ENVIRONMENTAL MONITORING AND MAINTENANCE

1. PURPOSE

To ensure the environment (temperature, humidity) remains within a comfortable and healthy range for the animals in the facility

2. RESPONSIBILITY

2.1 Trained and qualified personnel

2.2 Herd Manager

3. MATERIALS

3.1 Temperature and humidity sensors

3.2 Monitoring Log (DC-A-1A)

4. GENERAL

4.1 The thermoneutral zone is the temperature range where no additional energy is needed to maintain normal core body temperature.

4.2 Thermoneutral zone for:

- Cows: 5 - 25°C
- Calves (Newborn - 60kg): 16-25°C
- Calves (60 - 150kg): 10 - 25°C

4.2.1 The Temperature-Humidity Index (Figure 1) is a value that takes into consideration both ambient temperature and relative humidity and is a better proxy for predicting heat stress than either of these parameters alone.

4.2.2 Heat stress in dairy cattle can seriously impact the production, fertility, and health of the cow, as well as the health and future production and fertility of her unborn calf.

4.2.3 Cold and heat stress in calves impacts their immune system function (health) and development.

4.2.4 Temperature and humidity sensors are located within each area of the barn that houses animals (main barn, calf barn, heifer barn, hydro room).

	Heat Stress	Cold Stress
Cows	Milk production (high) Pregnancy BCS Age/size/breed Feed and Water Intake	Coat length/type/if wet Health status BCS Windchill Age/size/breed
Calves	*	Health status (ex. dystocial, pneumonic) Age/size/breed Coat type/ if wet Bedding type/depth Nutrition Drafts

Table 1: Many factors influence the risk of occurrence of heat and cold stress.
* Insufficient literature, but as thermoregulation in calves is similar to cows the same factors if relevant, apply.

	Heat Stress	Cold Stress
Cows	Increasing Respiration Rate (>60 bpm) Panting Drinking Sweating Reduced feed intake Reduced milk production Increased standing Shade seeking Decreased activity	Bunching Orientation facing sun/away from wind Reduced milk production Increased intake
Calves	Increased respiration rate Reduced feed intake Increased water intake Decreased activity Increased standing time	Shivering Nesting Bunching Increased feed intake

Table 2: Physiological and Behavioral Coping Mechanisms to Environmental Stress

4.3 Sufficient water intake is important for good production and health for cattle of all life stages.

4.4 The average water consumption for adult lactating cattle is 115 L/day. Milk does not meet a calf's requirement for water, particularly in higher temperatures or when scouring.

4.5 Production, environment, and diet affect the amount of water a cow requires. Generally, cows consume 4 liters of water for every liter of milk produced. An increase in temperature can increase water intake by 1.2L/°C. Diets higher in salts, buffers, dry matter, and crude protein will also increase water consumption.

4.6 Flow rate in water bowls should be maximized as Holsteins can drink at a rate of 24 L/min.

5. PROCEDURE

5.1 TEMPERATURE AND HUMIDITY

5.1.1 Before the spring season, ensure the air intakes in the ceiling have been closed.

5.1.2 Temperature and humidity sensors are checked in each area: main barn, calf barn, heifer barn, and hydro room, twice daily, at the beginning of the morning and afternoon shifts.

5.1.3 Readings are recorded on the log sheet located in the respective area.

5.1.4 In warmer months (temperature >22°C):

5.1.4.1 Readings are checked against the “Temperature-Humidity Index Table” (Figure 1) and the Heat Stress Score (1-5) is recorded.

5.1.4.2 If the score is >1, corrective action must be recorded on the log sheet and carried out.

5.1.4.3 If the score is 3 or above, a technician or the farm manager must be consulted, and corrective action must be recorded on the log sheet and carried out.

5.1.5 In cooler months (temperature <10°C):

5.1.5.1 A low-temperature threshold will be indicated on the log sheet.

5.1.5.2 If the temperature is below the threshold a corrective action must be recorded on the log sheet and carried out.

5.2 WATER

5.2.1 Check water bowls daily for cleanliness and function.

5.2.1.1 Check the last bowl of each row of stalls and each box stall for functionality and appropriate flow rate.

5.2.2 Any water bowl that is not functioning or functioning poorly must be reported to a technician immediately.

5.2.3 Water bowls in the main barn must be cleaned and individually tested for function on a regular basis.

6. CORRECTIVE ACTIONS

6.1 COOLING

6.1.1 MAIN BARN

6.1.1.1 Ensure all ventilation (wall) fans are on and working.

6.1.1.2 Ensure ceiling vents are closed.

6.1.1.3 Ensure the garage door in the handling area is closed.

6.1.1.4 Ensure all ceiling fans are on and working.

6.1.1.5 Place floor fans at the end of feed rows or in front of individual animals displaying signs of heat stress.

6.1.1.6 Bring the animal to the handling area and gently hose it down for 15-20 minutes.

6.1.1.7 Ensure water bowls are clean and flow is good to encourage drinking.

6.1.1.8 Ensure reflective window film is intact.

6.1.2 CALF BARN

6.1.2.1 Open calf barn doors to handling area and outside.

6.1.2.2 Ensure heating units are off.

6.1.2.3 Place floor fans in calf barn directed at pens.

6.1.2.4 Offer Calf-Lyte in room temperature water to calves exhibiting signs of heat stress.

6.1.2.5 Ensure water bowls are clean to encourage drinking.

6.1.3 HEIFER BARN

6.1.3.1 Ensure heifer barn doors to handling area and outside are open.

6.1.3.2 Place floor fans.

6.1.3.3 Ensure water bowls are clean to encourage drinking.

6.1.4 HYDRO ROOM

6.1.4.1 Ensure ceiling fans (in alley) are on.

6.1.4.2 Place floor fans.

6.1.4.3 Move dry cows outside/into main barn.

6.2 HEATING

6.2.1 MAIN BARN

6.2.1.1 Turn off one or more ventilation (wall) fans.

6.2.1.2 Close the red double doors, if needed.

6.2.1.3 Close doors to the handling area if the draft is coming from the hay barn.

6.2.1.4 Place panels over the screen opening above the box stalls.

6.2.2 CALF BARN

6.2.2.1 Maintain the temperature 14 °C throughout the winter months. If it drops below this level, promptly inform the lead technician.

6.2.2.2 Ensure doors to handling area and outside are firmly shut.

6.2.2.3 Ensure both heaters are functioning.

6.2.2.4 Insert empty bedding bags/stack full bedding bags along the bottom of the garage door and in the exhaust pipe at the end of the barn to limit drafts.

6.2.2.5 Put coats on calves.

6.2.2.6 In case of a heating system malfunction, provide an extra feeding of milk or milk replacer at noon.

6.2.2.7 Offer warm water.

6.2.2.8 Add more bedding (straw) to pens.

6.2.3 HEIFER BARN

6.2.3.1 Maintain the temperature 12 °C throughout the winter months. If it drops below this level, promptly inform the lead technician.

6.2.3.2 Ensure heifer barn doors to handling area and outside are firmly shut.

6.2.3.3 Ensure windows are closed.

6.2.3.4 Ensure both heaters are functioning.

6.2.3.5 Insert empty bedding bags/stack full bedding bags along the bottom of the garage door and in the exhaust pipe at the end of the barn to limit drafts.

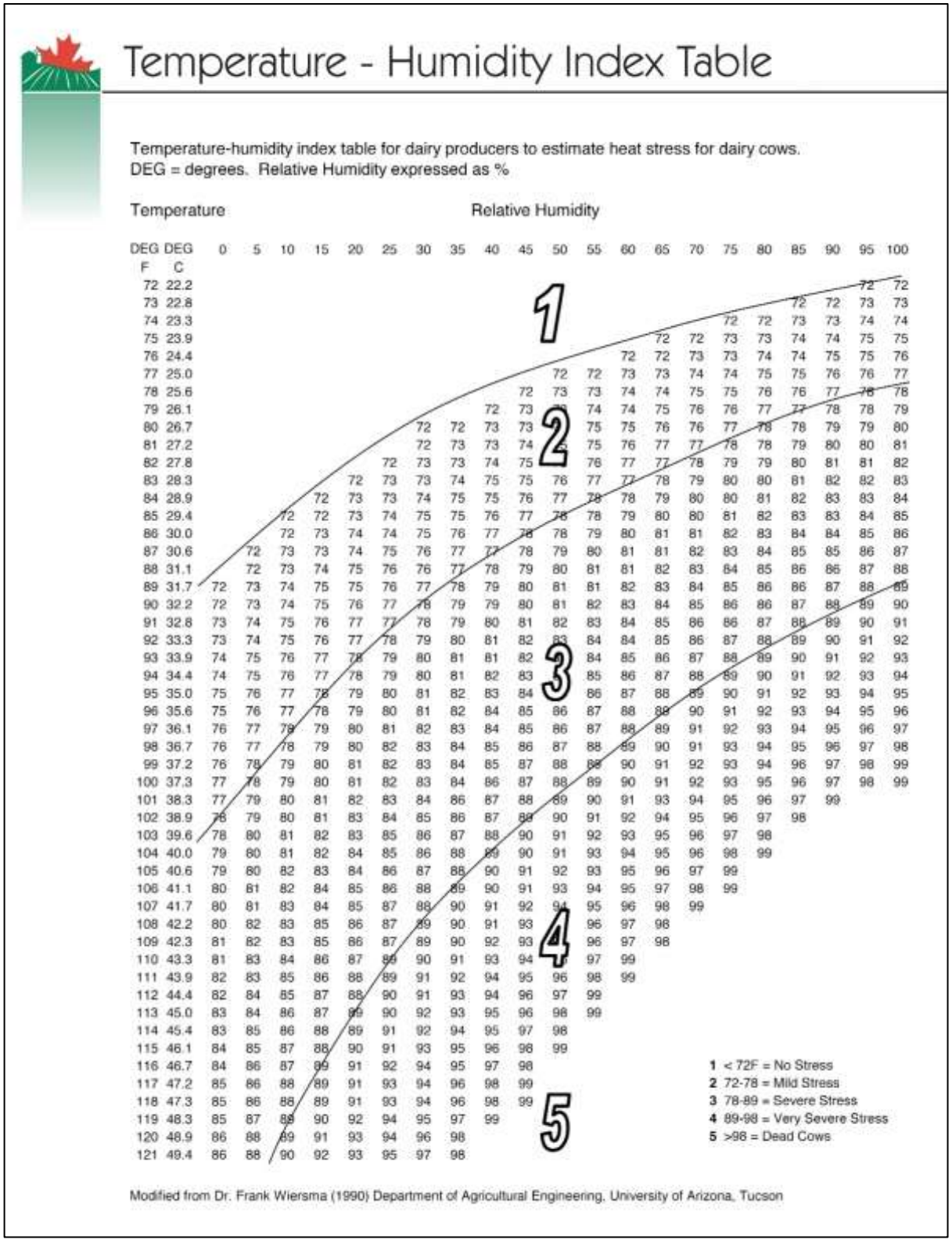
6.2.3.6 Add additional bedding, particularly to back pens (youngest animals).

6.2.4 HYDRO ROOM

6.2.4.1 Turn ceiling fans off.

- 6.2.4.1.1 Push in the plastic panel to close off the air exchange fan in the middle of the room.
- 6.2.4.1.2 Ensure the louvers on both exhaust fans are intact.
- 6.2.4.1.3 Place bedding filled bags in the gutter (chain gutter room side) to prevent cold air from entering the hydro room from the gutters.

6.2.4.2 Add more animals.



Temperature - Humidity Index Table

Temperature-humidity index table for dairy producers to estimate heat stress for dairy cows.
DEG = degrees. Relative Humidity expressed as %

Temperature		Relative Humidity																				
DEG F	DEG C	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
72	22.2																				72	72
73	22.8																		72	72	73	73
74	23.3																72	72	73	73	74	74
75	23.9														72	72	73	73	74	74	75	75
76	24.4													72	72	73	73	74	74	75	75	76
77	25.0											72	72	73	73	74	74	75	75	76	76	77
78	25.6										72	73	73	74	74	75	75	76	76	77	78	78
79	26.1									72	73	73	74	74	75	76	76	77	77	78	78	79
80	26.7							72	72	73	73	74	75	75	76	76	77	78	78	79	79	80
81	27.2							72	73	73	74	75	75	76	77	77	78	78	79	80	80	81
82	27.8						72	73	73	74	75	76	76	77	77	78	79	79	80	81	81	82
83	28.3					72	73	73	74	75	75	76	77	77	78	79	80	80	81	82	82	83
84	28.9				72	73	73	74	75	75	76	77	78	78	79	80	80	81	82	83	83	84
85	29.4			72	72	73	74	75	75	76	77	78	78	79	80	80	81	82	83	83	84	85
86	30.0			72	73	74	74	75	76	77	78	78	79	80	81	81	82	83	84	84	85	86
87	30.6		72	73	73	74	75	76	77	77	78	79	80	81	81	82	83	84	85	85	86	87
88	31.1		72	73	74	75	76	76	77	78	79	80	81	81	82	83	84	85	86	86	87	88
89	31.7	72	73	74	75	75	76	77	78	79	80	81	81	82	83	84	85	86	86	87	88	89
90	32.2	72	73	74	75	76	77	78	79	79	80	81	82	83	84	85	86	86	87	88	89	90
91	32.8	73	74	75	76	77	77	78	79	80	81	82	83	84	85	86	86	87	88	89	90	91
92	33.3	73	74	75	76	77	78	79	80	81	82	83	84	84	85	86	87	88	89	90	91	92
93	33.9	74	75	76	77	78	79	80	81	81	82	83	84	85	86	87	88	89	90	91	92	93
94	34.4	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94
95	35.0	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
96	35.6	75	76	77	78	79	80	81	82	84	85	86	87	88	88	90	91	92	93	94	95	96
97	36.1	76	77	78	79	80	81	82	83	84	85	86	87	88	89	91	92	93	94	95	96	97
98	36.7	76	77	78	79	80	82	83	84	85	86	87	88	89	90	91	93	94	95	96	97	98
99	37.2	76	78	79	80	81	82	83	84	85	87	88	88	90	91	92	93	94	96	97	98	99
100	37.3	77	78	79	80	81	82	83	84	86	87	88	89	90	91	92	93	95	96	97	98	99
101	38.3	77	79	80	81	82	83	84	86	87	88	89	90	91	93	94	95	96	97	99		
102	38.9	78	79	80	81	83	84	85	86	87	89	90	91	92	94	95	96	97	98			
103	39.6	78	80	81	82	83	85	86	87	88	90	91	92	93	95	96	97	98				
104	40.0	79	80	81	82	84	85	86	88	89	90	91	93	94	95	96	98	99				
105	40.6	79	80	82	83	84	86	87	88	90	91	92	93	95	96	97	99					
106	41.1	80	81	82	84	85	86	88	89	90	91	93	94	95	97	98	99					
107	41.7	80	81	83	84	85	87	88	90	91	92	94	95	96	98	99						
108	42.2	80	82	83	85	86	87	89	90	91	93	94	96	97	98							
109	42.3	81	82	83	85	86	87	89	90	92	93	94	96	97	98							
110	43.3	81	83	84	86	87	89	90	91	93	94	96	97	99								
111	43.9	82	83	85	86	88	89	91	92	94	95	96	98	99								
112	44.4	82	84	85	87	88	90	91	93	94	96	97	99									
113	45.0	83	84	86	87	89	90	92	93	95	96	98	99									
114	45.4	83	85	86	88	89	91	92	94	95	97	98										
115	46.1	84	85	87	88	90	91	93	95	96	98	99										
116	46.7	84	86	87	89	91	92	94	95	97	98											
117	47.2	85	86	88	89	91	93	94	96	98	99											
118	47.3	85	86	88	89	91	93	94	96	98	99											
119	48.3	85	87	88	90	92	94	95	97	99												
120	48.9	86	88	89	91	93	94	96	98													
121	49.4	86	88	90	92	93	95	97	98													

1 < 72F = No Stress
2 72-78 = Mild Stress
3 78-89 = Severe Stress
4 89-98 = Very Severe Stress
5 >98 = Dead Cows

Modified from Dr. Frank Wiersma (1990) Department of Agricultural Engineering, University of Arizona, Tucson

Figure 1: Temperature-Humidity Index Table

7. REFERENCES

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