NATIONAL TRAINING CENTER

Environment, Safety, and Health Department

General Procedure

Title:	Inclement Weather Restrictions
Number:	ESH-GP-552
Revision:	3

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REVISION HISTORY

Rev.	Date	Description of Revision
3	04/XX/15	Updated document to reflect current contractor organization and activities.
2	10/07/11	Reclassified as general procedure. Revised to address inclement weather procedures for all individuals/activities at NTC facilities (not just training).
1	06/17/09	First revision under new contractor approved.

1.0 PURPOSE

Management at the U.S. Department of Energy (DOE) National Training Center (NTC) are aware of inclement weather conditions that may pose a hazard to instructors, students, and visitors; facilities maintenance personnel and subcontractors; and employees during training, maintenance, and operational activities. The purpose of this procedure is to ensure that such conditions do not result in personal injury or degradation of training.

Inclement weather hazards include wet conditions, cold temperatures, hot temperatures, high winds, weather-obscured visibility, and lightning.

2.0 SCOPE

This procedure applies to all NTC outdoor training, maintenance, and other activities.

3.0 CANCELLATION

This procedure supersedes ESH-GP-552, *Inclement Weather Restrictions*, dated October 2011.

4.0 REFERENCES

4.1 10 CFR 851, Worker Safety and Health Program

4.2 DOE Policy 450.4A, Integrated Safety Management Policy

4.3 DOE Order 473.3, Protection Program Operations

4.4 National Weather Service Wind Chill Hazard Guidelines

4.5 National Weather Service Heat Index Program

4.6 377th ABW Weather Squadron Automated Weather Observation System

4.7 Threshold Limit Values for Chemical Substances and Physical Agents, Biological Exposure Indices, American Conference of Governmental Industrial Hygienists (ACGIH)

4.8 NTC-PM-505, NTC Worker Safety and Health Program Plan

5.0 DEFINITIONS

5.1 CONDUCTION. The transfer of heat between materials that contact each other.

5.2 CONVECTION. The transfer of heat in a moving fluid. Air flowing past the body can cool the body if the air temperature is cool. On the other hand, air that exceeds 35°C (95°F) can increase the heat load on the body.

5.3 EVAPORATIVE COOLING. Occurs when sweat evaporates from the skin. High humidity reduces the rate of evaporation and thus reduces the effectiveness of the body's primary cooling mechanism.

5.4 HEAT STRESS. The net heat load on the body from the combined contribution of metabolic production and external environmental factors.

5.5 METABOLIC HEAT. A by-product of the body's activity.

5.6 RADIATION. The transfer of heat energy through space. A worker whose body temperature is greater than the temperature of the surrounding surfaces radiates heat to these surfaces. Hot surfaces and infrared light sources radiate heat that can increase the body's heat load.

5.7 STRENUOUS ACTIVITY. A movement or series of movements requiring or characterized by great effort, energy, or exertion (e.g., training in Level B personal protective equipment such as full-face SCBA, hooded chemical suits, gloves, and boots).

5.8 WIND CHILL. A function of the air temperature and wind velocity upon the exposed body.

6.0 POLICY

It is NTC policy to ensure all operations are conducted in environmental conditions that are conducive to completing the task at hand and do not subject individuals to weather-related hazards.

Attention to potentially hazardous weather conditions is especially important for activities conducted outdoors at the NTC's live-fire range (LFR) and Integrated Safety and Security Training and Evaluation Complex (ISSTEC). NTC policy requires appropriate managers, project supervisors, and instructors to:

- Be fully aware of active or potential weather conditions that might result in either a degraded learning or working environment, and
- Postpone or cancel activities when potentially hazardous weather conditions exist.

7.0 RESPONSIBILITIES

Although each individual is responsible for his or her duties listed in this section, these duties may be delegated to another individual who is equally qualified to perform the same function.

7.1 Oversight Programs Director

As the director of the NTC's Environment, Safety, and Health (ES&H) Department, the Oversight Programs Director, is responsible for ensuring all activities conducted at the NTC are conducted safely in an environment that is conducive to completing the tasks at hand and free from inclement weather hazards.

7.2 ES&H Department

7.2.1 Review or survey operations periodically to ensure the requirements of this procedure are being implemented properly and fully.

7.2.2 Ensure risk analysis reports adequately address weather-related hazards.

7.3 LFR, ISSTEC, Training and Facilities Maintenance Management

7.3.1 Ensure the implementation of this procedure by their department personnel (i.e., all activities are conducted in an environment that promotes a good learning environment and is free from inclement weather hazards).

7.3.2 Ensure all students who will engage in strenuous physical training, or training involving protective masks, have approved medical releases from their sending organizations on file at the NTC prior to their beginning training.

7.3.3 Ensure NTC training involving heavy activity over prolonged periods of time in hot weather is reviewed and approved by an exercise physiologist prior to implementation.

7.4 NTC Instructors / Supervisors

NOTE: In hot weather, instructors shall emphasize the potential for heat-related injuries—including exertional heat illness (EHI)—during pre-training safety briefings.

7.4.1 Prior to activities, identify an inclement weather shelter area and advise students and observers of its location.

7.4.2 Communicate the requirements of this procedure, including the potential hazards of inclement weather.

7.4.3 Ensure staff, students, visitors, and subcontractors are not exposed to potentially hazardous inclement weather conditions while on site.

7.4.4 Postpone or cancel activities when weather conditions dictate.

7.5 NTC Staff, Students, Visitors, and Subcontractors

The staff, students, visitors, and subcontractors at the NTC are responsible for adhering to this procedure.

8.0 OPERATIONS

8.1 Overview

The NTC staff must always be aware of potentially hazardous inclement weather conditions that can affect training and maintenance activities, and must react quickly and properly to developing weather conditions that may expose individuals to hazards. Activities will be postponed or cancelled when necessary.

8.2 Wet Weather

Rain, sleet, hail, or snow can create unsafe environments for the conduct of training and operations.

Lead Instructors and Supervisors: Take the actions below to ensure safety in wet weather conditions.

8.2.1 Ensure you are aware of potential weather-related conditions that could adversely affect planned activities.

8.2.2 Ensure alternate plans exist that can be implemented in the event heavy rain, sleet, hail, or snow requires cancellation of planned activities.

8.2.3 Inspect work and training areas that have been subjected to heavy rain, sleet, hail, or snow to ensure the precipitation has not resulted in potentially unsafe conditions.

8.2.4 Cease activities when any one of the following conditions exists:

A. Protective Force Training

- Unable to fire weapons safely.
- Unable to manipulate weapons safely.
- Footing (stability) on a firing line is impaired.
- Ability to see targets clearly is impaired.
- Cannot operate vehicles safely due to road conditions or driving surfaces.
- Cannot traverse tactical shooting courses, obstacle courses, land navigation courses, or other overland tactical courses safely.

B. Maintenance / Other Activities

- Footing (stability) is impaired.
- Ability to see clearly is impaired.
- Cannot operate vehicles safely due to road conditions or driving surfaces.
- Cannot operate tools or machinery safely.

8.3 Cold and Windy Weather

Extended exposure to cold and windy weather can degrade performance and seriously affect safety.

Lead Instructors and Supervisors: Take the actions below to ensure safety in cold and windy weather conditions.

8.3.1 Ensure ice and snow accumulations in, or on, training and work areas are removed so no one slips and falls.

8.3.2 Ensure individuals are properly clothed for training/working in a cold/windy environment, are allowed frequent rest breaks in warm areas, and drink water or warm nonalcoholic fluids regularly to prevent dehydration.

8.3.3 Prior to beginning activities, brief individuals on the symptoms of frostbite and hypothermia and advise them of preventative measures.

A. Protective Force Training

1. Watch students closely to ensure they do not sustain frostbite or begin showing signs of hypothermia.

2. Immediately remove students whose performance or physical condition appears to be degraded by the cold weather.

3. Refer suspected cases of cold injury to the LFR Paramedic for examination and treatment.

B. Maintenance / Other Activities

Periodically review activities to identify hazards that may be the result of cold/windy conditions.

8.3.4 Extended cold weather exposure can pose serious safety hazards to individuals working and training outdoors.

8.3.4.1 Use the Wind Chill Chart (Appendix A) to determine when it is safe to conduct outdoor activities.

1. Activities may be conducted when wind speed and ambient temperatures are **anywhere in the Light Blue area** shown on the left side of the chart.

2. Terminate activities and remove individuals from the training/working area when wind speed and ambient temperatures are **anywhere in the two darker blue or violet areas** on the right side of the chart.

8.3.4.2 Compute real-time wind chill data (wind speed, ambient temperature) using one of the following methods:

1. Ask the LFR ES&H Specialist to compute the wind chill index using the portable weather station.

2. Call the 377th Air Base Wing 24-hour Automated Weather Observation System at 242-4044.

NOTE: Ambient temperatures are provided in degrees Celsius, and wind speeds are provided in knots. Both require conversion to degrees Fahrenheit and miles per hour.

8.3.4.3 Go to http://www.weather.gov/om/windchill/index.shtml (the National Weather Service website), where the wind chill index can be automatically computed by entering local wind speed and ambient temperature.

NOTE: Ambient temperatures and wind speeds from the National Weather Service website are measured at the Albuquerque Sunport and may differ from conditions at the NTC training/work site.

8.4 Hot Weather

Hot, dry weather at high altitude can have a rapid and deleterious effect on the human body and can quickly degrade performance and safety. The pre-training and pre-work

safety briefings must emphasize the potential for heat-related injuries such as EHI, including its signs and symptoms.

Lead Instructors and Supervisors: Take the actions below to ensure safety in hot weather conditions.

8.4.1 Encourage use of sunscreen and brimmed hats.

8.4.2 Ensure drinking water is available at training/work locations, and remind individuals to consume water regularly to prevent dehydration.

8.4.3 Establish shaded rest areas near training/work sites and provide frequent rest periods. Encourage individuals to loosen or remove restrictive clothing during rest breaks.

8.4.4 Prior to activity, brief individuals on the signs and symptoms of heat injury and the measures to take to reduce its possibility.

A. Protective Force Training

1. Observe students closely and continually to ensure signs of heat injury (heat exhaustion, heat cramps, or heat stroke) are not developing.

2. Immediately remove students who exhibit any sign(s) of heat injury.

3. Refer suspected cases of heat injury to the LFR Paramedic for examination and treatment.

B. Maintenance / Other Activities

Periodically review activities to identify hazards that may be the result of hot/dry conditions.

8.4.5 Extended exposure to high temperatures can pose serious safety hazards to individuals working and training outdoors.

8.4.5.1 Use the Heat Index Chart (Appendix B) and the Heat Index/Heat Disorder Chart (Appendix C) to determine if activities should be discontinued. The LFR ES&H Specialist can compute the heat index using the portable weather station.

NOTE: Activities are not recommended when the heat index is in the "EXTREME CAUTION" area of the Heat Index Chart.

8.4.5.2 Prior to implementation, activities involving heavy physical activity over prolonged periods of time in the "EXTREME CAUTION" portion of the Heat Index Chart (Appendix B) must be reviewed and approved by a recognized and approved expert (e.g., exercise physiologist) using the "Heat Stress" criteria of ACGIH Threshold Limit Values and Biological Exposure Indices" (see Appendix D, Thermal Stress, for additional guidance).

8.5 High Winds and Elevated Fire Conditions

The ability to conduct selected activities may depend on prevailing wind speeds and elevated fire conditions.

Lead Instructors and Supervisors: Take the actions below to ensure safety in high wind and elevated fire conditions.

8.5.1 When strong winds or elevated fire conditions interfere with the safe conduct of outdoor activities, immediately halt all activities and have individuals leave the area.

A. Protective Force Training

NOTE: This does not apply to training inside the Live Fire Shoot Houses, Tactical Training Tower, or ISSTEC facilities.

1. Tactical Training Tower Exterior: Suspend training if wind speeds exceed 30 mph.

2. Coyote Springs Road/No Sweat Blvd: Do not use pyrotechnics to support training if the wind speed exceeds 15 mph or fire conditions are elevated.

3. Outside ranges or training areas: Suspend live-fire or ESS training when wind speed is 30 mph or higher.

4. Locations other than the LFR or ISSTEC (e.g., M-60 Range or No Sweat Blvd): Before conducting training, consult with an ES&H Specialist regarding fire danger and associated fire prevention measures.

B. Maintenance / Other Activities

Periodically review activities to identify hazards that may be the result of high winds or elevated fire conditions. Rooftop work will be suspended when wind speed is 30 mph or higher.

8.5.2 Suspend all spark-producing and flame-producing cutting activities with torches and saws when wind speeds exceed 30 mph.

8.5.3 Ask the LFR ES&H Specialist for immediate readings of wind speed using the portable weather station.

8.6 Weather-Obscured Visibility

Outside activities must cease when dust, rain, snow, sleet, hail, fog, or other atmospheric conditions adversely affect the ability of individuals to see clearly and conduct activities in a safe manner.

8.7 Lightning

Lead Instructors and Supervisors: Take the actions below to ensure safety in lightning conditions.

8.7.1 Determine if activities should continue by using a portable lightning detector or asking an ES&H Specialist to use a portable lightning detector.

If no lightning detector is available, determine the approximate distance of a lightning strike by counting the seconds between the lightning discharge flash and the audible report (thunder). Using an estimate of 5 seconds per mile, if 25 seconds or less have passed, lightning is considered to be in the immediate vicinity (within 5 miles) and activities will be terminated.

8.7.2 If thunderstorms are building in the area or are forecast, alert—or request the LFR ES&H Specialist to alert—the Range Master, ISSTEC Coordinator, and/or appropriate manager.

8.7.3 Postpone all outdoor activities when lightning strikes are within 5 miles of a training location or work site.

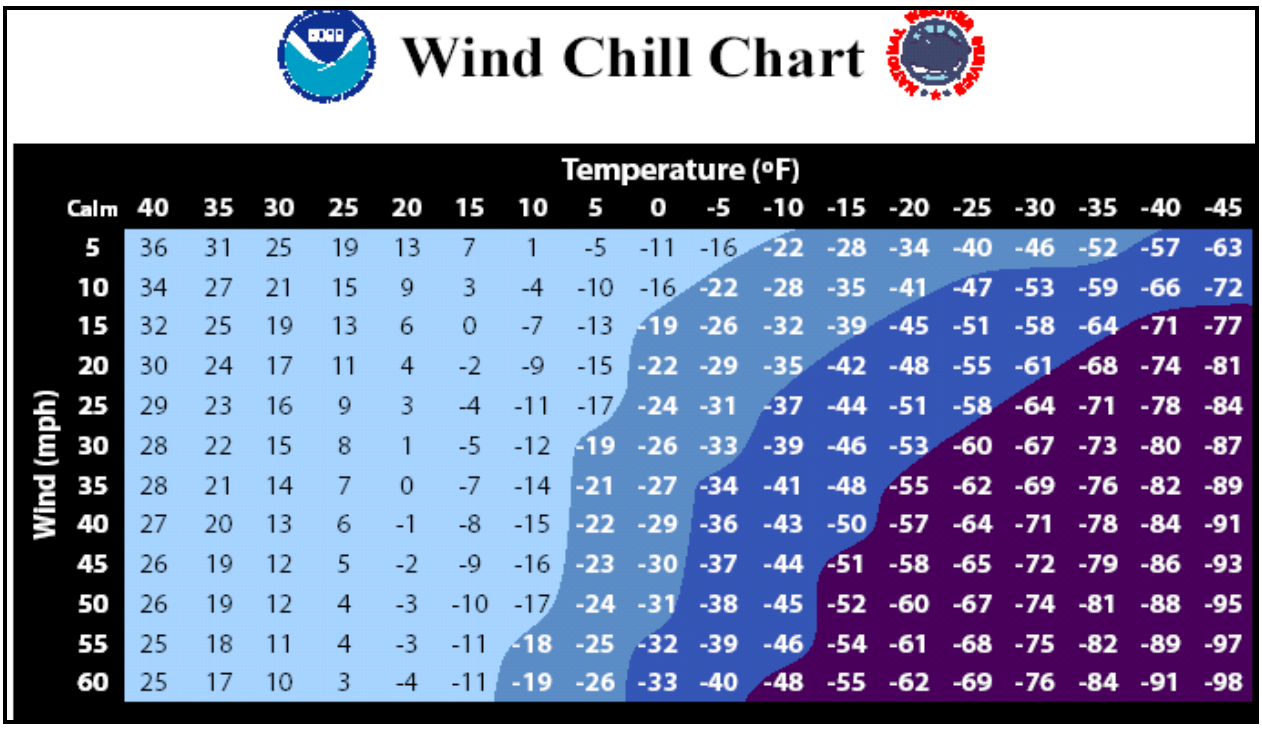
8.7.4 Ensure all personnel immediately leave the area, and seek shelter in a building or other covered facility.

8.7.5 Resume activity if, within 30 minutes, no lightning strikes have occurred within 5 miles of the area and the weather front appears to be moving away from the area.

9.0 APPENDICES

A – Wind Chill Chart
B – Heat Index Chart
C – Heat Index/Heat Disorder Chart
D – Thermal Stress

APPENDIX A – WIND CHILL CHART



Wind Chill Chart

Wind (mph)	Temperature (°F)																	
	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
	5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
	10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
	15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
	20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
	25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
	30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
	35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
	40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
	45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
	50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
	55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
	60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Activities may be conducted when the wind chill is within the **light blue areas** on the left side of the chart.

Activities will be terminated if the wind chill factor moves into the **two darker blue areas or violet area**.

APPENDIX B – HEAT INDEX CHART

Heat Index

Air Temp (°F)	Relative Humidity (percentage)																				
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
135°	120	126																			
130°	117	122	131																		
125°	111	116	123	131	141																
120°	107	111	116	123	130	139	148														
115°	105	107	111	115	120	127	135	143	151												
110°	99	102	105	108	112	117	123	130	137	143	150										
105°	95	97	100	102	105	109	113	118	123	129	135	142	149								
100°	91	93	95	97	99	101	104	107	110	115	120	126	132	138	144	150					
95°	87	88	90	91	93	94	96	98	101	104	107	110	114	119	124	130	136	140	150		
90°	83	84	85	86	87	88	90	91	93	95	96	98	100	102	106	109	113	117	122	126	131
85°	78	79	80	81	82	83	84	85	86	87	88	89	90	91	93	95	97	99	102	105	108
80°	73	74	75	76	77	77	78	79	79	80	81	81	82	83	84	85	86	87	88	89	90
75°	69	69	70	71	72	72	73	73	74	74	75	75	76	76	77	77	78	78	79	79	80
70°	64	64	65	65	66	66	67	67	68	68	69	69	70	70	70	70	71	71	71	71	72

= **Heatstroke risk extremely high!**
EXTREME DANGER!
CEASE ACTIVITY!

= Heat exhaustion likely, heatstroke possible
DANGER!
CEASE ACTIVITY!

= Heat exhaustion possible
EXTREME CAUTION!

= Fatigue possible
CAUTION!

APPENDIX C – HEAT INDEX / HEAT DISORDER CHART

Heat Index	Possible Heat Disorders for People in Higher Risk Groups
130°F or higher	Heatstroke/sunstroke **highly likely** with continued exposure.
105°F - 130°F	Sunstroke, heat cramps, or heat exhaustion **likely**. Heatstroke **possible** with prolonged exposure and/or physical activity.
90°F - 105°F	Sunstroke, heat cramps, and heat exhaustion **possible** with prolonged exposure and/or physical activity.
80°F - 90°F	Fatigue **possible** with prolonged exposure and/or physical activity.

RECOMMENDED WATER INTAKE

Ambient Temperature	Work/Rest Cycle-Minutes	Water Intake (Quarts/Hour)
88°F - 91°F	Continuous	At Least 1.5
92°F - 94°F	50/10	At Least 2
95°F - 97°F	45/15	At Least 1
98°F - 99°F	40/20	At Least 1.5
100°F & above	30/30	More Than 2

NOTES:

- Body armor/protective gear: Add approximately 10°F to the heat index.
- Chemical biological weapon (CBW) protective gear:
  - If conducting easy work, add 10°F to the heat index.
  - If conducting moderate or hard work, add 20°F to the heat index.
- Work/rest cycle may be adjusted to the intensity of the activity.
- Refer to portable weather meters for site temperature.
- Rest cycle may include the following activities: Unscheduled pauses and administrative or operational waiting periods during work. Attempt to conduct rest periods in shaded areas.
- If an individual is becoming excessively hot despite these limits, he/she will be removed from the work or training environment.

APPENDIX D – THERMAL STRESS

D.1 PURPOSE AND SCOPE

This appendix provides the guidance, procedures, and minimum requirements for minimizing the risk of heat or cold stress-related disorders. Risk minimization is accomplished by identifying risk factors, training individuals to know the proper signs and symptoms, and providing guidelines for preventing heat or cold stress disorders during operations or activities at the NTC.

This appendix describes the emergency actions to be taken if an employee encounters another individual suffering from a thermal stress injury. The requirements described in this appendix are consistent with the thermal stress standards in the "Threshold Limit Values (TLVs) for Chemical and Physical Agents and Biological Exposure Indices (BEIs)" by the American Conference of Government Industrial Hygienists.

This appendix applies to all individuals who engage in strenuous physical activities and may be exposed to thermal stress hazards.

D.2 OVERVIEW

D.2.1 Controls

The five major types of engineering controls used to reduce heat stress in hot work environments are ventilation, air cooling, fans, shielding, and insulation. Heat reduction can also be achieved by using equipment and tools that reduce the physical demands placed on an employee. However, for this approach to be successful, the metabolic effort required for the employee to use or operate these devices must be less than the effort required without them. Another method is to reduce the effort necessary to operate equipment such as power assists. The individual should be allowed to take frequent rest breaks in a cooler environment.

D.2.2 Acclimatization

The human body can adapt to heat exposure to some extent. This physiological adaptation is called *acclimatization*. After a period of acclimatization, the same activity will produce fewer cardiovascular demands. The individual will sweat more efficiently (causing better evaporative cooling), and thus will more easily be able to maintain normal body temperatures.

A properly designed and applied acclimatization program decreases the risk of heat-related illnesses. Such a program basically involves exposing employees to work in a hot environment for progressively longer periods. According to the National Institute for Occupational Safety and Health (NIOSH), employees who have had previous experience in jobs where heat levels are high enough to produce heat stress, the regimen should be 50 percent exposure on Day 1, 60 percent on Day 2, 80 percent on Day 3, and 100 percent on Day 4. For new employees who will be similarly exposed, the regimen should be 20 percent exposure on Day 1, with a 20 percent increase in exposure each additional day.

D.2.3 Fluid Replacement

Cool (50°-60°F) water or any cool liquid (except alcoholic beverages) should be made available to employees to encourage them to drink small amounts frequently (such as one cup every 20 minutes). Ample supplies of liquids should be placed close to the work area. Although some commercial replacement drinks contain salt, this is not necessary for acclimatized individuals because most people add enough salt to their summer diets.

D.2.4 Engineering Controls

1. General ventilation is used to dilute hot air with cooler air (generally cooler air that is brought in from the outside). This technique clearly works better in cooler climates than in hot ones. A permanently installed ventilation system usually handles large areas or entire buildings. Portable or local exhaust systems may be more effective or practical in smaller areas.

2. Air treatment/air cooling differs from ventilation because it reduces the temperature of the air by removing heat (and sometimes humidity) from the air.

3. Air conditioning is a method of air cooling, but it is expensive to install and operate. An alternative to air conditioning is the use of chillers to circulate cool water through heat exchangers over which air from the ventilation system is then passed. Chillers are more efficient in cooler climates or in dry climates where evaporative cooling can be used.

4. Local air cooling can be effective in reducing air temperature in specific areas. Two methods have been used successfully in industrial settings. One type, cool rooms, can be used to enclose a specific workplace or to offer a recovery area near hot jobs. The second type is a portable blower with built-in air chiller. The main advantage of a blower, aside from portability, is minimal set-up time.

5. Another way to reduce heat stress is to increase the air flow or convection using fans, etc. in the work area (as long as the air temperature is less than the employee's skin temperature). Changes in air speed can help employees stay cooler by increasing both the convective heat exchange (the exchange between the skin surface and the surrounding air) and the rate of evaporation. Because this method does not actually cool the air, any increases in air speed must impact the employee directly to be effective.

   NOTE: If the dry bulb temperature[1] is higher than 35°C (95°F), the hot air passing over the skin can actually make the individual hotter. When the temperature is more than 35°C and the air is dry, evaporative cooling may be improved by air movement, although this improvement will be offset by the convective heat. When the temperature exceeds 35°C and the relative humidity is 100 percent, air movement will make the individual hotter. Increases in air speed have no effect on the body temperature of individuals wearing vapor-barrier clothing.

[1] Temperature measured by a thermal sensor, such as an ordinary mercury-in-glass thermometer, that is shielded from direct radiant energy sources.

6. Heat conduction methods include insulating the hot surface that generates the heat and changing the surface itself.

7. Simple engineering controls such as shields can be used to reduce radiant heat (i.e., heat coming from hot surfaces within the individual's line of sight). Surfaces that exceed 35°C (95°F) are sources of infrared radiation that can add to the individual's heat load. Flat, black surfaces absorb heat more than smooth, polished ones. Having cooler surfaces surrounding the individual assists in cooling because the individual's body radiates heat toward them.

   NOTE: With some sources of radiation such as heating pipes, it is possible to use both insulation and surface modifications to achieve a substantial reduction in radiant heat. Instead of reducing radiation from the source, shielding can be used to interrupt the path between the source and the individual. Polished surfaces make the best barriers, although special glass or metal mesh surfaces can be used if visibility is a problem.

8. Shields should be located so they do not interfere with air flow, unless they are also being used to reduce convective heating. The reflective surface of the shield should be kept clean to maintain its effectiveness.

D.2.5 Administrative Controls and Work Practices

1. Training is the key to good work practices. Unless all employees understand the reasons for using new, or changing old, work practices, the chances of such a program succeeding are greatly reduced.

2. NIOSH states that a good heat stress training program should include (at least) the following components:

   - Knowledge of the hazards of heat stress;
   - Recognition of predisposing factors, danger signs, and symptoms;
   - Awareness of first-aid procedures for, and the potential health effects of, heat stroke;
   - Employee responsibilities in avoiding heat stress;
   - Dangers of using drugs, including therapeutic ones, and alcohol in hot work environments;
   - Use of protective clothing and equipment; and
   - Purpose and coverage of environmental and medical surveillance programs and the advantages of employee participation in such programs.

3. Hot jobs should be scheduled for the cooler part of the day. Routine maintenance and repair work in hot areas should be scheduled for the cooler seasons of the year.

D.2.6 Monitoring Programs

1. Every individual who works in extraordinary conditions that increase the risk of heat stress should be personally monitored. These conditions include wearing semi-

permeable or impermeable clothing when the temperature exceeds 21°C (69.8°F) or working at extreme metabolic loads (greater than 500 kcal/hour), etc.

2. Personal monitoring can be done by checking the heart rate, recovery heart rate, oral temperature, or extent of body water loss.

3. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one-third and maintain the same rest period.

4. The recovery heart rate can be checked by comparing the pulse rate taken at 30 seconds (P1) with the pulse rate taken at 2.5 minutes (P3) after the rest break starts. The two pulse rates can be interpreted using the table below.

Heart Rate Recovery Criteria

Heart rate recovery pattern	***P_3***	***Difference bet. P_1 and P_3***
Satisfactory recovery	<90	--
High recovery (conditions may require further study)	90	10
No recovery (may indicate too much stress)	90	<10

5. Oral temperature can be checked with a clinical thermometer after work but before the individual drinks water. If the oral temperature taken under the tongue exceeds 37.6°C, shorten the next work cycle by one-third.

6. Body water loss can be measured by weighing the individual on a scale at the beginning and end of each work day. The individual's weight loss should not exceed 1.5 percent of total body weight in a workday. If a weight loss exceeding this amount is observed, fluid intake should increase.

D.2.7 Other Administrative Controls

The following administrative controls can be used to reduce heat stress:

1. Reduce the physical demands of work (e.g., excessive lifting or digging with heavy objects);

2. Provide recovery areas (e.g., air-conditioned enclosures and rooms);

3. Use shifts (e.g., early morning, cool part of the day, or night work);

4. Use intermittent rest periods with water breaks;

5. Use relief workers;

6. Use employee pacing;

7. Assign extra employees; and

8. Understand the proper response toward "imminent danger". One of the most important aspects of good thermal stress program is for employees to know when an operation should be stopped and being empowered to do so. Some of the reasons to suspend an operation are significant environmental impact, personnel endangerment, quality problems, or the inability to follow standards. All employees are empowered to suspend operations.

D.3 HEAT STRESS

D.3.1 General Information

1. Hot weather is probably the single greatest hazard facing runners. With the exception of an automobile accident, running in hot weather is the quickest way to die.

2. Outdoor operations conducted in hot weather, especially those that require employees to wear semi permeable or impermeable protective clothing, are also likely to cause increased employee heat stress.

3. The body has two closely related defenses against heat: temperature control thermo-regulation and salt and water regulation.

4. Under hot conditions, sweating is the most important way the body cools itself. Veins in the skin dilate and blood is shunted to the body's surface, bringing heat with it. A sweating response occurs and the body heat is lost by evaporation of sweat.

5. One liter of sweat weighs approximately 2.2 pounds; therefore, a runner who loses 2-3 liters of sweat an hour will rapidly become dehydrated. If fluid losses are not replaced, body cooling cannot continue. Even a 2 percent decrease in hydration can result in a decrease in performance.

6. The heart must work harder in hot weather. For example, a runner's heart rate may be 120 while running a 6-minute mile at 60°F. When the temperature reaches 90°F, the same runner's heart rate may be 160 while he runs an identical 6-minute mile.

7. Loss of body water is a critical danger. Sodium and potassium losses can occur, especially over a period of several days or weeks of hot weather running. Therefore, ensure that intake is increased.

8. Heat acclimatization occurs after several days of exercising in hot climates. Body changes occur that help maintain low body temperature during exercise. These adaptations include an increased sweating rate; an increase in blood water content of plasma volume, allowing extra reserve of fluid for sweating; an increased blood flow to the skin in response to heat; and a decreased rate of muscle glycogen use and salt losses. The end result of heat acclimatization is the maintenance of lower body temperature during exercise, fatigue will be delayed, heart rate will lower, and the natural thirst mechanism will be more accurate.

   WARNING: Never ignore the signs or symptoms of heat-related disorders!

D.3.2 Causal Factors

1. The following factors affect a person's sensitivity to heat: age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, and a variety of medical conditions (e.g., hypertension). However, even the type of clothing worn must be considered. Prior heat injury predisposes an individual to additional injury.

2. It is difficult to predict who will be affected and when because individual susceptibility varies. In addition, environmental factors include more than the ambient air temperature. Radiant heat, air movement, conduction, and relative humidity all affect an individual's response to heat.

3. The following predisposing medical conditions add to the risk of heat illness:

    - Malignant Hyperthermia – can lead to muscle rigidity, resulting in elevated body temperatures from the accelerated metabolic rate in the skeletal muscle.

    - Neuroleptic Malignant Syndrome – associated with use of neuroleptic agents and antipsychotic drugs and an unexpected idiopathic increase in core temperature during exercise.

    - Arteriosclerotic Vascular Disease – compromises cardiac output and blood flow through the vascular system by thickening arterial walls.

    - Scleroderma – skin disorder that decreases sweat production, thereby decreasing heat transfer.

    - Cystic Fibrosis – causes increased salt loss in sweat and can increase risk of hyponatremia.

    - Sickle Cell Trait – limits blood-flow distribution and decreases oxygen-carrying capacity. The condition is exacerbated at higher altitudes.

D.3.3 Heat Fatigue

Lack of acclimatization is a factor that predisposes an individual to heat fatigue. The use of a program of acclimatization and training for work in hot environments is advisable. The signs and symptoms of heat fatigue include impaired performance of skilled motorsensory, mental, or vigilance jobs.

First Aid: There is no treatment for heat fatigue except to remove the heat stress before a more serious heat-related condition develops.

D.3.4 Heat Rashes

Heat rash is the most common problem in hot work environments. Prickly heat is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by un-evaporated sweat, and heat rash papules may become infected if they are not treated.

First Aid: In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

D.3.5 Heat Collapse (Fainting)

In heat collapse, the brain does not receive enough oxygen because blood pools in the extremities. As a result, the exposed individual may lose consciousness. This reaction is similar to that of heat exhaustion and does not affect the body's heat balance. However, the onset of heat collapse is rapid and unpredictable. To prevent heat collapse, the individual should gradually become acclimatized to the hot environment.

Symptoms include decreased blood pressure due to vasodilation and pooling of blood in the peripheral vessels. There is profuse sweating and an abnormally high heart rate. Body temperature is generally normal.

First Aid: Lie the victim down, elevate feet to increase blood flow to the brain, and get the person out of the heat.

D.3.6 Heat Cramps

Heat cramps involve muscular pains and spasms, usually in the active muscles, due largely to loss of salt from the body in sweating or to inadequate intake of salt. This is the lowest level of heat illness and is not a medical emergency. Heat cramps are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused by both too much and too little salt. Cramps appear to be caused by the lack of water replenishment. Because sweat is a hypotonic solution, excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments. Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Recent studies have shown that drinking commercially available carbohydrate-electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

Symptoms manifest themselves especially affecting the muscles of the legs and abdomen. Another symptom is fatigue. Body temperature is normal.

First Aid: Exert firm pressure with your hands on the cramped muscle or gently massage them to help relieve the spasm. Give the victim sips of salt water (one teaspoon of salt per glass), half a glass every 15 minutes over a period of about one hour. Plain water is acceptable if no salt is available.

D.3.7 Heat Exhaustion

Heat exhaustion is a response to heat characterized by fatigue, weakness, and collapse due to inadequate intake of water to compensate for fluid loss through sweating. The signs and symptoms of heat exhaustion are headache, nausea, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment. Heat exhaustion should not be dismissed lightly for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended;

moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, a medical emergency.

Symptoms include approximately normal body temperature, pale, cool and clammy skin, profuse perspiration, tiredness, thirst, weakness, headache (perhaps cramps), nausea (dizziness), and possible fainting.

First Aid: Give the victim sips of water (one teaspoon of salt per glass) every 15 minutes over a period of one hour. Plain water is acceptable if no salt is available. Have the victim lie down and raise his feet 8-12 inches, loosen clothing, apply cool, wet cloths and fan the victim or move him to an air-conditioned room. If the victim vomits, do not give him additional fluids. Get the victim to a hospital immediately where an intravenous salt solution can be administered. The victim should not return to work for several days and should be protected from exposure to abnormally warm temperatures.

D.3.8 Heat Stroke (Immediate Medical Emergency)

Heat stroke occurs when the body's system of temperature regulation fails and body temperature rises to critical levels. Heat stroke is an immediate, life-threatening emergency for which medical care is urgently needed.

Symptoms of heat stroke include confusion, irrational behavior, loss of consciousness, convulsions, lack of sweating (usually), hot/dry skin, and/or high body temperature (may be 106°F or higher).

First Aid: Immediate measures should be taken to cool the body quickly. Once the victim's temperature is reduced to below 102°F, care should be taken to prevent over-chilling the body. The following first aid measures are applicable whenever the body temperature reaches 105°F:

Call for professional medical help, then:

1. Undress the victim and repeatedly sponge the bare skin with cool water or rubbing alcohol, OR
2. Apply cold packs continuously, OR
3. Place the victim in a tub of cold water (do not add ice) until his temperature is lowered sufficiently. When the victim's temperature has been reduced enough, dry him off.

WARNING #1: Regardless of his/her protests, no individual suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

WARNING #2: Never ignore signs or symptoms of heat-related disorders.

D.3.9 Exertional Heat Illness (EHI)

EHI has been recognized as a substantial problem in military operations and training. It is a fairly common illness in healthy young adults undergoing strenuous physical training

in warm and humid weather. EHI arises from sustained or heavy exertion, usually in hot environment. Typically, onset is abrupt, occurring during or shortly after exertion, with orthostatic manifestations (faintness, staggering, or visual disturbance) leading to events such as collapse, confusion, and delirium. EHI is significantly different from the classic heat illness that is typically associated with extended exposure to a hot environment and that primarily impacts older people or those with weak cardiovascular reserve.

The most severe cases of EHI, similar to those in classical heat illness, are categorized as exertional heatstroke, exertional heat injury, and exertional heat exhaustion.

- Exertional heatstroke: Characterized by early, severe, non-focal encephalopathy (neurological disturbance) with hyperthermia (increase in core temperature).

- Exertional heat injury: A progressive multi-system disorder, with hyperthermia accompanied by organ damage or severe dysfunction (e.g., metabolic acidosis, acute renal failure, or muscle necrosis).

- Exertional heat exhaustion: A reversible, non-life-threatening multi-system disorder reflecting the inability of the circulatory system to meet the demands of thermoregulatory, muscular, cutaneous, and visceral blood flow.

EHI requires urgent diagnosis and treatment. Although severe cases of EHI constitute clear medical emergencies, patients with EHI at milder levels also require urgent and aggressive management to avoid progression. Specifically,

1. In controlled settings, emergency medical care for EHI should be arranged in advance;
2. If transportation to an emergency department requires more than 5 to 10 minutes, provisions should be made for administering intravenous fluids en route; and
3. At least one paramedic should be present on site while strenuous training is conducted. When emergency vehicles leave the training site, strenuous activities should be stopped until medical support and transport are again available.

D.3.10 Preventative Measures for Heat Illness

A. Heat acclimatization – To achieve full heat acclimatization, a person must exercise in the heat for approximately *2 full weeks*. Partial acclimatization occurs otherwise. Fit individuals tend to acclimatize quicker and have a better tolerance to heat.

B. Decrease intensity and duration of exercise in order to maintain the same prescription heart rate. Monitor the individuals much more frequently when they exercise in hot weather (i.e., take their heart rate during the initial phase of the work-out and periodically throughout, when initially exercising in the heat). The heart rate will show dehydration, environmental heat load and lack of acclimatization.

C. Ensure adequate water replacement, and educate personnel on the importance of increased water intake during exercise in the heat (Appendix C). Schedule 15-20 minutes prior to exercise: 10-16 ounces of water during exercise and every

10-15 minutes ingest 6-10 ounces. Weigh pre- and post-exercise to know how much water needs to be replaced (one pint for every pound lost).

WARNING: Daily fluid intake should not exceed 12 quarts unless directed by a medical doctor.

D. Clothing should be as brief as possible, loosely weaved, natural fiber and of a light color since dark colors absorb heat while light clothes reflect it.

E. Exercise during the heat of the day should be avoided. Early morning and late evening are the most desirable times to exercise in order to avoid the direct radiation of the sun.

F. Know the warning signs of heat illness.

G. Follow National Weather Service Heat Index Charts (Appendices B and C in this procedure).

D.4 COLD STRESS

D.4.1 Introduction

A comprehensive cold weather injury prevention and management program will follow the principles of Integrated Safety Management (ISM) by identifying hazards, assessing the hazards in terms of severity and probability, and implementing appropriate controls to abate the hazards. Spot-checking and supervision by first-line leaders must be employed to ensure control measures are being implemented. Units train using risk-management principles; therefore, supervisors will apply the same framework to prevent cold weather injuries. Cold-casualty prevention is a line management responsibility. This section provides information that will assist in presenting cold weather injury prevention in the ISM format.

D.4.2 Analyze the Hazards

Cold weather may present a hazard if any one of the following is present:

- Cold (temperature 40°F and below)
- Wetness (rain, snow, ice, humidity) or wet clothes at temperatures below 60°F
- Wind (wind speed 5 mph and higher)
- Lack of adequate shelter/clothing
- Lack of provisions/water
- Other risk factors, such as
  - Previous cold injuries or other significant injuries
  - Use of tobacco/nicotine or alcohol
  - Skipping meals/poor nutrition.
  - Low activity
  - Fatigue/sleep deprivation
  - Little experience/training in cold weather operations
  - Cold casualties (not reported) in the previous 2 to 3 days

D.4.3 Assessing the Hazards

The potential for cold casualties can be assessed by determining:

1. The magnitude of cold exposure. Reliable measurement equipment must be used to determine:

    - Air temperature (thermometer).
    - Wind speed (anemometer).
    - Wetness.
    - Weather forecast (local weather station or another source such as the worldwide web).

2. NTC employees must have:

    - Proper clothing in good condition, clean and without stains, holes or blemishes that could decrease the insulation.
    - Adequate shelter.
    - Proper fitness.
    - Proper food and hydration.

3. Related concerns, including:

    - Degree of mobility, which impacts on an individual's heat generation.
    - Contact with ground or other surfaces that may increase conductive cooling.
    - Exposure to wet conditions (e.g., rain, snow, sleet).

D.4.4 Develop and Implement Hazard Controls

1. Cold casualties can be controlled through education.

    a. Employee education should include:

        - Assessing cold stress.
        - Recognizing and preventing cold injuries.
        - Limiting the effects of cold through clothing, shelter, and nutrition.
        - Learning how to work effectively in cold environments.

    b. Manager education should include:

        - Supervising employees who often have only a superficial understanding of cold.
        - Evaluating the impact of cold on the mission (for example, everything takes longer and people will become more fatigued and more likely to make mistakes).

c. Experiential learning should include:

- Remembering that true effectiveness in cold environments only comes with experience.
- Practicing the clothing principles of layering and staying dry. These principles must be tailored to the individual, and must be practiced so they will learn when to dress down (before sweating begins) and when to add layers (before shivering begins).
- Using equipment in the cold. Everything takes longer, so practice is needed. Employees need to be able to identify where special tools or clothing (e.g., contact gloves) may be necessary.
- Planning for longer sessions (weather may change quickly and hinder operations, and fatigue impacts even routine operations).

2. The posting of cold-casualty prevention information as an ongoing reminder.

3. Establishing SOPs for most routines.

4. Training

a. Clothing should be appropriate and worn properly.

- Clothing must be kept dry, and wet, damp clothes changed as soon as possible.
- Clothing is to be worn loose and in layers, and hands, fingers, and the head are to be covered and protected.
- All clothing must be clean and in good repair (no broken zippers or holes).
- Proper footgear must be worn that are not too tight and are dry.
- Socks must be clean and dry. Wet or damp socks must be changed as soon as possible, and foot powder should be used on feet and boots.
- Gloves or mittens are to be worn.
- Hands should be warmed under clothes before hands become numb.
- Skin contact with snow, fuel, or bare metal is to be avoided. Proper gloves should be worn when handling fuel or bare metal.
- Gloves should be waterproofed by treating them with waterproofing compounds.
- Face and ears should be covered with a scarf or an insulated cap with flaps over the ears, or a balaclava.

- Face and ears should warmed by covering them with the hands; the face and ears should not be rubbed.
- Face camouflage should not be applied when the air temperature is below 32ºF.
- Sunscreen should be worn.
- Sunglasses should be worn to prevent snow blindness.

b. The body must be kept warm:

- Employees and students should keep moving.
- Large body muscles should be exercised to keep warm.

c. Health and nutrition should be sustained:

- Alcohol use is to be avoided - alcohol impairs the body's ability to shiver.
- Tobacco products are to be avoided - tobacco products decrease blood flow to the skin.
- Regular meals should be eaten to maintain energy.
- Water or warm nonalcoholic fluids should to be drunk regularly to prevent dehydration.
- Carbon monoxide poisoning can be prevented by using only DOE-approved heaters in confined areas.

d. NTC employees should protect each other. NTC employees must be alert to signs of frostbite and other cold weather injuries.

e. Leadership initiatives should be practiced:

- Work activities or training should be limited or discontinued during very cold weather.
- Enclosed heated vehicles should to be used for transport.
- Warming areas should be made available.
- Ensure rest breaks, warming breaks, and meal breaks are observed.
- Ensure all equipment is working properly.

D.4.5 Perform Work Within Controls

1. Cold casualty controls

    - Controls must be defined and in place
    - Controls must be integrated into SOPs

2. Employees must be educated on workplace hazards and controls.

3. Employees must be encouraged to speak up about potential problems.

4. Risk is accepted at the appropriate level.

D.4.6 Provide Feedback and Continuous Improvement

The final step in the ISM function process is the supervision and evaluation of the controls taken to prevent cold casualties. Examples are:

1. Ensure all personnel are educated in the prevention, recognition, and treatment of cold-weather injuries.

2. Delegate responsibilities to ensure cold-weather control measures are implemented.

3. Monitor the adequacy/progress of implementation of control measures.

4. Perform spot-checks of rest and warming areas, and water supplies.

5. Record and monitor indicators of increasing cold risks such as:

    - An increase in the number of cold-weather injuries
    - An increase in the number of complaints/comments about cold
    - Observations of excessive shivering or signs of cold-weather injuries

6. Continuously evaluate current control measures and formulate new ways to keep warm and avoid cold injuries.

D.4.7 Measures for Exercising in the Cold

1. Dress in layers. Start exercising a little cool, then as you warm, unzip or remove a layer of clothes. Wear a hat. Most of the body's heat will be lost through the head. The clothing next to the skin should be made of synthetic fibers so it will keep moisture away from the skin.

2. Drink water. Even during cold weather exercise, the body loses a lot of water. Make sure you keep hydrated.

3. When you start, if possible head into the wind. This way on your return, when you are most sweaty, the wind will be at your back.

4. Be aware of slippery surfaces.

5. Cold air can trigger asthma in some people with this medical condition. A scarf or face mask can help.

6. Move indoors if it is too cold.

7. Avoid alcohol, this dilates the blood vessels and causes more heat to be lost.

8. Shivering is a good warning sign to get indoors.

9. Be aware of wind chill. The real “coldness” of the temperature is a combination of temperature and wind speed (see Appendix A).

APPENDIX E – NTC CLOSURE OR DELAY

E.1 OVERVIEW

A weather-related closure or delay at the NTC would be preceded by a closure or delay of Kirtland Air Force Base activities and those of other tenant organizations (i.e., Sandia National Laboratories and the National Nuclear Security Administration [NNSA] Albuquerque Complex). These actions are made under the direction of the Commander of the 377th Air Base Wing.

E.2 NTC CLOSURE DURING WORKDAY

At the NTC, only the NTC Director or designated representative may direct the termination of NTC operations and authorize the release of contractor staff. The NTC Director or designee will notify the contractor General Manager to terminate activities, and the General Manager and/or Deputy General Manager will advise subordinate managers to terminate operations and release their employees. All employees can expect to be advised by their manager, and by email, when to terminate operations and the time they may leave the NTC.

E.3 NTC CLOSURE OR DELAYS AT START OF WORKDAY

In the event of severe weather conditions at the start of the workday, employees should call the following numbers and make decisions regarding their workday and travel accordingly:

- 853-7669 for information regarding delays at Kirtland Air Force Base and the NTC.

E.2 SEVERE WEATHER INFORMATION

The following are additional resources for information on potential severe weather conditions in the Kirtland AFB/Albuquerque/Bernalillo County areas.

- Check local television. Channels 2 (KASA), 4 (KOB), 7 (KOAT), and 13 (KRQE) have regular updates of weather-related closures of federal, state, county, and city activities.
- For general information concerning road closures, go to the City of Albuquerque and the New Mexico Department of Transportation websites at:
    - http://www.cabq.gov/ and click on “A to Z”, then “W”, then “Weather” for updates on weather conditions.
    - http://www.nmshtd.state.nm.us/ and click on “Travel Information”, then “Road Conditions” for updates on road conditions.
- Check local radio stations such as KOB 770 AM.