



# Combe Mill Society - Risk Assessment

## Activity: Operation of the Beam Engine

Risk Assessment undertaken by: **PHi, PHa**

**Assessment Date** 20 September 2023  
**Next review date:** 1 March 2024  
**Date of last review:** Not applicable: new version  
**Assessment Ref:** RA04\_v7\_BeamEngOps

**Certification** The contents of and conclusions drawn in this Assessment are the responsibility of the HTA and have been certified by the DRS as meeting the requirements of the Combe Mill Society for display on the web site.

### Abbreviations used in this risk assessment

Where an action or reference applies to a specific person that person is referred to by his or her initials. These persons are:

- PHi, Peter Hirst (HTA); PHa, Philip Hawtin.

Where an action devolves on a post holder the following abbreviations are used:

Abbreviation	Post/ Meaning
Approved Operator	Either a Proficient or a Competent Person as appropriate
CMS	Combe Mill Society
CP	A Competent Person; A person who has been approved as being capable of taking limited control of the Engine provided there is a PP available at the Mill
DRS	Director Responsible for Safety
HTA	Head of the Beam Engine Technical Area or, where appropriate, a Proficient Person approved to take the HTA's place.

\*Residual Risk (RR) =H x P



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<b>Abbreviation</b>	<b>Post/ Meaning</b>
QNA	Quantitative assessment Not Applicable
PP	A Proficient Person: a fully trained Operator capable of undertaking the responsibilities of the HTA when necessary.

Hazard  (1)	Who might be harmed  (2)	Consequence of Hazard (H) and associated uncontrolled Risk.  (3)	Risk from matrix (4)			Control Measures adopted or required to make the Residual Risk Rating acceptable  (5)	Residual Risk
			H	P	Risk		RR*
<b>Layout</b>						The following Assessment is divided into 4 parts <ol style="list-style-type: none"> <li>1. General information</li> <li>2. Basic hazards present even when Engine is not in steam.</li> <li>3. Additional Risks present when Engine is in steam</li> <li>4. Additional Risks when trainees or visitors are involved.</li> </ol>	

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<b>1 General</b>  1.1 Hierarchy of command						At all times when the beam engine is in steam the following hierarchy of control will apply:  1) If the HTA appointed by the board is present then that person is in charge and has all the powers delegated to an HTA by the Board.  2) If the formal HTA is absent from the site then one of the Proficient Persons is appointed as the HTA's authorised deputy and has for the time being all the powers that the HTA would have had he/she been present.  3) Where the operating team includes more than one PP and the approved deputy HTA is absent from the control area, each has the power to take full charge of the engine as set out in the Method Statement, as the necessity dictates.  (continued on next page)	

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1.1 Hierarchy of command (cont.)						(continued from previous page)  4) Competent Persons are permitted to oversee the steady state operation of the engine and to shut it down in an emergency. They have no additional powers. Unless formally granted by the HTA.	
1.2 General approach to minimising risk	Operators & Trainees				QNA	The Beam Engine is a Heritage engine. Its design is such that modifications to meet modern safety standards cannot be made without damaging the engine’s heritage aspects. Its operation is carried out by trained Operators working to a detailed Method Statement. CMS trains its own Operators and the training they are given places special emphasis on the personal aspect in the safe control of an Engine of this age.	QNA

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<p><b>2 Basic Hazards</b></p> <p>2.1 Injury to members of the public when manoeuvring the fly wheel into the start position.</p>	<p>members of the public</p>	<p>It is on occasion necessary to bar the engine in order to get it into the start position. This involves placing a bar into the fly wheel assembly. The bar intrudes into the walk way adjacent to the doorway leading into the forge area. Should members of the public try to pass the bar they could injure themselves. The Harm level is Moderate and the frequency is Likely leading to a Moderate unconstrained Risk.</p>	3	4	<p>3 X 4 = 12</p>	<p>Whenever practicable the barring is done when there are no visitors in the Mill.</p> <p>The operation is carried out by Approved Operators.</p> <p>If the operation must be carried out when the public are in the Mill, prior to moving the flywheel, members of the public are excluded from the work area.</p> <p>This action closes a fire escape route. During the closure members are posted, either side of the blockage one in the forge and the other at the top of the stairs in the Engine house. These members ensure that visitors are kept away from the work and hence allow the bar to be immediately removed in the event of an emergency.</p> <p>Preventing public access to the work area removes any opportunity for the Hazard to arise. The risk posed by failing to close the area to the public is very unlikely. The residual risk is Tolerable and acceptable.</p>	<p>3 X 1 = 3</p>

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2.2 Accidental movement of an apparently stationary engine	Operators	<p>Injuries to Operators caused by the engine moving (as a result of out of balance mechanical forces) when it is expected to be stationary.</p> <p>Tests have shown that it is difficult to move the engine in this way. Assessed Harm level Major, Probability Unlikely leading to an unconstrained Moderate Risk</p>	4	2	4	<p>All operations are carried out by Approved Operators or by trainees under the personal supervision of an approved supervisor working to a written method statement.</p> <p>This confirms the Probability of Unlikely</p> <p>As an additional precaution, when necessary, an arrangement that allows the flywheel to be chocked has been provided and must be used when required. This further reduces the Probability to Very Unlikely making the Residual Risk Tolerable and acceptable.</p>	4
					X		2
							X
							2
							=
							8
							4
							X
							1
							=
							4

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			H	P	Risk		RR*
2.3 Entry into the Engine Pit	Operator entering pit	Space within the pit is very limited. Were the engine to move the consequence could be fatal. Harm level Extreme and the Probability Unlikely. The Risk though Moderate is not controlled	5	2	5 X 2 = 10	Before a person enters the pit the following arrangements must be in place: 1) the engine must not be in steam and all pipework must be cold; 2) the flywheel must be chocked to prevent the engine from rotating; 3) Entry into the pit under lone working arrangements is not permitted; 3) A second person must be present in the engine house and must not leave it, whilst the person is in the pit, other than to seek urgent help. Entry, under these restricted conditions, reduces the Probability to Very Unlikely. The Residual Risk remains Moderate. Whilst still Moderate this risk, in the absence of any practicable additional options, is acceptable.	5 X 1 = 5

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Hazard (1)	Who might be harmed (2)	Consequence of Hazard (H) and associated uncontrolled Risk. (3)	Risk from matrix (4)			Control Measures adopted or required to make the Residual Risk Rating acceptable (5)	Residual Risk
			H	P	Risk		RR*
2.5 Unauthorised entry	Persons who enter the control area other than in accord with due process.	Level of Harm estimated as Major and the probability as possible. The Risk is Moderate	4	3	4 x 3 = 12	The Moderate basic risk results from the risk to small children who could fall into the cold well. Adults are unlikely to be harmed by a cold engine. The engineering control area is separated from the rest of the engine house by a steel fence with a lockable gate. The gate is left unlocked during working sessions on the cold engine. In the absence of working members, it must be locked shut whenever the Mill is open to visitors and children are expected. It is a requirement of admission to the Mill that children must be accompanied by a responsible adult. These measures reduce the probability to Very Unlikely and the risk to Tolerable.	4 x 1 = 4

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			H	P	Risk		RR*
2.6 Fall when oiling engine.	Operator carrying out the lubrication	See 2.6A immediately below.			From 12A 4 4 = 16	Major lubrication is normally carried out with the lubrication of the Line shaft (RA15) and the risk is assessed there. PPs are required to be familiar with the relevant requirements in RA15 so that they can carry out the lubrication if it has not already been completed. The Operators are not allowed to carry out this lubrication on a lone working basis. RA15 assesses the Residual Risk as Moderate.	From 12A 4 X 2 = 8

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			H	P	Risk		RR*
2.6A Beam Engine Lubrication <b>(Extract from RA15)</b>	Operator doing the oiling (referred to in RA15 as “The Oiler”)	RA15 estimates the unmitigated Risk as Substantial based on an estimated Severity of Harm of Major and the Probability of its Occurrence as Likely	4	4	4 4 = 16	1) The key additional safety measure is the required physical presence of a second person in the engine house throughout the entire oiling period. 2) Prior to the start of the oiling, the oiler must ensure the assistant knows what is required from him/ her. Especially: a) what help is needed to assist the oiler to minimise the risk of an accident b) how to provide practical help if an accident does occur. 3) The assistant must not undertake non-safety related activities except under the specific instruction of the oiler. If these require the assistant to leave the engine house the oiling work must stop. 4) These measures reduce the Probability of an incident to Unlikely and the Residual Risk to Moderate. In all probability the measures will also reduce the level of Harm due to a faster response to any incident but no quantitative claim is made for this. The risk is acceptable.	4 X 2 = 8

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			H	P	Risk		RR*
<b>3 Mill in Steam</b>  3.1 Access of Operators to the control area	Operator arriving for work	Excess numbers in the control area hampers safe control.  The risk cannot be quantified but the aim is to keep the number of persons in the control area to the minimum necessary to ensure the safe control of the then current activities.			QNA	Arriving Operators enter the control area to speak to the person in control.  In accordance with the Hierarchy of Command (see Hazard 1.1): 1) If the entering Operator is the HTA or, in the absence of the HTA, the authorised deputy, then this person takes over control of the engine. 2) If the entering Operator is a PP but neither the HTA nor the authorised deputy, he should speak with the person currently in charge to determine if it is appropriate that he/she should take over control of the engine. 3) If the engine is under the control of a CP then any arriving PP must take over its control.	QNA

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			H	P	Risk		RR*
3.2 Access of visitors to the control area	Any person Present.	Any person entering the control area is exposed to the risks described elsewhere in this assessment. These risks are quantified elsewhere.			QNA	<p>The presence of visitors provides distractions for the Operators. The aim is to exclude all visitors unless their presence is deemed essential by the person in charge of the engine at the time.</p> <p>Prior to entering the controlled area an intending visitor must obtain the permission of the Operator in charge to pass through the entry gate.</p> <p>1 If granted, the visitor may enter the controlled area and his/her safety becomes the responsibility of the Operator in charge.</p> <p>2 <b>Note</b> If there is only one Approved Operator in the control area and that person is a Competent Person the visitor's request for entry must be denied.</p>	QNA

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			H	P	Risk		RR*
3.3A Impact with moving machinery accessible from the entrance corridor	Operators, Trainees & Visitors allowed to enter control area,	The level of potential Harm is Major and possibly fatal. Taken as Fatal. The likelihood of occurrence is assessed as Possible and the uncontrolled Risk is Substantial	5	3	5 X 3 = 15	All operations are carried out by Approved Operators or by trainees under the personal supervision of a Proficient Person (PP). The restricted role of Competent Persons is set out in Hazard 15. The working area is small and when the engine is in steam no more than two persons are allowed in the area without the specific approval of the Proficient Person in charge. As a result of the training and limitation on numbers in the work area the frequency is expected to fall to Unlikely. This leads to a Moderate Residual Risk which, in the absence of other appropriate measures, is acceptable.	5 X 2 = 10

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			H	P	Risk		RR*
3.3B Impact with moving machinery accessible from the control area	Operators, Trainees & Visitors allowed to enter control area,	The level of potential Harm is Major and possibly fatal. Taken as Fatal. The likelihood of occurrence is assessed as Possible and the uncontrolled Risk is Substantial	5	3	5 X 3 = 15	The machinery concerned is located on either side of narrow passage way between the engine and the flywheel. The HTA has concluded that it is not normally necessary to enter this passage way when the engine is operating. If the engine is stationary the Probability of Occurrence falls to Very Unlikely. In the Unlikely event that the engine was to be operating then the assessment in 3.3A would apply; leaving the Bounding Residual Risk as Moderate which, in the absence of other appropriate measures, is acceptable	5 X 1 = 5 5 X 2 = 10

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			H	P	Risk		RR*
3.3C Impact with moving machinery	All other persons in the engine house	A sturdy steel wire mesh fence with steel frame work prevents the access of the public to the engine. The fence is effectively a part of the building. The hazard, were it to be realised, could cause Harm, assessed as Major.  The fixed fence makes the Probability Very Unlikely The risk is formally Tolerable.	4	1	4 X 1 = 4	No further action is necessary or practicable. The Residual Risk is acceptable.	4

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			H	P	Risk		RR*
3.4 Entrapment of clothing in moving machinery	Operators and trainees.	The moving engine could foul loose clothing drawing the person into the engine causing Extreme Harm with a Likelihood of possible. The Risk is Substantial.	5	3	5 X 3 = 15	No person working on the engine is allowed to wear loose clothing (e.g. ties or scarves)  All operations are carried out by Approved Operators or by trainees under the personal supervision of a PP.  As a result of the training and limitation on numbers (see Hazard 2A) the frequency falls to Unlikely and the Residual Risk to Moderate and, in the absence of other appropriate measures, is acceptable.	5 X 2 = 10
3.5 Entrapment of beards, long hair and limbs in the moving machinery.	Operators	Beards, long hair and limbs could all be the means by which a person was dragged into the engine causing Extreme Harm with a Likelihood of Possible. The associated risk is Substantial.	5	3	5 X 3 = 15	Beards and long hair must be securely tied back or covered with a cap.  This preventative measure removes the problem of beards and long hair. Whilst the use of specially trained Operators reduces the frequency to Unlikely producing a Moderate Residual Risk which, in the absence of other appropriate measures, is acceptable.	5 X 2 = 10

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			H	P	Risk		RR*
3.6 Entrapment of fingers between the manual slide valve control lever and the steam inlet valve hand wheel,	Operator	Trapped fingers are likely to involve Moderate injuries at a Possible frequency giving rise to a Moderate uncontrolled Risk. This hazard is inherent in the design of the engine	3	3	3 X 3 = 9	All operations are carried out by Approved Operators or by trainees under the personal supervision of a PP. Limiting the execution in this way leads to a reduction in the frequency to Unlikely and a corresponding Tolerable Residual Risk which is acceptable.	3 X 2 = 6

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			H	P	Risk		RR*
3.7A Scalds and burns	Operators	All steam supply piping is fully lagged. The assessed level of Harm is Moderate at a Probability of Possible leading to a Moderate Risk.	3	3	3 X 3 = 9	All operations are carried out by Approved Operators or by trainees under the personal supervision of a PP  Minor leaks are repaired expeditiously and any damaged lagging similarly replaced.  The PP in charge of the actual operation of the beam engine is responsible for ensuring that: -appropriate PPE is available before the engine is run -overseeing its proper use in practice.  These additional arrangements reduce the Probability to Unlikely and the Residual Risk to Tolerable which, in the absence of any practicable additional options, is acceptable.	3 X 2 = 6

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			H	P	Risk		RR*
3.7B Scalds and burns	General public	A sturdy steel wire mesh fence with a steel frame work prevents public access to all hot parts. The assessed level of Harm is Moderate at a Probability of Unlikely leading to a Tolerable Risk.	3	1	3 X 1 = 3	No further action is necessary. The Residual Risk is as low as reasonably practical.	3 X 1 = 3

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			H	P	Risk		RR*
3.8 Fall when talking to the public	Operator	<p>The engine is in a pit. When talking to the public, from the control area the pit Operators have to look up: This can lead to neck pain.</p> <p>For some years to obviate this difficulty, a modified bench was used as a platform. It would be possible to step backwards from this platform falling to the level of the engine. The fall could cause Major injuries and the Probability was assessed as Possible. The resulting Risk although Moderate was not controlled and consequently unacceptable.</p>	4	3	4 X 3 = 12	<p>There is inadequate space for a proper platform and the use of an ad hoc alternative is banned. There are two approved options available to Operators:</p> <p>a) the Operator can speak from the floor of the control area where the expected Harm is Minor and the Probability Possible. The Residual Risk is Tolerable. Or</p> <p>b) if there are two Approved Operators present, one can come up to the public area and talk to visitors whilst the second controls the engine. In this case the Residual Risk becomes that associated with slips, trips and falls and (see Hazard 2.4). This too is Tolerable</p> <p>Both methods are currently used but because of the possibility of neck pain b) is the preferred option.</p> <p><b>Note:</b> If only one Approved Operator is available, the speaker in option b) can, subject to the HTA's agreement, be a member with the necessary engineering background but lacking the operating experience. Such a substitute person has no right of access to the control area.</p>	2 X 3 = 6

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			H	P	Risk		RR*
<b>4 Supervisory</b>	<b>Arrangements</b>						
4.1 Supervision of fee paying visitors	Visitor undergoing a beam engine driving experience, course Supervising PP	The various hazards that can arise are set out above and the details are not repeated here  The aim of the analysis is to demonstrate that the risk to the visitor and supervisor is no greater than that faced by the supervisor when working alone.			As above	1) Visitors are supervised on one to one, hands on basis for the entire time that they are within the fenced operating area. 2) The supervisor must be a PP who has been approved by the HTA to undertake this duty. 3) The supervisor must not undertake any other tasks when the visitor is in the fenced area. 4) Before starting the activity the supervisor must ensure that the visitor is given an introduction to CMS’s safety arrangements and our expectation of the visitor. The detailed risks above were confirmed as applicable when supervised visitors were on the Beam Engine Driving Course.	As above

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			H	P	Risk		RR*
4.2 Supervision of training	Person undergoing initial training Supervising PP	The various hazards that can arise are set out above and the details are not repeated here			As above	Trainees are supervised in the same way as visitors.  When they have completed their initial training, Trainees are reclassified as Competent Persons.  The detailed risks above were confirmed as applicable when supervised trainees were present.	As above
4.3 Supervision of Competent Persons	A CP gaining additional experience and undergoing further training, Supervising PP	The various hazards that can arise are set out above and the details are not repeated here			As above	1) A Competent Person (CP) may control the normal operation of the Beam Engine unsupervised and, if necessary, shut it down; provided there is a PP present on the site and able to go to the Engine House whenever required. 2) The HTA may permit a CP to undertake additional unsupervised tasks but should keep a written record. 3) All other tasks must be supervised by a PP.  The individual hazards assessed above have been reconsidered against this scenario. The detailed risks above were confirmed as applicable when a CP was in charge of the Beam Engine.	As above

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Topic	Comment
Appendix: Safety Related Responsibilities created by the DRS:	
This Appendix is not formally a part of the associated Risk Assessment. It has been prepared by the DRS providing a reminder of the existing safety management responsibilities that impact on the application of the Assessment.	
1 Trainee development	As soon as the HTA is satisfied that the Trainee is sufficiently skilful, the HTA will reclassify the Trainee as a Competent Person and enter the person's name on the list that the HTA is required to keep. (See Item 3 below)  The HTA must then ask the appropriate person (at present Tony Simmons) to issue the Competent Person with a certificate of Competence
2 CP development	As soon as the HTA is satisfied that the CP is sufficiently skilful the HTA will reclassify the CP as a PP and enter the person's name on the list that the HTA is required to keep. (See item 3 below)  The HTA must then ask the appropriate person (at present Tony Simmons) to issue the Proficient Person with a certificate of Proficiency

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Topic	Comment
<p>3 Loss of control of risk due to persons carrying out duties for which they were not properly trained and/or experienced.</p>	<p>1) The HTA is required to maintain up to date lists of the names of Competent and Proficient Persons These lists are the definitive list of Competent and Proficient Persons approved to operate the Beam Engine.</p> <p>2) The certificates of Competency and Proficiency provide reassurance to the persons concerned that they are on the HTA's appropriate list. Their possession is not obligatory.</p> <p>3) Any person may ask for his/her name to be removed from a list.</p> <p>4) The HTA is formally responsible for ensuring that CMS's safety requirements are met in the Beam Engine area.</p> <p>5) The HTA seeks to resolve such matters by discussion.</p> <p>6) If such discussion fails the HTA should consult the DRS.</p>

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### Risk Rating Matrix

		Probability of Occurrence (P)				
		Very Unlikely	Unlikely	Possible	Likely	Very likely
Consequence of Incident expressed as the resulting "Severity of Harm" (H)	Negligible	Trivial (1)	Trivial (2)	Trivial(3)	Tolerable(4)	Tolerable(5)
	Minor	Trivial(2)	Tolerable(4)	Tolerable(6)	Moderate(8)	Moderate(10)
	Moderate	Tolerable(3)	Tolerable(6)	Moderate(9)	Moderate(12)	Substantial(15)
	Major	Tolerable(4)	Moderate(8)	Moderate(12)	Substantial(16)	Very serious(20)
	Extreme	Moderate(5)	Moderate(10)	Substantial(15)	Very serious(20)	Very serious(25)

\*Residual Risk (RR) =H x P



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### Guidance on Interpretation

Parameter Level	HSE Descriptor	Meaning
<b>Severity of Harm (H)</b>		
1	Negligible	Postulated event not expected to lead to noticeable harm.
2	Minor	Level of harm that could lead to an injury that needs first aid treatment at the Mill
3	Moderate	Level of harm that could lead to an injury that requires professional help
4	Major	Serious medical injuries: for example broken limbs or a period of unconsciousness or the need to report the incident to a Regulatory Body
5	Extreme	Harm that could lead to death or life changing permanent injuries
<b>Probability of Occurrence (P)</b>		
1	Very Unlikely	Not more than once in 10 years
2	Unlikely	Not more than once a year
3	Possible	Over 1 but not more than twice a year
4	Likely	Over 2 but not more than 4 in a year
5	Very likely	Almost certain to appear: the occurrence is often overlooked as being a 'normal everyday occurrence'.

\*Residual Risk (RR) =H x P



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### Further Typical Measures that may be required to make the Residual Risk Acceptable

Risk R	Trivial	Tolerable	Moderate	Substantial	Very serious
Comment	Residual Risk (RR= 1 to 3) The risk is effectively non-existent and is acceptable as it stands.	RR = 4 to 6 The risk is adequately controlled but consider any justifiable minor additional measures	RR = 5-12 Additional controls should be considered where possible. The risk may or may not be adequately controlled.	RR=15-16 The risk is not adequately controlled: set out steps that must be taken before execution of operation can be approved	RR=20-25 The risk is not adequately controlled: the operation is unacceptable. Rigorous control methods are essential. Find an alternative if practicable.

\*Residual Risk (RR) =H x P