



Federation of Piling Specialists

**NOTES FOR GUIDANCE ON PUWER
(REGULATIONS 11 & 12)**

**IN RELATION TO
GUARDING AND CLEANING OF AUGERS ON PILING OPERATIONS**

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This document has been produced in consultation with the HSE

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Of necessity this document addresses the broad principles that should be adopted. Advice in respect of specific equipment or operations should be obtained from the appropriate body or technical reference source.

The recognition of the various and individual responsibilities of "DUTY OF CARE" are fundamental to the application of these Guidance Notes and the principle of "Identify the Hazard, Apply an appropriate Control Measure and Check the Residual Risk is low enough" should always be applied.

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NOTES FOR GUIDANCE ON PUWER (REGULATIONS 11 & 12) IN RELATION TO GUARDING AND CLEANING OF AUGERS ON PILING OPERATIONS

1.0 INTRODUCTION

- 1.1 The Federation of Piling Specialists (FPS) Auger Safety Working Group was formed following a meeting with the Health & Safety Executive (HSE), in April 1999. The working group included representatives from the FPS, HSE and rig manufacturers and has continued to meet from time to time since 1999 to ensure that these guidance notes remain current.
- 1.2 These guidance notes seek to identify a practical approach to The Provision and Use of Work Equipment Regulations (PUWER) 1998 as amended 2002, as they apply to rigs used in the bored piling industry.

The Federation of Piling Specialists (FPS) chaired a working group to consider continuous flight auger piling, rotary bored piling, displacement auger piling and limited access augered piling.

The British Drilling Association (BDA) chaired a second working group to consider small diameter drilling and mini-piling.

- 1.3 These guidance notes cover continuous flight auger, rotary bored piling, displacement auger piling and mini piling, Small diameter drilling, which is commonly used for grouting, soil nailing and ground anchoring applications, is covered elsewhere and reference should be made to the BDA Guidance Notes.
- 1.4 The new safety standard for drilling and foundation equipment BS EN 16228 is divided into 7 Parts; Part 1 - Common requirements, other Parts that are relevant include Part 2 - Mobile drill rigs for civil and geotechnical engineering, quarrying and mining and Part 4 - Foundation equipment, which are all listed in Appendix B at the end of this document. The main difference between Part 2 and Part 4 machines is that; smaller machines with a rotary torque less than 35 kNm, or having a multi-directional drilling capability, which usually involves the addition of drill rods, casing or augers during the drilling process are covered by Part 2, whereas typically larger rigs with a rotary torque greater than 35 kNm are covered by Part 4.

2.0 PILING SYSTEMS

2.1 Continuous Flight Auger Piling (CFA Piling)

With this type of pile the auger or digging tool extends over the full depth of the pile bore. Generally the auger is screwed into the ground in one pass although there are some variations involving telescoping masts or locking drive bars. On completion of the boring process concrete or grout is pumped through the stem of the auger as the tool, which is loaded with spoil, is extracted.

Spoil emanates at the surface as a result of displacement during the boring process as well as during the concreting or extraction process. The spoil is removed from the proximity of the pile by some form of excavator.

2.2 Rotary Bored Piling

The primary means of excavation for this type of pile is by auger, digging bucket or barrel. The tool is rotated by a Kelly bar powered by either a mechanical or hydraulic rotary table.

The excavation cycle consists of the tool being lowered into the pile bore, rotated to load the tool and then withdrawn fully loaded. Once the tool is above the ground the rig is commonly slewed to the side of the bore and the spoil is discharged. Each digging cycle typically

advances the bore up to 500mm, thus each pile consists of a large number of repetitive cycles. The pile bore may need to be temporarily cased (lined) using steel casings that are installed into the ground as the pile bore depth is increased. These are usually extracted during or immediately after the bore is filled with concrete.

2.3 Displacement Auger Piling

A variety of displacement auger piles are now being utilised in the UK. Here the tool is designed to displace the pile spoil laterally into the ground thus either eliminating or significantly reducing the volume of spoil emanating at the surface. The tooling is similar to rotary bored piling in that a short drilling head is generally driven by a smooth shaft at a low rotational speed. Should the situation arise that instead of a smooth Kelly bar, a continuous flight auger is used to drive the drilling head, the recommendations for CFA piling should be followed.

2.4 Mini Piling

When compiling market statistics the FPS differentiates between mini-piling and other bored piles on the basis of diameter in that 300mm and less is classified as mini-piling. However, mini piling rigs and techniques are now used to install piles of much greater diameter, often where access is limited. These rigs commonly have no cab in which the operator sits at the controls and the pile bore is advanced by extending the drill string in sections. The string could comprise an auger, a casing, or a drill rod.

The mini-piles can be constructed using a wide range of techniques. These may include rotary applications using tools and casings or the CFA method. Either way the pile may be formed using concrete or grout. The recommendations in this guide relate mainly to vertical piles. The installation of raking piles in excess of 10 degrees from the vertical is covered by a separate section.

2.5 Cased Piling

Cased Secant Piling (CSP) has been developed to combine the more cost effective CFA technique with the use of temporary casings that are traditionally used with rotary bored piling. Within the UK it is commonly referred to as 'CSP', however, depending on the equipment manufacturer, the technique is also referred to as:

- Cased Secant Piling
- Rotary Twin System
- Cased CFA

The auger and casing are both screwed into the ground at the same time using counter-rotating rotary tables (The auger is rotated clockwise and the casing is rotated anti-clockwise). The pile is constructed in one pass and during the boring process spoil emanates from the top of the casing and is then safely discharged to ground. When the required depth is reached, concrete or grout is pumped through the hollow stem of the auger as the auger and casing is withdrawn from the ground. Once the pile has been constructed, any spoil that is left in the auger is discharged out of the bottom of the casing directly onto the ground by slewing the rig to one side and rotating the auger anti-clockwise.

3.0 GENERAL REVIEW

3.1 PUWER

These guidance notes are concerned with Regulations 11 and 12 of PUWER. An extract is appended to this document and it is recommended that this be read in full. (There is also a listing of relevant documents in appendix B). In summary, Regulation 11 requires an employer to take effective measures to prevent access to any dangerous part of machinery or effective measures to stop the movement of any dangerous part before a person enters the danger

zone. With regard to the measures to be taken there is a strict hierarchy of control measures which need to be examined in terms of their practicability. They are ranked in order of importance as follows:-

- Fixed guards
- Other guards (eg interlocked guards) or protection devices (eg interlocked proximity guards)
- Protection appliances (unlikely to be applicable instead of guards)
- and the provision of information instruction, training and supervision as is necessary.

The word practicable has been defined by case law and is an extremely stringent test. It is important to note that the law does not consider cost to be a relevant factor in the determination of what is practicable.

Regulation 12 is concerned with protection against specific hazards. In this note the hazard being considered is the ejection of spoil from piling equipment. This is considered to present a particular hazard when ejection could occur at some height above the ground.

The employer must fit the guarding to comply with the highest practicable level in the hierarchy. A lower level of guarding may only be fitted if it is evident that the higher level is not practicable. It means that, for example, only if it can be demonstrated that a fixed guard is not practicable can other guarding be considered.

Notwithstanding the recommendations below, the working party and the HSE believe that training, supervision etc must be maintained at a high level on piling sites. In addition the Management of Health and Safety Regulations require that all operations be the subject of a risk assessment.

3.1.1 General Principles of Machine Guarding and Use

Permanent works designers and their structural engineers should be assisting by designing pile plans that do not require placement in very tight spaces. And principal contractors should be assisting by sequencing work to also avoid this.

Fixed guards should be attached using fittings that require a tool to dismantle them - eg spanner tight bolts/nuts.

Opening guards designed to prevent access to danger zones should be held closed by a positive interlock. This must be of a type that is not easily defeated. Where the guard only needs to be opened occasionally and at a time when rotation is not needed, it may be possible to secure the guard shut using eg a padlock or other tool tight fastening.

As a general principle opening guards with sufficient working room to be closed with a person still inside them are discouraged. This is because other industry sectors have experienced serious and fatal incidents when the machine could only be made to run with a person present to eg clear blockages. The layout of the guard should not facilitate poor practice.

A controlled zone will also be needed around the auger and spoil discharge area and attendant plant area. This is to ensure the rig crew leave the immediate area during operations that could result in entanglement or crush injuries or impact. In many instances the edge of the control zone is best defined using eg pedestrian barriers that are easy to move as work progresses. These act as a reminder and help with supervision. In most instances they do not need to be continuous or linked together, although this can help; for instance where the rig operator does not have a clear view of certain areas.

In all instances there will need to be an exclusion zone established around a piling rig in order to keep other trades and especially the public away from the operation. Where it is likely that people could get too close then the working area will need to be fenced off. In this situation the pedestrian barrier will usually need to be continuous or linked together. Public protection of this nature also prevents people being run over by moving plant.

3.2 Historical Context

The FPS has for many years sought to minimise accidents and incidents. It has a very active safety and training committee which enables members to share experiences and difficulties in order to achieve improvement. All members inform the FPS of events that are required to be reported to the HSE against RIDDOR 2013 on a quarterly basis and the causes and remedial measures are discussed at length. Since 1994 such reports have been related to various factors (e.g. age, time of day, etc.), and, in particular, the piling system has been recorded.

The subject of auger guarding and cleaning has been reviewed with the benefit of this information and in the context of the PUWER. The following observations are made for each of the piling systems being considered.

3.3 Continuous Flight Auger Piling

3.3.1 The guarding on CFA rigs has been the subject of much discussion. It is apparent that a certain amount of guarding can be provided over the lower area of the auger string. Adequate protection can be achieved by extending the gate (guide) which is used to maintain the position of the augers. This is present on the majority of rigs used for CFA piling. The gate needs to be opened to allow the piling rig to achieve its full depth and to facilitate the rigging of the augers. Larger guards which could accommodate the rotary table can be considered but these will still need to be opened, or entered within, for rigging purposes.

Additionally they do not allow work immediately adjacent to structures, especially in corners. To be acceptable, when anyone has to enter the danger zone, the auger must NOT be rotating

3.3.2 During the drilling process spoil rises to the surface as a result of displacement of the auger volume and bulking of the strata. The amount of spoil that arises can be quite large. Normally excavators are used to remove this spoil. The bottom of the guard has to be above ground level to allow spoil to exit the excavation and be removed. The height of the top of the guard has to be such as to prevent personnel coming into contact with the auger but there also needs to be due regard to the means of auger cleaning. A survey of a number of piling projects has been carried out and the recommendations for dimensions given in section 4 arise from these.

3.3.3 Of much greater seriousness is the incidence of spoil either being ejected or becoming detached from augers at various heights above ground and falling. This has caused injuries to personnel adjacent to the auger. This situation is of concern to the members of the FPS. Several methods and procedures have been tried with differing degrees of success.

3.3.4 A variety of means of cleaning have been examined. There are obvious problems with manually cleaning the auger using conventional hand held tools. This method is not viable for the larger diameter of pile and for ground conditions which make the removal of spoil from the auger very difficult. This method would only be legal when the auger is not rotating.

3.3.5 An attendant excavator can be used to remove spoil but this generally requires the bucket to be adapted and the 'local' driver to be trained to undertake this task.

3.3.6 Dedicated mechanical cleaners can be classified into three groups: star wheel cleaners operate from the side and use the rotation of the auger to facilitate the removal of spoil, bottle brush or rotating wire brush cleaners are powered brushes on a vertical shaft which sweep spoil from the auger and cylinder type cleaners which rotate around the auger and are made by several manufacturers (e.g. Soilmec, Casagrande, Dawson).

- 3.3.7 It is believed that each type of mechanical cleaner can be used to effectively and safely clean augers and each has its merits in different ground conditions.
- 3.3.8 If the cleaners themselves rotate then appropriate measures (e.g. guarding) will be required and the discharge of spoil must be such as to not cause a hazard.

3.4 Rotary Bored Piling

- 3.4.1 It is inadvisable to introduce guards into this process which would themselves create a greater hazard. However temporary casings are used to provide ground support at the surface. They also prevent personnel accidentally slipping into the bore and ensure that loose material cannot fall into the bore during the reinforcing or concreting cycles. Extending this casing to project above ground level provides some protection during most of the boring process.
- 3.4.2 In the recommendations in Section 5.0 consideration will need to be given to the hierarchy of measures detailed within PUWER, Regulation 11 as amended 2002.
- 3.4.3 The digging tools used in rotary piling vary according to the strata being excavated and include augers, digging and cleaning buckets and coring barrels. Since the buckets generally discharge directly onto the ground or spoil heap with no rotation, this guidance note only considers the cleaning of augers.

3.5 Displacement Auger Piling

- 3.5.1 Whilst this system is currently only a minor part of the existing UK bored piling market its use is likely to increase.
- 3.5.2 Being displacement piles, spoil is not normally an issue. The general nature of these systems is described above in section 2.3.
- 3.5.3 The rigs used to install displacement auger piles are typically the same as those used to install CFA piles. It is envisaged that the measures taken to meet the PUWER, regulation 11 for CFA piling will be equally applicable to displacement auger piling.

3.6 Mini Piling

- 3.6.1 Mini piling generally comprises small rigs, installing piles and achieving the required depth by means of extending the drill string or auger in sections. Short lengths of drill string (auger, casing or rod) typically 1m to 3m long are added until the required depth is reached. This is carried out either manually, with the assistance of an auxiliary winch or by using an automated feed system. In the absence of an automatic feed system, the crew require repeated access to the head of the drill string with the rotary table needing to pass up and down the full length of the mast. Some rotation of the head and drill string occurs during the addition of and removal of sections of drill string. The rotating drill string, even at relatively low speed is a source of potential danger.
- 3.6.2 On extraction, short lengths of auger, casing or rod are removed requiring repeated access by the crew to the head. It is essential for the spoil which is generated to be removed to permit safe access for the handling of the drill string.

3.7 Cased Piling

- 3.7.1 This technique combines CFA piling with the use of a casing. The casing provides the guard for the auger however, to mitigate the potential risk of entanglement on the casing surface a control zone is to be established using a pedestrian barrier.. ie - all personnel stay outside the control zone while the casing is rotating.
- 3.7.2 Spoil that emanates at the top of the casing shall be safely discharged to the ground.

4.0 CFA PILING : RECOMMENDATIONS ON GUARDING AND CLEANING

4.1 CFA Piling : Guarding

- 4.1.1 The guard on the rig should be kept closed whenever the auger is turning, except as noted below. Should manual intervention be required then the auger must be stopped.
- 4.1.2 To enable spoil emanating from the pile during drilling to be removed whilst constructing the pile, the bottom of the guard should be no more than 750mm above ground level.
- 4.1.3 The top of the guard should be at such a height above ground level as to preclude personnel coming into contact with the auger in normal usage. This height will be dependent on the shape of the guard but typically the level of the top should be 1.8 metres above ground level. Alternatively the guard should be sufficiently offset from the auger that personnel leaning over the guard cannot touch the auger. Please note the height of 1.8 metres represents best practice in the UK which is higher than is required under BS EN 16288.
- 4.1.4 A mechanical cleaner may also be used as a guide/guard or form part of a guard. If it is to provide guarding then it would either need to be fixed or have limited movement such as to maintain the required dimensions of guarding (see above).
- 4.1.5 It may be necessary to open the guard towards the end of the boring cycle to allow the lowering of the drill head to ground level. If such an event is necessary then the gate must be opened and no personnel should be in the area of the open gate whilst the auger is turning. Alternative guarding arrangements will also need to be made if any personnel are, or can be, within such proximity of the rotating auger as to make contact. The guard should be closed as soon as the rotary table is above the level of the guard during the extraction or concreting cycle. Alternative designs of guard which provide protection throughout the full boring cycle are to be preferred so long as the stand-off distance of the guard is not excessive.
- 4.1.6 Many rigs have fixed access ladders on the mast, which could enable personnel to come into close proximity of an unguarded auger. The auger must not be rotated when personnel are using such access, except to align auger connections. The bottom of these types of ladders shall be removed or made inaccessible whilst augering is in process.
- 4.1.7 In all cases a robust and full risk assessment must be undertaken for each job prior to the commencement of work, which reflects the hierarchy of control and addresses the guarding and cleaning of augers. A method statement shall be prepared and all operatives are to be briefed as to its contents and control measures.

4.2 CFA Piling : Cleaning

- 4.2.1 All CFA augers must be cleaned to prevent spoil being raised to such a height above ground level as to cause injury in the event of the spoil becoming dislodged. Given the guarding it is envisaged that cleaning will take place between 2m and 4m above ground level.
- 4.2.2 What is deemed to be a satisfactory level of cleaning must involve some judgement since it is not practicable to remove all material. The primary reason to remove spoil is

to prevent injury and it must therefore be the responsibility of the practitioner to decide what this amount is.

- 4.2.3 A mechanical means of cleaning the auger should be used except where exceptional circumstances do not permit it.
- 4.2.4 Should any manual cleaning be required then the auger must not be rotated whilst this operation is being performed.

4.3 CFA Piling : Exception

- 4.3.1 In most circumstances it is practicable to fit and operate the auger guards as detailed above. However, in extreme situations where mechanical means of guarding may not be practicable, then the guidance below, assuming that it is strictly adhered to, may be adopted as an alternative approach to the guarding of CFA augers referred to under section 4.1 above.

*[HSE guidance is that the project designer should be consulted, as it may be that the designer has not adequately considered the health and safety of those constructing the works in that the designer has failed to allow adequate working space for the piling rig to be operated safely.]

- 4.3.2 A controlled zone must be designated at each pile position and can be defined as a zone at least 2m radius from the centre of the auger. This shall be demarcated by means of a pedestrian barrier, along with appropriate signage. A banksman with full visibility of the controlled zone will be at all times in attendance whilst the piling rig is active and will be given authority and responsibility to ensure only authorised persons are permitted within the zone. No person is permitted within the zone whilst the auger is rotating. Should any manual intervention be required the auger must be stopped. An excavator can be used within the zone for the purposes of clearing spoil, but only under the banksman's supervision.
- 4.3.3 All persons entering the controlled zone must have received an induction from the piling contractor detailing the risks associated with CFA piling. The banksman must be trained on slinger/signaller matters and have had a minimum of the equivalent of one day's safety training in the previous 12 months. He must be identified as the banksman.

5.0 ROTARY BORED PILING : GUIDANCE ON GUARDING AND CLEANING

5.1 Rotary Bored Piling: Guarding

- 5.1.1. Temporary casings must be used on all piles and left a minimum of 950mm above the ground level to provide protection to the bore and at the area where the auger repeatedly passes below ground level. If the casing is installed below this level additional "pig-pen" or linked pedestrian fencing must be provided.
- 5.1.2. On rotary bored piling rigs where the kelly bar is mounted some considerable distance from the base machine (typically 4-5m), any fixed guard is not practicable.
- 5.1.3. Similarly any other guard or protection device is not practicable given the fact that the auger and kelly bar repeatedly enter the bore, are withdrawn and the whole assembly slewed off the pile location to discharge spoil (typically some 45° to 90° slew).
- 5.1.4. The following procedures shall be adhered to on rotary piling operations (as defined in this guidance note).
- 5.1.5. A controlled zone must be nominated at each pile location. This controlled zone will extend 2m beyond the area occupied by the rig and its slewing area, the pile bore and the discharge spoil heap. This shall be demarcated by means of a pedestrian barrier,

along with appropriate signage A rotary piling rig banksman will be at all times in attendance on the piling rig and will be given responsibility and authority to ensure only authorised persons are permitted within the zone.

- 5.1.6. All persons entering the controlled zone must have received an induction from the piling contractor detailing the risks associated with the rotary piling operation. The banksman must be trained on slinger signalling matters, have had a minimum of one day's safety training in the previous 12 months. He must be identified as the banksman.
- 5.1.7. In all cases a robust and full risk assessment must be undertaken for each job prior to the commencement of work, which reflects the hierarchy of control and addresses the guarding and cleaning of augers. A method statement shall be prepared and all operatives are to be briefed as to its contents and control measures.

5.2. Rotary Bored Piling : Cleaning

- 5.2.1 The discharge of spoil is likely to be hazardous and a thorough risk assessment should be made and appropriate measures taken. The recommendations made below will minimise the risk.
- 5.2.2. The loaded auger should be carefully slewed off the pile position to the discharge point in a controlled manner.
- 5.2.3 When the auger is being spun off it should be as close to the ground (or spoil heap) as possible to minimise the spread of spoil.
- 5.2.4 The auger spin speed should be only sufficient to empty the tool so as to minimise the spread of spoil.
- 5.2.5 In the event that it is necessary for the works to be carried out in close proximity to untrained or unaware personnel (e.g., adjacent site boundary or other operations) then suitable barriers will need to be erected or precautions taken to contain the spoil and protect any personnel (including those outside the site boundary) from debris.

6.0 DISPLACEMENT AUGER PILING: GUIDANCE ON GUARDING AND CLEANING

6.1 Displacement Auger Piling : Guarding

- 6.1.1 The recommendations on guarding for CFA piling in section 4 above should be used for displacement auger piling.

6.2 Displacement Auger Piling : Cleaning

- 6.2.1 Typically spoil is not generated by this technique therefore cleaning is not required. In situations where a continuous flight auger is used to drive the displacement tool, the guidelines for CFA (section 4.2) shall be followed.

7.0 MINI PILING: GUIDANCE ON GUARDING

7.1 Mini Piling: General

- 7.1.1 The rig controls should be positioned so that the operator has a clear view of the working process.
- 7.1.2 All controls should be physically remote from the rotary table and drill string and should be biased to the neutral position and with 'hold to run' controls.

7.2 Mini Piling: Guarding

- 7.2.1. On near vertical piles it is the HSE's position that interlocked guarding is practicable. The guard should cover the drill string from approximately 0.5m from to 1.6m above ground level (Where breakout clamps/jaws are fitted the guard should be no more than 200mm above the upper clamp/jaw), or an equivalent elevated position. The interlock when activated should put the machine in a "restricted operating mode", which means:
- a rotational speed of not more than 30 rpm or "inching mode" that is no more than half a revolution per activation and;
 - a feed speed of not more than 15 m/min, or "inching mode" that is no more than 10 cm feed stroke per activation and;
 - "hold-to-run" controls for rotation and feed functions and;
 - an indicator informing the operator and crew that the "restricted operating mode" is on.

When hold to run controls for rotation are released the rotating parts shall stop in less than half a revolution.

- 7.2.2. There are circumstances that are foreseen where specific; applications, positions, or orientations (e.g. confined spaces, limited working areas, work close to obstacles or structures) make it not possible to use of safeguards (guards and protective devices). In these circumstances a "special protective mode for specific circumstances" must be installed, which will allow the operation of the rig without guards and sensitive protective devices. However, safeguards must be designed to remain as far as possible fixed on to the rig e.g. adjustable, foldable, retractable, slideable.

The "special protective mode for specific circumstances" is not be permitted if the operator at the control station or when using a remote control has the possibility to reach the moving parts involved in the drilling process.

The "special protective mode for specific circumstances" must be selected by a lockable mode selector switch, which when activated; allows the machine to be operated as follows and the machine must be fitted with:

- rotation and feed controls must be hold-to-run;
- rotation and feed can operate at normal speed.
- a warning signal (visual and/or audible) informing the operator and crew that the "special protective mode for specific circumstances" is on;
- additional pressure sensitive devices.

During the use of the "special protective mode for specific circumstances" the rotation and feed speeds of the machine must be reduced when adding and removing rods or tools. The reduction of rotation and feed speed must be in accordance with the "restricted operating mode", which may be achieved for example by the activation of sensors fitted to clamps.

- 7.2.2 Guards should be robust enough to prevent a person from falling against the rig and drill string, but not so heavy that they cause instability of the rig. Regardless of age, rigs shall be fitted with a guard that is either retrofitted by the user or supplied and fitted by the manufacturer. The guard should not obscure the driller's vision. Where off-vertical drilling is being carried out, consideration should be given to the height of the guard necessary to comply with PUWER and the extent of the area to be guarded for inclined drilling shall be from a reference plane to a point where a person cannot reach the dangerous parts while these parts are moving. The reference plane shall normally be ground level but shall also include adjacent walkways or working platforms on the machine at higher level. Inclined drilling guards should extend upwards as far as necessary depending on the angle, to provide protection to a height of 1.8m above the reference plane. Where a rig is working in confined spaces, limited working areas or close to obstacles or structures then this feature can be included and considered as part of the guarding measure provided that the other elements forming the guard include an interlock that when activated puts the rig into a "safe handling mode".

- 7.2.3 At least one emergency stop should be fitted to each rig, one being next to the operator position. Such stops must be separate from the usual on/off switch and require a manual re-set once activated.
- 7.2.4 Both the interlock on the guard and the emergency stop shall be tested at the start of each shift.
- 7.2.5 Trip wires should be considered as additional snatch-wire emergency stops only. Where fitted they shall be fitted as close to the rotating drill string as possible to prevent injury from entrapment. If activated, trip devices should stop the rotation within half a turn of the drill string.
- 7.2.6 In most circumstances it is practicable to fit and operate the auger guards as detailed above. However, in extreme situations where mechanical means of guarding may not be practicable, then the guidance below, assuming that it is strictly adhered to, may be adopted as an alternative approach.
- 7.2.7 A controlled zone must be nominated at each pile position. This shall be demarcated by means of a pedestrian barrier, along with appropriate signage. A banksman with full visibility of the controlled zone will be at all times in attendance whilst the mini-piling rig is active and will be given authority and responsibility to ensure only authorised persons are permitted within the zone. No person is permitted within the zone whilst the auger or drill string is rotating. Should any manual intervention be required the auger or drill string must be stopped.
- 7.2.8 Although the interlock guard itself may not be present, the “safe handling mode” shall still be operable. The banksman will only be allowed to move inside the controlled zone once the “safe handling mode” is activated. This will be obvious to all from the indicator on the rig. The driller shall not operate the drill head at full speed when any person is standing inside the barrier.
- 7.2.9 All persons working close to the controlled zone must have received an induction from the piling contractor detailing the risks associated with mini piling and a reading of the method statement for that particular site. The banksman must be trained on slinger/signaller matters and have had a minimum of the equivalent of one day’s safety training in the previous 12 months. He must be identified as the banksman.

*[HSE guidance is that the project designer should be consulted, as it may be that the designer has not adequately considered the health and safety of those constructing the works in that the designer has failed to allow adequate working space for the piling rig to be operated safely.]
- 7.2.10 Notwithstanding 7.2.6 above, in all cases a robust and full risk assessment must be undertaken for each job prior to the commencement of work, which reflects the hierarchy of control and addresses the guarding and cleaning of augers. A method statement shall be prepared and all operatives are to be briefed as to its contents and control measures.

8.0 CASED PILING

8.1 Cased Piling: Guarding

- 8.1.1 During normal operations, the auger is guarded by the casing.
- 8.1.2 During drilling, partial protection from the rotating casing is provided by the casing clamps. In addition the zone directly around the casing will be barriered off by pedestrian barrier or the like.

- 8.1.3 Nevertheless, because of the entanglement and in-running nip potential outlined above, a controlled zone must be designated at each pile position and can be defined as a zone at 2m radius from the centre of the auger. A banksman with full visibility of the controlled zone will be at all times in attendance whilst the piling rig is active and will be given authority and responsibility to ensure only authorised persons are permitted within the zone.
- 8.1.4 All persons entering the controlled zone must be properly informed and instructed on the risks associated with Cased Piling. The banksman must be trained on slinger/signaller matters and have had a minimum of the equivalent of one day's safety training in the previous 12 months. He must be identified as the banksman.

8.2 Cased Piling: Cleaning

- 8.2.1 During the boring process, spoil 'flights' up the auger that is usually within the casing and emanates at the top of the casing, which may take place 20m - 30m above ground level. This spoil has to be safely discharged to ground level in a controlled manner, which may for example be achieved using a chute system to contain and control the fall of the spoil. The Safe Method of Work for this operation shall be fully described in the Method Statement and any risks dealt with in the Risk Assessment. In addition, where the auger and casing can be contrarotated independently, consideration must also be made to control any risk from spoil on exposed augers.
- 8.2.2 Once the pile has been constructed, any spoil that is left in the auger has to be discharged onto the ground in a controlled manner, which is normally achieved by:
- The rig is slewed to one side in a controlled manner with the casing as close as possible to the ground to minimise the spread of spoil.
 - The spoil is discharged by rotating the auger anti-clockwise. The speed of rotation should be only sufficient to empty the casing.

9.0 REVIEW

It is recognised that technology may develop to the extent that both the systems operated in the UK and the guarding and cleaning methods referred to in this document may be superseded. This aspect is to be kept under review by the FPS Safety committee to ensure that these guidance notes are appropriate and remain valid in such circumstances. The Safety Committee is to ensure that any changes that need to be made in the light of any relevant developments are communicated to the FPS membership and other working group members as an addendum or a revision to these guidance notes.

APPENDIX A

The Regulations

The Provision and Use of Work Equipment Regulations 1998 (PUWER 98) as amended by the Health and Safety (Miscellaneous Amendments) Regulations 2002 are made under the Health and Safety at Work etc Act 1974 (HSW Act) and came into force on 5 December 1998. PUWER 98 brings into effect the non-lifting aspects of the Amending Directive to the Use of Work Equipment Directive (AUWED). The primary objective of PUWER 98 is to ensure that work equipment should not result in health and safety risks, regardless of its age, condition or origin.

To provide guidance on the Regulations the Health & Safety Executive (HSE) has published an Approved Code of Practice (ACoP) entitled Safe Use of Work Equipment. The 2014 4th edition can be downloaded without charge from the HSE website. Note that the ACoP applies to all work equipment in all industry sectors and does not deal specifically with piling rigs.

The particular regulations considered by this guidance note are Regulation 11 and Regulation 12 which are as follows:-

Regulation 11

- 1) *Every employer shall ensure that measures are taken in accordance with paragraph (2) which are effective –*
 - a) *to prevent access to any dangerous part of machinery or to any rotating stock-bar; or*
 - b) *to stop the movement of any dangerous part of machine or rotating stock-bar before any part of a person enters a danger zone.*

- 2) *The measures required by paragraph (1) shall consist of –*
 - (a) the provision of fixed guards enclosing every dangerous part or rotating stock-bar where and to the extent that it is practicable to do so, but where or to the extent that it is not, then*

 - (b) the provision of other guards or protection devices where and to the extent that it is practicable to do so, but where or to the extent that it is not, then*

 - (c) the provision of jigs, holders, push-sticks or similar protection appliances used in conjunction with the machinery where and to the extent that it is practicable to do so,*

and the provision of such information, instruction, training and supervision as is necessary.

- 3) *All guards and protection devices provided under sub-paragraphs (a) or (b) of paragraph (2) shall*
 - a) *be suitable for the purpose for which they are provided;*
 - b) *be of good construction, sound material and adequate strength;*
 - c) *be maintained in an efficient state, in efficient working order and in good repair;*
 - d) *not give rise to any increased risk to health or safety;*
 - e) *not be easily bypassed or disabled;*
 - f) *be situated at sufficient distance from the danger zone;*
 - g) *not unduly restrict the view of operating cycle of the machinery, where such a view is necessary;*

- h) *be so constructed or adapted that they allow operations necessary to fit or replace parts and for maintenance work, restricting access so that it is allowed only to the area where the work is to be carried out and, if possible, without having to dismantle the guard or protection device.*
- 4) *All protection appliances provided under sub-paragraph (c) of paragraph (2) shall comply with sub-paragraphs (a) to (d) and (g) of paragraph (3)*
- 5) *In this regulation –*
 - “danger zone” means any zone in or around machinery in which a person is exposed to a risk to health or safety from contact with a dangerous part of machinery or a rotating stock-bar;*
 - “stock-bar” means any part of a stock-bar which projects beyond the head-stock of a lathe.*

Regulation 12

- 1) *Every employer shall take measures to ensure that the exposure of a person using work equipment to any risk to his health or safety from any hazard specified in paragraph (3) is either prevented, or, where that is not reasonably practicable, adequately controlled.*
- 2) *The measures required by paragraph (1) shall –*
 - a) *be measures other than the provision of personal protective equipment or of information, instruction, training and supervision, so far as is reasonably practicable; and*
 - b) *include where appropriate, measures to minimise the effects of the hazard as well as to reduce the likelihood of the hazard occurring.*
- 3) *The hazards referred to in paragraph (1) are –*
 - a) *any article or substance falling or being ejected from work equipment;*
 - b) *rupture or disintegration of parts of work equipment;*
 - c) *work equipment catching fire or overheating;*
 - d) *the unintended or premature discharge of any article or of any gas, dust, liquid, vapour or other substance which, in each case, is produced, used or stored in the work equipment;*
 - e) *the unintended or premature explosion of the work equipment or any article or substance produced, used or stored in it.*
- 4) *For the purposes of this regulation “adequately” means adequately having regard only to the nature of the hazard and the nature and degree of exposure to the risk.*

APPENDIX B

Legislation and Standards

The following list, whilst not exhaustive, gives some of the more important legislation which may be applicable in Great Britain. In other countries, reference should be made to the appropriate national legislation. UK Legislation can be downloaded without charge from www.legislation.gov.uk/uksi HSE publications can be downloaded without charge from www.hse.gov.uk

Legislation

Health and Safety at Work Act 1974

Management of Health and Safety Regulations 1999

Machinery Directive 06/42/EC 2006 Provision and use of Work Equipment Regulations 1998

The Health and Safety (Miscellaneous Amendments) Regulations 2002
Supply of Machinery (Safety) Regulations 2008 amended 2011
Construction (Design and Management) Regulations 2015

Standards

EN 16228	Part 1: Drilling and foundation equipment – Safety – Common requirements
EN 16228	Part 2: Drilling and foundation equipment – Safety – Mobile drill rigs for civil and geotechnical engineering, quarrying and mining
EN 16228	Part 4: Drilling and foundation equipment – Safety – Foundation equipment
BS EN ISO 12100:2010	General principles for design, risk assessment and risk reduction.
BS EN 953:1997 + A1:2009	Safety of Machinery – general requirements for the design and construction of guards
BS EN ISO 13850:2008	Safety of Machinery – emergency stops -principles
BS EN 1088: 1995 + A2:2008	Safety of Machinery – interlocking devices associated with guarding – principles for design and selection
BS EN 349: 1993 + A1:2008	Safety of Machinery – minimum gaps to avoid crushing of parts of the body
BS EN ISO 14121-1:2007	Safety of Machinery – risk assessment principles
BS EN ISO 13857:2008	Safety of Machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs
PD 5304: 2005	Guidance on the Safe Use of Machinery