the external distribution system **114**; and (2) flow to be redistributed on undergarment **28** and/or in space **30**.

[0051] The maximum perspiration rate for a human may be about 1.5 liters per hour. The size and capacity of the reservoirs, pumps, bladders, inlet tubing, outlet tubing, outlet headers, and distribution system tubing may be determined, for example, from the maximum perspiration rate and the number and location of pumps used.

[0052] Two-stage evaporative cooling garment **10** may be more efficient under certain temperature conditions. For example, garment **10** may be particularly effective for cooling when the ambient (external to garment **10**) wet bulb temperature is less than the temperature of impermeable barrier **32**, and the temperature of impermeable barrier **32** is less than the temperature of skin **26** (FIG. **2**). Even when temperature and humidity conditions may be less than optimal for functioning of garment **10**, garment **10** may, nevertheless, provide important advantages. For example, removal of sweat condensate **42** and/or unevaporated sweat **40** from the interior of garment **10** reduces humidity in air space **30**, thereby enhancing first-stage evaporation (from skin **26** or undergarment **28**). Also, condensed sweat **42** and/or unevaporated sweat **40** that may accumulate inside a garment may cause skin **26** of human **24** to become very soft and perishable. Removal of the sweat helps reduce damage to skin **26**.

[0053] Thermal physiological modeling of two-stage evaporative cooling indicates that physiological heat strain may be reduced. FIGS. **8**A-B, **9**A-B, and **10**A-B are graphs of core temperature (FIGS. **8**A, **9**A, **10**A) and physiological strain index (PSI) (FIGS. **8**B, **9**B, **10**B) versus time, with and without two-stage evaporative cooling. PSI reflects thermal-work strain (i.e., increases in both body temperature and heart rate). The graphs were created from a computer simulation of a human walking while clad in two different ensembles and breathing filtered outside air. One ensemble is a MOPP-4 (Mission Oriented Protective Posture-Level 4) suit without two-stage evaporative cooling. A second ensemble (labeled as ACP2E) is a two-stage evaporative cooling garment **10** with a standard U.S. Army Combat Uniform (ACU) as undergarment **28**. In FIGS. **8**B, **9**B, and **10**B, a physiological strain index (PSI) of **10** corresponds to maximum permissible core temperature (T_C) and heart rate (HR). In practice, a maximum PSI of 8 is more desirable.

[0054] FIGS. **8**A-B assume no direct sunlight, ambient temperature of 20 degrees C., relative humidity (RH) of 50%, and a dew point of 9.5 degrees C. FIGS. **9**A-B assume no direct sunlight, ambient temperature of 25 degrees C., relative humidity of 38%, and a dew point of 9.5 degrees C. FIGS. **10**A-B assume no direct sunlight, ambient temperature of 30 degrees C., relative humidity of 28%, and a dew point of 9.5 degrees C. Compared to the MOPP-4 ensemble, the ACP2E ensemble shows substantially extended safe exposure times and a reduction in PSI (i.e., thermal-work strain) of about 40% (FIG. **8**B), 35% (FIG. **9**B), and 25% (FIG. **10**B), respectively.

[0055] Tests were conducted with a stationary sweating thermal manikin wearing a commercially available chemical protection suit (Blauer Multi-threat Ensemble, Blauer Manufacturing Company, Boston, Mass. 02215). The chemical protection suit was modified for water distribution on its outer surface. The modification included a thin wicking fabric bib and related tubing to distribute water over chest, abdomen and groin areas. The wicking bib system provided an evaporating water surface over about 27% of the suit area. In a climate chamber environment of 95° F. and 40% RH, the wicking bib system increased cooling by 119 watts, compared to cooling without the bib. With 80% of the suit wet, the potential cooling increase is estimated to be about 340 watts. The manikin tests further demonstrate the cooling capability of the two-stage evaporative cooling apparatus and method.

[0056] The simulation results of FIGS. **8**B, **9**B, and **10**B and the manikin test results indicate that, at least for the test conditions, the ACP2E garment enables unlimited safe exposure times, compared to safe exposure times of about 180 minutes (FIG. **8**A), 130 minutes (FIG. **9**A), and 110 minutes (FIG. **10**A) for the MOPP-4 ensemble.

[0057] It will be understood that many additional changes in the details, materials, steps and arrangement of parts, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention, as expressed in the appended claims.

What is claimed is:

1. A protective garment for an animate being, comprising:
an impermeable inner layer;
a reservoir disposed interior to the inner layer, for collecting sweat from the animate being; and
a pump for moving the sweat from the reservoir to a location external to the inner layer.

2. The garment of claim **1**, wherein the animate being is a human.

3. The garment of claim **1**, wherein the sweat collected in the reservoir comprises at least one of 1) unevaporated liquid sweat, and 2) liquid sweat that has exuded from the animate being, evaporated, and condensed on the inner layer.

4. The garment of claim **1**, wherein the pump is disposed interior to the inner layer.

5. The garment of claim **1**, further comprising a plurality of reservoirs disposed inside the inner layer, for collecting sweat from the animate being; and a plurality of pumps for moving the sweat from the reservoirs to locations external to the inner layer.

6. The garment of claim **1**, further comprising a distribution system located external to the inner layer, for distributing the sweat on an exterior of the garment.

7. The garment of claim **6**, further comprising inlet tubing having one end in fluid communication with the reservoir and another end connected to an inlet of the pump.

8. The garment of claim **7**, further comprising outlet tubing having one end connected to an outlet of the pump and another end that passes through the inner layer.

9. The garment of claim **8**, wherein the outlet tubing is operatively connected to the distribution system.

10. The garment of claim **2**, wherein the pump and reservoir are disposed in a boot of the garment.

11. The garment of claim **2**, wherein the reservoir comprises a gutter connected to the inner layer.

12. The garment of claim **11**, wherein the pump is disposed on a torso of the human.

13. The garment of claim **11**, wherein the gutter is disposed circumferentially on the inner layer of a torso portion of the garment.

14. The garment of claim **11**, wherein the pump is disposed at an elbow joint of the human.

15. The garment of claim **14**, wherein the gutter is disposed circumferentially on an inner layer of a sleeve portion of the garment.