography lists additional selected technical information on the subject.

1-4. Environmental conditions in the Arctic and Subarctic.

The design, construction and maintenance of utility systems are all affected by the special environmental conditions found in the Arctic and Subarctic. These conditions include adverse temperatures, wind, and snow; high costs; remoteness of locations, limited availability of construction materials and labor; need for fuel additives, synthetic lubricants, oils and greases for construction equipment; thermal stresses; frost heaving and permafrost.

a. Temperature. The low temperature prevailing in the cold regions is the most critical environmental factor. The intensity of the cold is important, but equally critical is the duration of the cold period. Mean annual air temperatures in the Northern Hemisphere are presented in TM 5-852-1/AFR 88-19, Vol. 1. Air temperatures in arctic locations range from highs of 80 degrees F in summer to lows of -75 degrees F in winter. Interior locations away from the tempering effects of oceans or large water bodies tend to have the greatest extremes. Sub-zero temperatures can persist for months and it is not uncommon for air temperatures to remain below -30 degrees F for a week or more at many locations in Alaska.

b. Permafrost. Permafrost is defined as any perennially frozen ground. The presence of frozen soil has the greatest impact on design and construction, so permafrost is typically a major design consideration. Figure 4-1 in TM 5-852-1/AFR 88-19, Vol.1, illustrates the approximate distribution of permafrost in the Northern Hemisphere. In the zone of continuous permafrost, frozen ground is absent only at a few widely scattered locations such as at the bottoms of lakes and rivers. In the discontinuous zone, permafrost is found intermittently. TM 5-852-1/AFR 88-19, Vol.1, contains detailed discussion on both permafrost and seasonal frost.

*c. Wind and related factor*s. Mean annual wind speeds for most arctic and subarctic locations are usually about 5 to 10 miles per hour in the interior and 10 to 20 mph at coastal locations. The combination of wind and low temperatures results in very large heat losses from exposed facilities and presents hazards for personnel. Blowing and drifting snow can create major construction and operational problems even when the total precipitation is low. The location and layout of utility systems and access points for operation and maintenance must be given careful consideration during planning and design to avoid problems with drifting snow.