



Temperature Extremes

Document Number: LMS0043A	Standard – Administrative	Applies To: Upstream
Revision Date: 2016/03/04 Revision: 2 Review Cycle: 3 Years	Document Owner (Title): Director, Environment and Industrial Hygiene	Effective Date: As noted on signature page

Summary of Changes

Rev No.	Section Changed	Revision Made
1	Revision	Revision 1 assigned as no previous revision number assigned
2	All	Transfer to new template

Scope

This Standard provides information on how to recognize, evaluate and eliminate/control worker exposure to hazardous temperature extremes.

Purpose

To prevent adverse health effects to workers from exposure to hazardous temperature extremes at Suncor Energy Inc., Upstream.

Compliance

This standard applies to all Suncor Energy Inc., Upstream employees, contractors, vendors and visitors and is part of the Upstream EHS management system.

Roles and Responsibilities

The following individuals and groups have the following roles and responsibilities:

Document Owner

- Ensures this document is reviewed according to the required revision cycle.
- Ensures the document is updated to accommodate changes to Suncor, provincial, and federal regulation.
- Ensures the document is updated to mitigate risks found as the result of an incident.

Document Approver

- Ensures this standard is necessary and that it aligns with management and company direction.

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Roles and Responsibilities *Continued*

- | | |
|--------------------------------------|--|
| OSIS Line Management | <ul style="list-style-type: none"> • Ensures implementation and adherence to this standard. • Maintains any training records. |
| Suncor Contract Physician | <ul style="list-style-type: none"> • Develops appropriate medical protocols. • Interprets and evaluates results from all medical pre-placement and surveillance screening. |
| Health and Wellness Centre | <ul style="list-style-type: none"> • Ensures that the pre-placement and surveillance information is maintained in employee medical files. • Responsible for counseling employees that are required to routinely work in areas of hazardous temperature extremes. |
| Industrial Hygiene department | <ul style="list-style-type: none"> • Identifies and evaluates sources of hazardous temperature extremes and the associated occupational groups that may be exposed. • Provides guidance to the Business Areas on the necessary control measures for the temperature extreme conditions. • Maintains all temperature extremes survey data. |

References

- [CCOHS OSH Answers: Cold Environments](#)
- TLVs and BEIs Based on Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. The American Conference of Governmental Industrial Hygienists (ACGIH)

Standard

All potential temperature extreme conditions will undergo an industrial hygiene process of recognition, evaluation and control to mitigate potential effects from extremes of heat and cold conditions.

Item	Description
Recognition	<p>1.1 The result of the body's inability to deal with the heat or cold burden may lead to heat/cold disorders, disability or even death. All new plants or areas shall be assessed for the potential of extreme temperature conditions during the design phase and verified after commissioning. Additional assessments will be conducted when there are changes in the plants, areas, processes, or PPE requirements that may affect extreme temperature conditions. Extreme conditions of cold shall be identified by the potential for workers to perform duties or tasks outdoors during winter conditions. Extreme conditions of heat shall be identified as areas where the air temperature, radiant temperature, humidity, air velocity, or activity will result in the potential for harmful body heat storage.</p>

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	Item	Description
Evaluation	1.2	There are no heat and cold stress regulations in the Alberta Occupational Health and Safety Code. The American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs) booklet is used as a guideline.
	1.3	The "work warm-up schedule" developed by the Saskatchewan Department of Labour has been adopted by the American Conference of Governmental Industrial Hygienists (ACGIH) as TLVs for cold stress. The magnitude of cold conditions will be assessed by the atmospheric temperature and wind speed and compared with Table 1 in Appendix I to establish the "work warm-up schedule" for a four hour shift.
	1.4	The magnitude of the heat conditions will be evaluated by measurement of the Wet Bulb Globe Temperature (WBGT). Table 2 in Appendix I shows the TLV levels for heat stress. Evaluation of heat stress can be performed as per Figure 1 in the TLV booklet under Thermal Stress section. Where WBGT measurements exceed the screening criteria in Table 2, TLV documentation must be consulted to perform detailed analysis if job data is available. It is recommended that the hygienist use time weighted average of the effective WBGT for the work is distributed in more than one location and the metabolic rate in performing the detailed analysis. Rational model such as the ISO Predicted Heat Strain model can also be used depending on data availability. Appendix 1, Table 3 provides examples of work intensity taken into account for recommending work-rest cycle.
	1.5	Type of clothing also adds to heat stress experienced by the workers. Appendix 1, Table 4 provides correction factors which need to be applied to the screening criteria. In addition to the clothing, acclimatization of the workers also affects the heat stress. Unexperienced workers must not immediately begin performing high intensity tasks. Twenty percent first shift can be spent getting accustomed to the temperature and metabolic requirements of the task. Experienced workers can spend up to 60% of the first shift getting accustomed to the work load while performing moderate to heavily intensive tasks.

2. Control Measures

	Item	Description
Elimination	2.1	The selection of the most appropriate control option(s) will be governed by the specific task and specific work area. The preferred hierarchy of control options is in the order below.
	2.2	During the design phase of projects, consideration must be given to eliminating hazardous temperature extremes.

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	Item	Description
Engineering	2.3	<p>During the design phase of projects, consideration must be given to reducing hazardous temperature extremes. For areas where hazardous temperature conditions already exist, consideration must be given to retrofitting the areas on a permanent or temporary basis to reduce hazardous temperature extremes. Suitable engineering controls could include the following:</p> <ul style="list-style-type: none">• Isolating workers from process by automation• Temperature controlled environments (air conditioning/heating)• Screening sources (heat shields/wind breaks)• Positioning fans or blowers to cool or warm work areas• Reducing humidity at source (e.g. minimizing steam usage)• Using thermal insulation on hot or cold surfaces• Using materials of low emissivity to reduce radiant heat• Using mechanical aids to reduce physical work load of task
Administrative	2.4	<p>Administrative controls are to be applied when hazardous temperature extremes cannot be engineered out. Suitable administrative controls include the following:</p> <ul style="list-style-type: none">• Scheduling jobs for warmer/cooler parts of the day• Providing access to heated/cooled rest areas• Providing ready access to drinking fluids• Rotating personnel to reduce exposure time• Allowing personnel to acclimatize (hot environments only)• Allowing personnel to "self-regulate" work pace• Ensuring a buddy system or supervisory surveillance is in place• Education of workers to be able to recognize and prevent heat/cold stress
Education	2.5	<p>All personnel required to routinely work in areas where hazardous temperature conditions can exist must receive information around working in temperature extremes (Heat Stress and Cold Stress Fact Sheet). Affected workers are to review appropriate controls through the field level hazard assessment process prior to commencing work.</p> <p>In the event of work involving extended periods of exposure to heat stress, engage your industrial hygienist to provide information on the following:</p> <ul style="list-style-type: none">• Review of Temperature Extremes Standard• Description of hazardous temperature extremes• Health effects and symptoms due to temperature extremes• Treatment of heat and cold stress disorders• Environmental and physical factors affecting response to temperature extremes• Controlling exposure to temperature extremes (Elimination, Engineering, Administrative Controls and Personal Preventive Measures)• Area specific survey data

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	Item	Description
Personal Protective Equipment	2.6	For areas with cold conditions, protective clothing is needed for work at or below 4°C. Clothing should be selected to suit the temperature, weather conditions (e.g., wind speed, rain), the level and duration of activity, and job design. Clothing should be worn in multiple layers which provide better protection than a single thick garment. The air between layers of clothing provides better insulation than the clothing itself. The inner layer should provide insulation and be able to "wick" moisture away from the skin to help keep it dry. Almost 50 percent of body heat is lost through the head, so Suncor approved warm headgear should be worn under the hard hat to reduce excessive heat loss.
	2.7	For areas with heat conditions, light clothing should be worn to allow maximum skin exposure and efficient body cooling by sweat evaporation. Unless a particular task dictates otherwise, avoid impermeable fabrics which reduce the body's ability to dissipate heat. Loose cotton fabrics are most appropriate. Where possible, light-coloured clothing should be worn when working outside in the hot sun. In extremely hot environments, air, water or ice-cooled insulated clothing should be considered. Ordinary clothing provides some protection from heat radiated by surrounding hot surfaces. In a high radiant heat situation, reflective clothing may be used.

3. Health Assessments Requirements

Item	Description
3.1	Personnel exposed to hazardous temperature extremes shall be included in the Risk-Based Health Assessment program for temperature extremes.
3.2	<p>A pre-placement medical evaluation will be performed on all employees that may be exposed to hazardous temperature extremes >10% of their working time. The pre-placement medical evaluation will include the following:</p> <ul style="list-style-type: none"> • Assessment of previous medical history with special emphasis on known or suspected illnesses that may be due to heat or cold intolerance; • Assessment of chronic conditions that may be affected by exposure to heat or cold stress (e.g. Raynaud's Disease, Diabetes, Hypertension, Seizure Disorders, Unstable Angina, Thyroid Problems) • Assessment of the use of therapeutic drugs and medications that may predispose individuals to heat or cold stress conditions.
3.3	<p>Appropriate health assessment will be conducted every two years on employees required to work on a routine basis in environments of hazardous temperature extremes. The health assessment protocol will consist of a short series of questions designed to determine the following:</p> <ul style="list-style-type: none"> • If temperature related injuries or illnesses have occurred due to recent exposures of employees to hazardous temperature extremes or • If recent changes or developments in medical history have significantly increased employee susceptibility to heat or cold stress related disorders.

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Item	Description
3.4	Workers exposed to hazardous temperature extremes will receive counseling on the recognition and prevention of heat and cold stress conditions during their medical evaluations.

End of Standard

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Appendix 1 – Cold and Heat Stress Guidelines**Table 1. TLV for Work/Warm-up schedule in a 4-hour shift for Cold Stress**

Air Temperature Sunny Sky	No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
	°C (approx)	Max. Work Period	No. of Breaks	Max. Work Period						
-26 to -28	(Norm Breaks) 1		(Norm Breaks) 1		75 min	2	55 min	3	40 min	4
-29 to -31	(Norm Breaks) 1		75 min	2	55 min	3	40 min	4	30 min	5
-32 to -34	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
-35 to -37	55 min	3	40 min	4	30 min	5	Non-emergency work should cease			
-38 to -39	40 min	4	30 min	5	Non-emergency work should cease		Non-emergency work should cease			
-40 to -42	30 min	5	Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease			
-43 & below	Non-emergency work should cease									

NOTES for Table 1:

- Schedule applies to any 4-hour work period with moderate to heavy work activity, with warm-up periods of ten (10) minutes in a warm location and with an extended break (e.g., lunch) at the end of the 4-hour work period in a warm location. For light-to-moderate work (limited physical movement): apply the schedule one step lower. For example, at -35°C with not noticeable wind (step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4-hour period (step 5).
- The following is suggested as a guide for estimating wind velocity if accurate information is not available:
5 mph: light flag moves; 10 mph: light flag fully extended; 15 mph: raises newspaper sheet; 20 mph: blowing and drifting snow.
- TLVs apply only for workers in dry clothing.

Source: Adapted from Occupational Health and Safety Division, Saskatchewan Department of Labour.

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Table 2. TLV for Heat Stress

Screening criteria for TLV and Action Limit for Heat Stress Exposure

Allocation of Work in a Cycle of Work and Recovery	TLV (WBGT values in °C)				Action Limit (WBGT values in °C)			
	Light	Mod- erate	Heavy	Very Heavy	Light	Mod- erate	Heavy	Very Heavy
75% to 100%	31.0	28.0	–	–	28.0	25.0	–	–
50% to 75%	31.0	29.0	27.5	–	28.5	26.0	24.0	–
25% to 50%	32.0	30.0	29.0	28.0	29.5	27.0	25.5	24.5
0% to 25%	32.5	31.5	30.5	30.0	30.0	29.0	28.0	27.0

Notes for Table 2:

1. The tolerance limits assume a healthy worker with no medical problems. If a worker has heart disease, lung disease, or diabetes, they will be less able to deal with heat stress. If the worker is taking diuretic medication or any medication that alters the body's fluid loss, they may be less able to deal with heat stress. Such workers should consult a physician before working in a hot environment.
2. If work and rest environments are different, hourly time-weighted average (TWA) WBGT should be calculated and used. TWAs for work rates should also be used when the work demands vary within the hour, but note that the metabolic rate for rest is already factored into the screening limit.

Source: Adapted from Threshold Limit Values (TLV) and Biological Exposure Indices (BEI) booklet: published by ACGIH.

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Table 3: Work Intensity Examples and metabolic rates

Intensity	Description	Site Specific Examples	Metabolic Rate (W)
Rest	Sitting		115
Light	Sitting with moderate arm and leg movement Standing with light work at machine or bench while using mostly arms	Taking precision measurement Turning wrenches	180
Moderate	Light pushing and pulling Sustained moderate hand, arm, leg and trunk work	Performing normal operational rounds Performing normal inspections	300
Heavy	Intense arm and trunk movement Carrying, shovelling, pushing and pulling heavy loads	Handling a fire hose during boiler wash Swinging a sledge hammer. Holding and operating impact wrench/grinder	415
Very Heavy	Very intense activity at fast to maximum pace	Shovelling Assembly or disassembly of bolts using slug wrenches and heavy hammer.	520

Table 4: Clothing and corresponding WBGT correction factor

Clothing Description	Correction factor (°C)
Ice vests	Per manufacturer's data
Work clothes (long sleeve shirt and pants)	0
Single layer coveralls with t-shirt and pants	0
Double layer woven coveralls or Tyvek	+3
Vapor barrier coveralls	+11

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Appendix 2 – Area Classification of Temperature Extremes

Plant	Specific Location	WBGT Readings (°C)
Base Plant		
Base plant Upgrading 1		
Plant 5	Ground Level, 2nd Deck, 3rd Deck, 4th Deck	20 - 31
	Under Coke Drum	24 - 56
Plant 6	6F-2 Furnace	24 - 54
	Compressor Building	21 - 36
Plant 7 and 8	Ground Level	18 - 30
Plant 7	7E-24 Catwalks	34 - 45
Plants 5, 6, 7, 8, 9, 10, 25, NTF and STF	Outdoor Areas or Duties performed Outdoors	
Base plant Upgrading 2		
Plant 52 Cokers	2nd and 6th Deck	27.1 - 38.5
	2nd and 6th Deck Operators Cabs	25 - 27
	52F-300 and 52F-301 Furnaces	23.6 – 29.1
Plant 54	4th and 5th Floor Hydrogen Furnace	31.8 – 40.9
	54GT-101B	24.9 – 25.9
	54E-102B	24.8 - 26
Plant 55	Naphtha & Gas Oil Hydrotreater Compressor Buildings	22.2 – 34.1
	55F-300 Furnace	21.5 - 33
	Fin Fans in all Hydrotreaters	23.2 – 28.6
	Diesel Hydrotreater Compressor Building	22 – 28.4
	55F-100 and 55F-200/201 Furnaces	21 – 28.1
Plants 52, 53, 54, 55, 56, 57, 59, Wastewater	Outdoor Areas or Duties performed Outdoors	
Base plant Mining		
Outdoor Tasks and Duties		
Base plant Extraction		
Plant 3	Above Sep Cells & Line 6	18 - 40
	Pump Floor, Exchanger Area	22 - 33
Plant 4	All Floors	15 - 34
Plant 82	Breaker Floor & Crane Level	18.9 – 47
Plant 85	OPP A, B and C	20.1 – 30.4
Plant 87	Top Deck above Cyclones 87T-13, 87T-14, 87T-23, 87T-24	23.3 – 30.9
FTPH & BRFT		16.3 - 36
Tailings Department		
Plants 3, 4, 16, 82, 85, 86, 87	Outdoor Areas or Duties performed Outdoors	

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Plant	Specific Location	WBGT Readings (°C)
Base plant Energy and Utilities		
Powerhouse	Basement, Turbine Hall, Levels, 1, 4, 4.5, 5, 5.5, Tripper Gallery, Boiler #4	13 – 35
	Burner Deck & Reducing Stations, Levels 2, 2.5, 3, 3.5	24 – 55a
Water Treatment	All areas	17 – 34
Plant 35	Ground Level	15 - 30
	Level 2	20 – 36
Plant 37	Ground Level	15 – 31
Electrostatic Precipitators	Level 5	11 – 33a
Base plant Materials Management	Outdoor Storage Areas	
Base plant Emergency Services	Fire Training Areas	
Base plant Laboratory Services	Outdoor Storage Areas	
Firebag		
Steam Generation Building (Area 5000)		16.4 – 26.7
MacKay River		
U100		32.0-33.8
Fort Hills		

Note: Heat stress risk is present year round and is not dependant on seasonality.

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The following individuals have approved and signed this document.

UserName: Sheila Chernys (schernys)

Title: Dir OS Enviro & Reg

Date: Friday, 04 March 2016, 01:57 PM Mountain Time

Meaning: Approver 1 Signed

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