Tasmanian Forest Industries Fire Weather Evaluation

Level 1

AHCWRK302A – Monitor weather conditions
FPICOR3203B – Evaluate fire potential and prevention

Learning Resource

forestworks
LEARNING AND SKILL DEVELOPMENT
FOREST, WOOD, PAPER & TIMBER PRODUCTS INDUSTRY

Introduction

Welcome to the Fire Weather Evaluation training session. This additional resource manual is for your reference and will assist with giving you extra information to help you back in the workplace.
On successful completion of this program you will receive the ForestWorks endorsement for Fire Weather Evaluation. This endorsement replaces the Fire Weather Observation endorsement.

The fire weather evaluator on site is responsible for taking weather readings during the prescribed period. By taking weather readings we hopefully can eliminate the potential of fire on your operations. This in turn reduces the potential loss of resource, income, property and life. These skills will also help you and your fellow workers to safeguard against such things as litigation.
The Fire Weather Evaluation endorsement is the first of 3 levels as part of fire courses offered. This program forms the platform of skills, knowledge and understanding required to minimise the likelihood of wildfire in Tasmania.

Assessment process

On completion of the delivery session an assessment will be conducted to achieve your endorsement

This will include:

- Theory assessment
- Practical assessment
- The theory assessment can be undertaken either verbally or in written form
- Please discuss with your trainer if you have any additional needs or learning or literacy difficulties.

Course Content

The Fire Weather Evaluation course will cover the following:

- Weather monitoring
- Fire preparedness
- Impact and causes of fire
- Instruments and equipment
- Maintenance
- Elements of weather
- Closure of operations.

Weather Monitoring - Frequently Asked Questions (FAQ's)

1. What is the weather monitoring period?

The weather monitoring period is between the 1st of October and the 30th of April. This period is identified as the Fire Season in Tasmania for the Forest Industries. (This may be extended due to extreme conditions).

2. When do I take weather readings?

Readings to be taken from commencement of operation until end of work on each site.

3. How often do I take weather readings?

Readings to be taken every 2 hours until a FFDI of 12 is reached and then hourly.

4. Who takes the fire weather readings on site?

A person holding the Fire Weather Evaluation endorsement.

5. When don't weather readings have to be taken?

The only exception to the above rule is when it's raining however still needs to be documented.

6. What is meant by drought factor?

The drought factor tells you the percentage of fine fuels less than 6mm in diameter available to burn. For example, if the drought factor is 10, this means that 100% of fine fuel is available to burn due to moisture content.

7. How do I know if I'm working in a wet forest or a dry forest?

In some cases this will be noted on the Forest Practices Plan for your current site, ask your supervisor or take the following as a general description:
Wet type forest – forests with dense, broad-leafed or rainforest understoreys.
Dry type forest – all forest types that are not a wet type forest.

8. How do I know which area I am in when fire weather warnings are given for different locations?

In some cases this will be noted on the Forest Practices Plan for your current site. If this isn't the case best practice is to ask your supervisor.

Fire Preparedness

It is essential to be prepared for fire on your site. With the threat of fire ever present prevention is the key to a successful season.

Prior to fire season you will need to:

Run and test all fire suppression equipment (pumps, extinguishers, hoses and ancillary equipment) this will be conducted as part of the pre season audit carried out by your principal company. The audit serves as a checklist which outlines the minimum requirements as required by the Forest Industries Fire Management Committee (FIFMC) for all operations during the prescribed fire period. The objective of good fire preparedness is a reduction of the incidents of wildfire resulting from forestry and related operations.

Recalibration of electronic weather instruments needs to be carried out. Equipment has been suggested for use by the FIFMC for Fire Weather Evaluators in the field. It is important that a uniform standard of equipment is in place. The equipment suppliers are listed in the Procedures: Fire Prevention At Forest Operations (obtained from principal companies).

Calibration of this equipment needs to be carried out in accordance with the manufacturer's recommendations.

Check fire weather kits to ensure they are compliant
A fire weather kit consists of approved instruments that enable the Fire Weather Evaluator to measure temperature, relative humidity (RH), wind speed, wind direction culminating in a Fire Danger rating (FDR).

A fire weather kit may consist of:
Digital electronic meter
Mason's hygrometer (wet and dry bulbs)
Baccharach slinging psychrometer
Wind meter
McArthur forest fire danger meter mark 5 1973
Beaufort scale
Log book
Compass.

Impact of Fire on Operations

Impact of fire on operations can be severe and long lasting. Some impacts can be identified instantly, others present themselves over time. In the short term impacts can be loss of life, equipment and property. In the longer term impacts can be loss of income, resource and also possible legal action. Every year this has a significant impact on the forest industry. With the emergence of high value assets such as plantations becoming more the norm in this state the potential for massive loss of resource is increasing rapidly.
Areas high in natural and cultural values such as national parks and conservation areas are also under threat, given their proximity to forest operations.

Causes of Fire on Operations

Fire can start from any number of sources. These can be (but not limited to):

- Exhausts on chainsaws and other equipment such as dozers, skidders, excavators and forwarders
- Discarded cigarette butts
- Welding or grinding
- Mechanical maintenance on plant or machinery
- Friction fire can be caused from bark on trees being dragged over rocky terrain
- Illegally lit fires
- Sparks from track plates on rocky terrain and also cables coming into contact with exposed rock (especially on granite)
- Direct heat from machinery
- Improperly maintained machinery
- Rubbish or oily rags left in the engine compartment
- Blown hydraulic hose.

Exhaust Systems

Exhaust systems are a significant cause of fires in Tasmania. A spark arrestor must be fitted to all machinery and be fully operational.
The majority of machinery is designed with safety features to reduce the likelihood of fire caused from an exhaust system. However, if this is not maintained a fire could be the result.

One item of machinery that requires further attention in terms of exhaust maintenance is the Stihl 066 or MS 660 chainsaw. The modification required is that the gauze spark arrestor (mesh screen) on the front of the exhaust is replaced with a blanking plate (solid metal plate) during the prescribed fire season. Another option is to replace the front of the muffler with a sealed front. All machinery on site has the potential to cause fire, therefore it's important to ensure that the exhaust system is maintained at all times.

Fuels on the Worksite

All fuels on site must be stored in accordance with the current Forest Practices Code and other relevant legislation. These need to be stored in a mineral earth bund capable of holding all stored fuels on the operation. This helps to minimise the fire risk on site in the event of any spillage.

There is a requirement that hydrocarbons are correctly stored on site. Hydrocarbons include diesel, petrol and oils and other petroleum products. These products are an accelerant and so need to be treated with the utmost respect.

Fire Weather Monitoring Equipment

Fire weather monitoring equipment may vary in brand, age and technology but the principles remain the same, to calculate fire danger readings by using the available fire weather instruments. Examples of these instruments are as follows:

- Digital electronic meter (wind, temperature and relative humidity)
- Mason's hygrometer (wet and dry thermometers)
- Baccharach slinging psychrometer
- Vaisala HM34 meter
- Deuta/Eschenbach cup anemometer
- Skymate SM -18 wind meter
- McArthur forest fire danger meter mark 5 1973
- Beaufort scale
- Log book
- Compass
- Relative humidity charts.

There may be other variances of weather measuring equipment and instruments available. These must be endorsed by the FIFMC prior to use.

Locations for Weather Reading

It's important to consider where weather readings are being conducted. Some conditions can greatly alter the final readings. Ideal places to take weather readings are:

- Old disused log landing
- Close to the parking or lunch area
- Landing site
- In a shaded area.

The options above for taking weather readings are ideal locations for the following reasons:

- Disused log landings have already been harvested and so there is little risk of damage to wet and dry hanging instruments
- The parking, lunch area and current landing site are all conveniently close and easily accessible
- Shaded areas provide a true indication of the weather conditions of our working environment.
- If readings are taken in direct sunlight this will give you a higher reading and therefore the reading will not be indicative of the actual working conditions and therefore this could result in a shutdown that is not required resulting in a loss of production.

Fire Weather Readings

When taking fire weather readings there are 4 elements that we are looking for. The elements in question are all part of the McArthur Scale. Using the McArthur Scale these combine to form a fire danger rating (FDR) for your area.

The 4 elements we are looking for are as follows:

- Drought factor
  If the drought factor is unknown use a drought factor of 10
- Air temperature
- Relative humidity reading (RH)
- Wind speed.

These four elements combine to form the fire danger rating (FDR) using the McArthur Scale

Once calculated the fire danger rating (FDR) and forest fire danger index (FFDI) provides guidance on when operations must shut down.

Maintenance

To produce accurate weather readings for your operation you must ensure that all equipment is effectively maintained. In order to achieve this, the following maintenance may be required:

- All electronic meters require calibration as per manufacturers specifications or industry requirements
- Wicks need to be checked prior to every fire season to ensure that they are clean and well maintained.
- This must be completed prior to fire season (1st of October).

Temperature

Air temperature is important as it directly affects the flammability of the fuel. Fuels receive heat from the surrounding air mass as well as direct radiation from the sun. The air is heated by coming into contact with the ground or water that is hotter than the air. The hotter the air mass the hotter the fuels in contact with it will be and therefore more flammable.

- Air temperature is the degrees Celsius measurement of temperature that directly affects the flammability of fuel and determines the amount of moisture air can hold

- Air temperature must always be taken by a correctly calibrated thermometer

- A thermometer needs between 5-10 minutes to stabilise to give an accurate reading

- Thermometers need to be placed in a shaded and open area so the air is free to circulate around the bulb. If the thermometer is in direct sunlight then it will be heated up directly by the suns rays giving a reading of radiant heat as opposed to air temperature

- Whenever measuring temperature, be sure to use common sense - is the reading that you would expect?

Place thermometer in the shade with good air circulation and wait for thermometer to stabilise

Readings need to taken at eye level (approx 1.7 metres)

A variation of 1 or 2 degrees may be incurred if reading the scale of a thermometer from an angle instead of at eye level.

Wet And Dry Bulbs (Mason's Hygrometer)

A Masons Hygrometer consists of 2 thermometers with one wet and one dry bulb. This instrument allows you to obtain a temperature reading as well as a relative humidity (RH) reading.

Slinging psychrometer

Measurements taken from wet and dry bulbs are used to calculate relative humidity (RH).

- The wet bulb always gives a lower temperature reading
- The dry bulb always gives a higher reading and also the actual air temperature.

These are the two measurements used for calculating relative humidity (RH).

Using the correct RH tables you will obtain the relative humidity for your location. (see table below)

Thermometer maintenance

- When using wet thermometers ensure the wick (muslin) is clean – dirty water will give an incorrect reading as it will affect evaporation
- It's recommended that you use distilled clean water for the wet bulb of the thermometer.

Relative Humidity Table

100								**8**										
87	100							**9**										
75	87	100						**10**										
64	75	88	100					**11**										
54	65	76	88	100				**12**										
45	55	66	77	88	100			**13**										
38	48	57	68	79	89	100		**14**										
31	40	49	59	69	79	89	100	**15**										
25	33	42	51	60	70	79	89	**16**	100									
19	27	35	44	52	61	70	80	**17**	90	100								
15	22	29	37	45	54	62	71	**18**	81	90	100							
10	17	24	31	39	47	55	63	**19**	72	81	90	100						
6	10	19	26	33	41	48	56	**20**	64	73	82	91	100					
8	**9**	**10**	**11**	**12**	**13**	**14**	**15**		**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
3	9	15	22	28	35	42	50	**21**	57	65	74	82	91	100				
	5	11	17	24	30	37	44	**22**	51	58	66	74	82	91	100			
	2	8	14	19	26	32	36	**23**	45	52	59	67	75	83	91	100		
		5	10	16	21	37	34	**24**	40	47	53	60	68	75	83	91	100	
		2	7	12	18	23	29	**25**	35	41	48	54	61	69	76	84	92	100
			4	9	14	20	25	**26**	31	37	43	49	55	62	69	77	84	92
			2	7	11	16	22	**27**	27	32	38	44	50	56	63	70	77	84
				4	9	13	18	**28**	23	28	34	39	45	51	57	64	71	77
				2	6	11	15	**29**	20	25	30	35	41	46	52	58	65	71
					4	8	13	**30**	17	22	26	31	37	42	47	53	59	65
					2	6	10	**31**	14	19	23	28	33	38	43	48	54	60
						4	8	**32**	12	16	20	25	29	34	39	44	49	55
						2	6	**33**	10	14	18	22	26	31	35	40	45	50
							4	**34**	8	11	15	19	23	27	32	36	41	46
							3	**35**	6	9	13	17	21	25	29	33	38	42
								36	4	8	11	14	18	22	26	30	34	39
								37	3	6	9	12	16	20	23	27	31	35
								38	1	4	7	11	14	17	21	24	28	32
								39		3	6	9	12	15	19	22	26	29
								40		2	5	7	10	13	17	20	23	27

Wet Bulb reading °c

Dry Bulb reading °c

Relative Humidity %

Wind Speed

The wind is a very important factor in bush fire behaviour and a key element in calculating a fire danger rating. Wind has a significant influence on the rate of fire spread as it will remove smoke and ash from the fire, allowing the influx of fresh air and oxygen to intensify the fire. The stronger the wind the greater the effect it will have.

Wind speed is also the most difficult element to measure accurately. Wind can be measured using an anemometer, electronic meter or estimated using the Beaufort Scale. (See following page)

To take wind readings:

- Take average wind speed measurements over one minute, however ten minutes is ideal
- Must be measured in kilometres per hour
- Wind speed must be taken with the meter facing into the wind
- In case of electronic equipment malfunctioning, use the Beaufort scale
- In order to get the correct wind speed the following is recommended:
  In a clear area, you need to walk 10 x the height of trees downwind or 4 x the height of trees upwind. At this distance you can get an accurate measurement of true wind speed.
- Standard wind measurements are to be taken at eye level, which is approximately 1.7 metres in height.
  To get the correct wind speed at a height of 10 metres, add half the wind speed again (multiply by 1.5)
  For example - Wind speed at 1.7 metres = 10 km per hour
  Therefore add half again (5km per hour) = 15 km per hour at 10 metre height
  This will provide the actual wind speed at a height of 10 metres.

Wind Meter

The Beaufort Scale

ESTIMATING WIND SPEED* Tree-top Effects	km/hr	TERM USED & BEAUFORT SCALE		FIRE NOTES	
Smoke rises vertically Leaves still	Under 1	Calm	0	Slash and Moorland	Top-disposal & Underburning
Smoke drifts slowly Slight leaf movement	1 - 5	Light Air	1		
Wind felt on face Leaves rustle	5 - 10	Light Breeze	2		
Leaves and small twigs moved	10 - 20	Light Wind	3	DON'T LIGHT ANY PRESCRIBED FIRES	
Dust raised Small branches moved	20 - 30	Moderate Wind	4		
Small trees sway	30 - 40	Fresh Wind	5		
Large branches moved Wires whistle	40 - 50	Strong Wind	6		
Large trees sway	50 - 60	Near Gale	7		
Breaks twigs off trees	60 - 75	Gale	8		
Breaks branches off	75 - 90	Full Gale	9		
WIND SPEED = 10 minutes average **STRONGEST GUSTS approximately 2 x WIND SPEED**					

Drought Factor

- Drought factor is a measurement from 1 -10 where 10 indicates that 100% of the fuel is dry
- 10 represents the driest measurement and 0 represents the wettest. On the McArthur Scale the range to select from is 2-10
- The drought factor is obtained via the Bureau of Meteorology or a print out of a current forecast
- If unsure when using the drought factor always use a drought factor of 10
- Drought factor relates directly to the moisture content of fine elevated fuels

Relative Humidity (RH)

- Relative humidity (RH) is a measure of the amount of moisture content in the air
- Relative humidity (RH) is expressed as a percentage of the maximum
- The higher the relative humidity (RH) the more moisture in the air
- The lower the relative humidity (RH) the dryer the air is
- RH can range from 100% saturation to near 0% for very dry air
- For example: On a foggy day the RH is close to 100%, as opposed to a bright, clear sunny day where the RH would be a lot lower
- Therefore lower relative humidity (RH) increases the fire danger rating (FDR)
- When RH is below 50% fire progression can be rapid and below 30% intensity can be extreme

Fire Danger Rating (FDR)

- FDR integrates effects on fire behaviour of temperature, humidity, wind speed and past rainfall (drought factor)
- The fire danger rating (FDR) is obtained using the McArthur scale
- The McArthur Scale is still the primary method of prediction of fire behaviour used in the Eastern half of Australia.

- The fire danger rating (FDR) can be rated as:
- Low – Moderate 0-11
- High 12-24 (Shutdown procedures come into effect at 20 and upwards)
- Very high 24-49
- Severe 50-74
- Extreme 75-99
- Catastrophic 100+
- A high fire danger rating is a combination of high drought factor, high temperature, low relative humidity and high wind speed. A high fire danger rating means that fires will spread quickly and will be difficult to suppress

McArthur Forest Fire Danger Meter

Log Books

Log books are a requirement for fire season:

- Log books are required to record all weather readings on your site during fire season
- Log books must be produced for audit when requested
- Log books can be obtained from various sources including but not limited to; Forestry Tasmania, principal companies and some training providers.

Log books have provisions for:

- Date
- Time
- Location or coupe
- Drought factor
- Wet and dry bulb readings (temperature in degree C)
- Relative humidity (RH)
- Wind speed and direction (km per hour)
- Fire danger rating (FDR).

Fire Weather Warnings

Fire weather warnings are issued by the Bureau of Meteorology indicating the potential risk of a fire starting. These warnings are useful in the assessment of required shut down procedures.

Your operation can also be affected by severe weather warnings.

Fire weather, wind and storm warnings can be obtained from the following:

- Local media outlets including radio, T.V. internet and newspaper
- ABC local radio provides frequent fire weather forecasts during the fire season
- Principal Companies
- Direct from Bureau of Meteorology phone – 6221 2054 24/7 for operational forecasts and warnings
- 1300 659 216 for recorded warning message
- For more information, if you have access to a computer, go to:
- **www.bom.gov.au**
- **www.fire.tas.gov.au**
- **www.eldersweather.com.au**

For more information on how fire weather warnings directly affect shut down procedures on your operation please refer to the Procedure: Fire Prevention at Forest Operations document as prescribed by the Forest Industries Fire Management Committee (FIFMC) annually.

Closure of Operations

SEVERE WEATHER SUSPENSION OF HAZARDOUS ACTIVITIES - minimum standards to be applied.

Note: some companies and organisations specify more stringent measures.

The following requirements apply to all cable harvesting operations, irrespective of forest or plantation type or time of year.

The following requirements apply to all conventional harvesting operations from 1st October until at least 30th April in the following Autumn,

All contractors engaged in hazardous forest activities:

- Must have on site a working set of fire weather measuring instruments, a fire weather logbook and two Fire Weather Evaluators each possessing a current ForestWorks Fire Weather Evaluators licence, and,

Upon commencement of any hazardous forest activities:

- Must take & record weather readings every 2 HOURS, until end of work on site each day
- Must take & record weather readings HOURLY once the FDR calculated from weather parameters measured at the operation reaches HIGH 12, or is likely to reach this rating within the next hour,
- Must suspend operations when the FDR calculated from weather parameters measured at the operation is equal to or greater than HIGH 20, OR the relative humidity is equal to or less than 30%
- Must keep sufficient personnel on site to deal with any fire, which may become apparent for a minimum of one hour after the suspension of hazardous activities.
- Suspend operations if no Fire Weather Evaluator is on site at time of scheduled readings.
- No readings are required if it is raining at the operation.

Procedures required after shutdown

Once you have determined your operation is required to shut down you must:

- ***Remain on site for at least one hour after shutdown***
- Continue to monitor the operational site for any evidence of fire which may be smouldering
- Park all machinery in a safe, clear area.

A weather reading must be taken one hour after shut down. This will determine whether you can return to work or operations may cease for the day.

Fire

Evidence of fire at your location could be but not limited to the following:

- A strong smell of smoke
- Visible signs of smoke at your location
- Flames are evident
- Smouldering materials
- Verbal notification by an external source.

If there is a fire on your operation you must:

- Stop work immediately
- Notify your Responsible Officer or Bush Boss (persons in charge)
- Notify your Company Supervisor
- Tasmanian Fire Service on 000 or 112 on mobile
- Investigate and attempt to suppress the fire with equipment available on site
- Always remember your own safety and the safety and capabilities of your crew.

Fire Fighting Equipment

Well maintained and effective equipment gives you the ability to be able to suppress a fire at your location. The information below gives you the guidelines as prescribed by the Forest Industries Fire Management Committee.
All fire suppression equipment must be able to be transported throughout your operational area.

- All fire fighting and fire weather monitoring equipment should be tested and run prior to the commencement of fire season (1st October)
- Your operation will be audited by the principal company by the end of October
- During fire season try and run fire suppression equipment **weekly** if possible or as a minimum at least once a **month**.

For conventional operations in wet and dry forests and other operations including land clearing, mound ploughing and site preparation you must have on site:

- Mobile tank with no less than 300 litres
- Self priming centrifugal pump producing a pressure of at least 400 kPa (5 hp)
- Minimum of 60 metres of hose (25mm diameter) with a jet nozzle fitted with couplings as used by Tasmania's fire fighting agencies.
- 2 rakehoes
- One knapsack or charged air/water extinguisher with a capacity of not less than 9 litres on each machine and within 100 metres of each chainsaw currently in use
- One set of approved fire weather reading instruments and log book.

For cable operations requirements are the same as conventional operations, plus the following:

- No less than 1000 litres of stored water
- Motorised pump (at least 10hp)
- 10 x 30m x 38mm lengths of hose
- 38mm variable fire fighting nozzle
- Knapsack/extinguisher at tail-hold and blocks.

Fire Fighting Equipment continued

There are some low risk activities that are exempt from the above prescribed requirements. Low risk can be defined as forestry work which poses little risk of fire and is being conducted away from forest, scrub or pasture fuels. However, don't be complacent as extreme fire weather will make these activities hazardous.

These low risk activities may include:

- Gravelling or grading formed pavements
- Road construction where the vegetation clearing has been completed
- Mechanised site preparation where there is not residual vegetation (pasture)
- Any manual work such as planting, fertilising and pruning with hand saws and tending with a hook or mattock.

These activities require:

- One rakehoe
- One knapsack or charged air/water extinguisher with a capacity of not less than 9 litres on each machine and within 100 metres of each chainsaw currently in use.

Activities must be suspended when an extreme fire weather warning has been issued.

Communications

It's important that all communication on site is effective, particularly in the event of a fire. Communication forms the basis of good fire management.
This communication may include:

- Verbal
- Written
- Hand signals/body language
- Mobile phone (if coverage available)
- UHF/VHF radio
- Signage

Harassment and Discrimination

Anti Discrimination is legislated in Australia. No comment or action of a discriminatory nature should ever be made in the workplace. This includes but is not exclusive to:

- Ethnicity
- Origin
- Skin colour
- Gender
- Age
- Sexuality
- Religion

Troubleshooting

If you think you encounter an incorrect reading or your equipment doesn't appear to be working properly consider some of the following:

- All measurement equipment must be kept in the shade away from direct sunlight with good air circulation
- Parallax error – Not holding thermometer at eye level
- Thermometer not in equilibrium – Wait for stabilisation
- Operator error – not familiar with equipment
- Low battery – charge or replace battery
- Don't subject equipment to knocks, bumps or drops
- Wick allowed to dry out – Refill with distilled water
- Dirty wick affecting evaporation – Replace wick
- Wrong tables used – Make sure appropriate tables are being used.

Summary

- It's vital that all relevant personnel are adequately trained in fire weather monitoring

- Whilst weather readings are important so is having the correct fire fighting equipment on the worksite and making sure that it is properly maintained.

Where to from here?

Level 2 – Bush Fire Awareness
Pre requisite – Level 1 - Fire Weather Evaluation

- The program is the second level of training and is for those individuals who may encounter fire on their operation.
- The course covers the following units of competence:
- PUAFIR215 – Prevent injury
- PUAFIR309B – Operate pumps
- PUAEQU001B – Prepare, maintain and test response equipment
- FPICOR2204B – Follow fire prevention procedures.

And then where?

Level 3 – Wildfire Suppression

- Pre requisite – Level 2 – Bush Fire Awareness
- The program is for those individuals actively involved in the suppression of wildfire

- The course covers the following units of competence:
- PUAFIR204B – Respond to wildfire
- PUAFIR303B – Suppress wildfire.

References:

- Procedures: Fire Prevention At Forest Operations (obtained from principal companies)
- The Forest Industry Fire Preparedness and Equipment Audit (obtained from principal companies)
- The above 2 documents are authorised by the Forest Industries Fire Management Committee (FIFMC).