resistance did not originate from another green plant but from a bacterium.

Be that as it may, of an Agrostis stolifera resistant to glyphosate herbicide becoming commercially available would have meant greenkeepers establishing pure stands on greens, tees and fairways which could then be sprayed with glyphosate to kill all 'contaminating' broadleaf weeds and rough grasses like timothy (Phleum pratense). Even other unwanted 'fine' turf species (e.g. Poa annua) would find their way into the sward one way or another.

The downside for greenkeepers would clearly have been the end of mixed turf grass species swards because anything other than the GM Agrostis stolonifera would be killed by the herbicide spray. Also grass clippings from the GM creeping bentgrass sprayed with glyphosate would be potentially toxic to other grasses and therefore requiring special handling and disposal.

GM grass pushes on

Further development of GM Agrostis stonifera was blocked but this did not deter the manufacturer (the seed company Scotts of Marysville in Ohio State and now called 'Scotts Miracle Gro') which is testing a new genetically modified turf grass in garden lawns of a small number of its employees during this 2014 growing season. The employees are testing a Poa pratensis (Kentucky bluegrass) genetically modified to withstand glyphosate in the 'Roundup' product developed, manufactured and marketed by Monsanto.

In January 2014 the Columbus (Ohio) Gazette said "If no one beats Scott's to the market it will be the first producer of what it calls 'enhanced turf grass'. Quoting Scott's they said the grass [GM Poa pratensis] is designed to grow slower, require less mowing, be easy to keep weed free and to require a lot less water.

GM turf grasses look set to make their mark in North America but obtaining approval in Europe and especially the UK may prove a much harder proposition. Not particularly due to scientific concerns in the EU, but general concerns articulated by the press and taken on board by broad swathes of the public.

Risk scenarios put forward against GM plant species are almost as varied as the gene transfer options offered to molecular biologists. Just imagine this invented scenario - "A bent grass (Agrostis) genetically modified for resistance to Fusarium Patch was approved and widely taken up by golf courses across the UK.

The gene conferring resistance was sourced from rhubarb and scientists said the 'rhubarb gene' caused the cells of the GM grass to manufacture a chemical that isolated leaf infections by Microdochium nivale. But the GM grass proved highly attractive to chafer grubs causing a population explosion and untold damage to golf courses throughout the country.

Foxes had a field day feeding on the chafer grubs but the chemical, transferred unaltered from chafer grubs to foxes, made these urban wild animals highly aggressive with reports of attacks on people all over London and other towns and cities throughout the country."

It clearly sounds contrived and is highly unlikely to happen but is just the sort of scenario bound to be used as an argument against, should development and approval of GM turf grass ever seem likely to happen in the UK.

TOP LEFT: Wild geese taking an early spring 'bite' among the few wild animals likely to eat GM grass

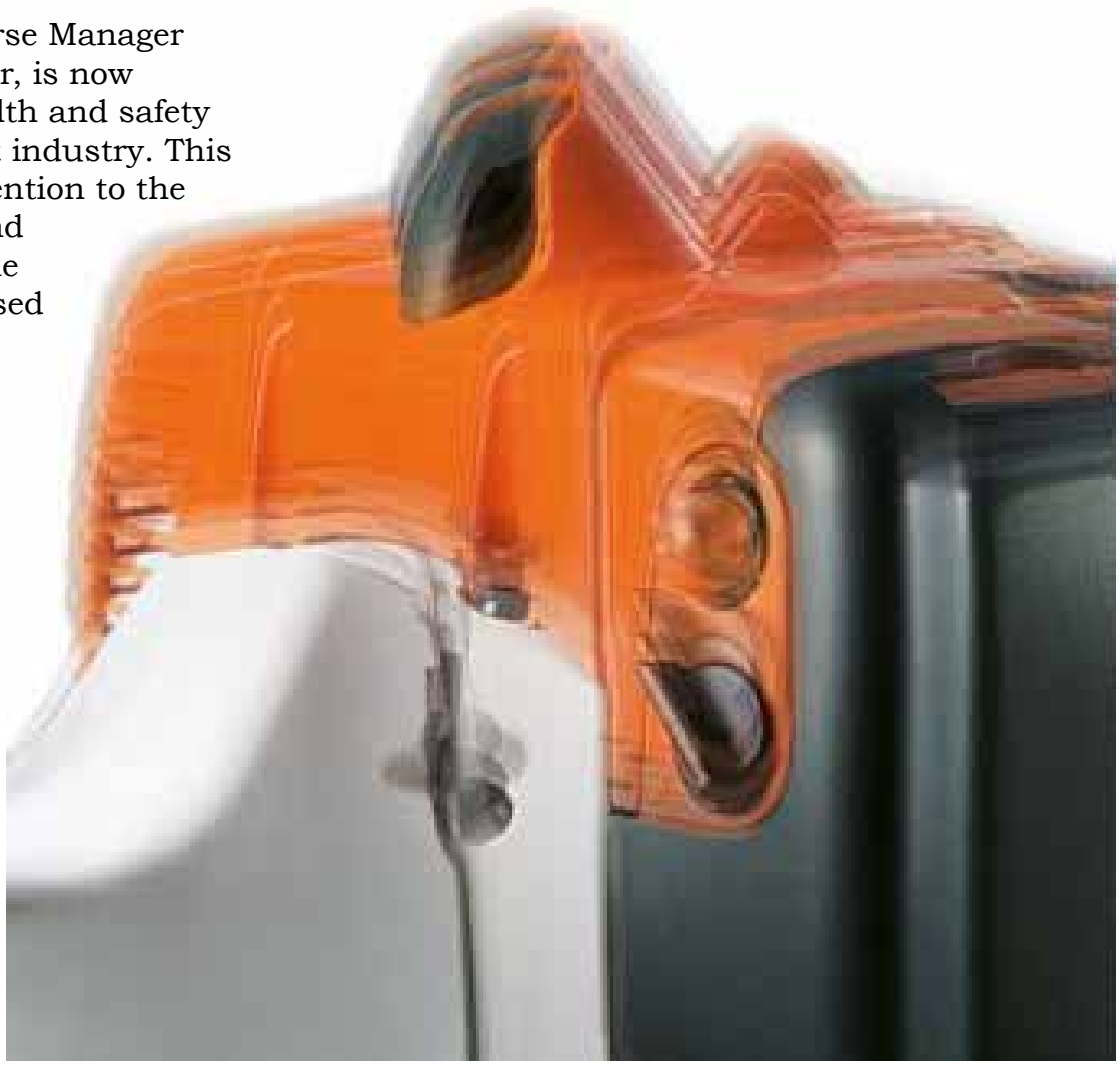
TOP RIGHT: 6 Changes in pesticide use brought about by the introduction of GM grass must not be allowed to add to environmental loading.

ABOVE LEFT: Turf grasses genetically modified for high salt tolerance would be of interest to coastal golf courses (Picture courtesy Kenny Liddell)

ABOVE RIGHT: There is always the fear that GM turf grass could impact on aquatic wildlife like the spawning frogs shown here

Bad Vibrations

John Ross, former Course Manager and Master Greenkeeper, is now working to improve health and safety in the turf management industry. This month he turns his attention to the common ailment of Hand Arm Vibration Syndrome – which is actually classed as a disease



The effects of vibration causing ill health and injury in the workplace are clearly understood. So much so that Hand Arm Vibration Syndrome (HAVS) has been listed as a prescribed disease in the UK since 1985 and is covered in RIDDOR2013(8) as being an occupational disease.

Its occurrence must be recorded by the person designated responsible for managing health and safety in the workplace and reported to the HSE.

So what is HAVS, how do we recognise it and how do we manage in order to prevent it?

HAVS is caused by the continuous use of vibrating machinery and affects nerves, muscles, joints and blood vessels. Symptoms appear in the vascular system which involves the tips of fingers going white (blanching), or the neurological system, which includes numbness and tingling of the fingers and a reduced sense of temperature or touch. Attacks in the early stages of the condition are not continuous and you do not have to be using vibrating equipment for the symptoms to manifest despite the fact they have been caused by that equipment, simply working in cold conditions is enough to trigger the symptoms.

When this occurs and the cold body subsequently warms back up an exaggerated return blood flow can occur that will lead to a throbbing of the fingers and the fingers going red and feeling extremely painful. HAVS will be triggered by conditions that have resulted in reduced blood circulation – and this includes smoking which causes small blood vessels to narrow and can exacerbate the symptoms.

If exposure to vibration continues then the symptoms will spread further up the hand and can even affect the thumb, sufferers will experience joint pain (Carpel Tunnel Syndrome) reduced muscle strength and permanent nerve damage. In turf management the equipment that can lead to HAVS is hand held power tools and hand guided power tools. HAVS does not appear overnight, it is a chronic condition that studies have suggested may take up to ten years to develop. Once it has developed it cannot currently be cured.

Managing HAVS

Exposure to vibration is regulated, and these regulations place a duty on the employer to either eliminate vibration at source, or to lower exposure to as low as is reasonably practicable. What eliminate at source means is taking physical contact with the vibrating equipment out of the task (using a remote control) or do not undertake the task (does that bank really need strimming?)

However where it cannot be eliminated (yes that bank does need strimming!) eliminate at source means introduce organisational and technical procedures appropriate to the activity and to apply MHSWR1999 (4) The Principles of Prevention.

So what do the regulations say?

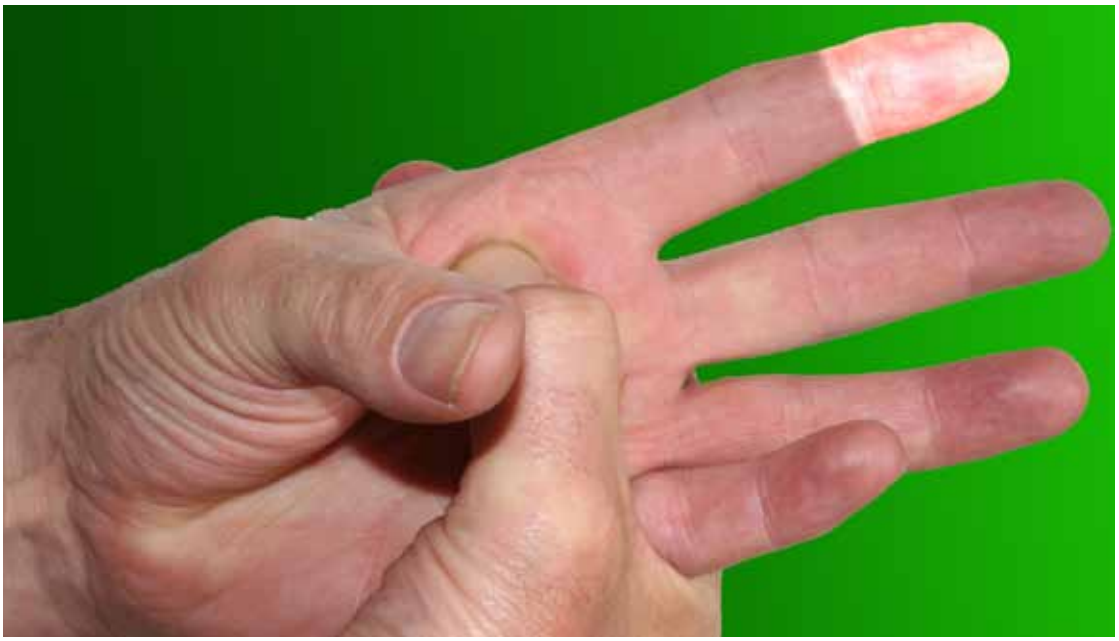
As vibration is a workplace hazard, any employer exposing their staff to vibration must conduct a vibration risk assessment. Like any risk assessment it is a tool that enables the manager to record what controls are in place, whether they are sufficient or not, and if any improvements needed. The risk

about the author

John Ross MG

John Ross is a Master Greenkeeper and was a Course Manager for 20 years. After taking redundancy in 2010 he studied for a degree in Health and Safety and is now a member of the Institution of Occupational Safety and Health. He established 'Compliant Grounds' in January 2013 with the intent of providing a qualified competent service to the golf industry - www.compliantgrounds.co.uk

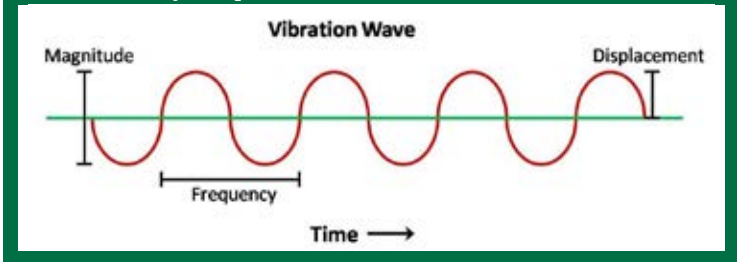
Catch John's 'Accident Causation' seminar at BIGGA's South East Regional Conference on Tuesday 19 November!



HSE Vibration Exposure Points Calculator

Vibration M/S2	3	4	5	6	7	8	9	10	12	15
Points per hour	18	32	50	72	98	130	160	200	290	450

100 points a day = Exposure Action Value
400 Points a day = Exposure Limit Value



assessment should determine who is exposed, the magnitude of exposure and the duration of exposure for all equipment. It should also identify vulnerable workers (those with early symptoms of HAVS) and young workers with developing bodies who are more susceptible to Musco Skeletal Disorder.

'You cannot manage what you cannot measure' is a well-known adage. Vibration can be measured because it is an oscillation around a fixed point and is measured like noise, in amplitude (the extent of oscillation) and frequency (how often it occurs).

In mechanical terms the measurement is expressed in Metres per second sq (M/S2), knowing the vibrating levels of machinery is the starting point to implementing procedures.

The amount of vibration you can be exposed to is subject to CVWR05 (4) Exposure Action Values (EAV) and Exposure Limit Values (ELV). The EAV is the amount of vibration over which the employer has to take action. The ELV is the maximum amount of vibration an employee can be exposed to in a day, these are both measured over an eight hour working period so is referenced as (A8). Unlike the regulations for noise Personal Protective Equipment is given no consideration.

Those values are an EAV of 2.5 M/S2 (A8) and an ELV of 5 M/S2 (A8). The data for these levels is provided by the manufacturers of the equipment and is published within the operators' manual. We must bear in mind that this is a measurement taken as factory new, and that equipment deteriorates, gets damaged, and is not always maintained as it should be.

The measurement provided by the manufacturer also does not consider wear and tear, service requirements, damaged parts, or blunt blades - all of which add to the vibration exposure. This means that any employer exposing employees to vibration also has a duty to measure to determine actual vibration levels.

Once vibration levels are established it is easy to put in place procedures that keep exposure levels below the ELV, the easiest way of doing this using a points system introduced by the HSE. Points are awarded to a vibration magnitude per hour, if the points tally for the day reaches 100 you have reached the Exposure Action Value and must take action, if the point tally reaches 400 you have hit the Exposure Limit Value that exposure cannot exceed.

Using the **HSE Vibration Exposure Points Calculator** we can see that equipment with a vibration magnitude of 5 M/S2 can be used for eight hours before the ELV is reached 50X8=400 exposure points.

I know from experience as a Course Manager, that much equipment greenkeepers and groundsmen use reaches the EAV, and some reaches the ELV, so we need to know what the duty of the employer is when those levels are reached. Those duties are shown in the table inset right (EAV):

Managing vibration is relatively easy once exposure levels have been established. The easiest way to do this is to put a timeframe on how long a piece of equipment can be used for, take into consideration breaks and rest periods and rotate tasks amongst the team all to ensure that points exposure on the HSE calculator remains below 400.

When purchasing equipment consider the vibration magnitude as part of your purchasing policy and buy the most suitable piece of equipment for the task but with the lowest exposure levels.

Inform your staff about HAVS and what the symptoms are, and tell them to report to you immediately if any symptoms are experienced and maintain equipment and ensure that it is set up correctly.

EAV

In applying the principles of prevention the employer should:

- Find other working methods which eliminate or reduce exposure
- Take account of the work to be done
- Choose equipment that reduces vibration exposure and replace equipment that is vibrating excessively
- Ensure equipment is maintained in accordance with the manufacturers' recommendations
- Provide employees with instruction on HAVS and what's being done to minimise exposure
- Limit the duration and magnitude of exposure with work schedules and rest periods
- Provide clothing to protect from the cold and the damp
- Implement a programme of health surveillance (in its simplest form this means regularly asking staff if any symptoms exist)

ELV

- Reduce exposure to below the limit value immediately
- Identify the reasons for that limit being exceeded and modify measures to prevent it being exceeded again

A Stirling success

Stirling Golf Club has initiated a ten-year development programme. Course Manager James Lindsay is working closely with Swan Golf Designs to achieve a better golf course. Howard Swan outlines the plans, the reasons behind them and explains why a close and harmonious relationship between greenkeeper and architect is so important

PICTURED: James Lindsay

Working together

It is always an exciting time for any golf course architect to visit a new project, particularly one at an established members' club. A club that calls on an architect's services may be looking to improve its layout, the condition and presentation and, ultimately, the performance - financially and otherwise - of its course.

However, we are repeatedly faced with a club that has clearly made short-term decisions regarding improving the course - possibly due to several changes of committees and the personnel within.

The president's legacy and/or the captain's mark are so often left behind long after they have departed, and become an integral part of the design of the golf course whether they are good or bad.

They then remain as an example of the personal involvement of the enthusiastic non-professional in the course.

This 'Do It Yourself' approach inevitably leads to wayward evolution of the course. There is far too much focus on tiny details because those making the decisions are simply too close to the action.

Getting things right in the way the course is redeveloped needs to be in the hands of the professional architect who can assess and evaluate the design of the golf course.

The professional greenkeeper can then take that assessment forward into a practical execution.

So, what is the plan at Stirling?

Stirling Golf Club has formed a Course Development Group to give the desired improvement works a sense of consistency over the ten-year period.

Autumn this year is likely to see the start of a woodland and landscape management programme to recreate the indigenous character of the course.

This will be accompanied by three of four holes being rebunkered in accordance with the overall plan.

This will be a fine start and will demonstrate to the membership the extent of the improvement which can be achieved without massive disruption, without massive capital cost and be the basis upon which subsequent years' works can be built and expanded, given that the resources are available to do so.

A technical audit of the old irrigation system is going to be made and there will also be some modest field drainage improvements.

The renovation programme is then likely to consider the redesign of some greens and tees to improve the routing as well as more bunkering.

A holistic view

Moving on, it is vitally important that a holistic view is taken of any course at one point in time and from this analysis, made objectively by the architect, recommendations for its future development follow.

That holistic view needs to encompass:

The course's overall design - its length, its balance, its rhythm, its flow, its variety, its challenge, the orientation of its holes, the variation from its flights of tees for the differing standards of play.

The course's safety - so often taken for granted, a problem may not be addressed until it is too late. You need to think about potential hazards on the margins of the course, and the proximity of the players on the course to each other when positioning greens and tees. Too close and you have a problem.

The performance of the greens - their shape, size, contour and the number of pin positions they have to spread wear and tear, their orientation to create an improved strategy of play, their entry and exit points, the featuring in their surrounds, their drainage, their bunkering

The performance of the tees - their size to ensure that wear and tear is managed relative to the way the flights are played by members and visitors alike, their shape and their profile

The performance of the bunkers - location, contribution to strategy, size and shape, playability, their technical performance in terms of drainage, both internally and in the shedding of water externally, sand quality, colour, depth and, some would argue most importantly, their aesthetic value

In each of these considerations, the ongoing maintainability of the

components has to be a vital consideration.

The performance of the various infrastructures of the golf course such as:

• **Its drainage -** the shedding of water, the collection of water, the speed of recovery from rainfall

• **Its traffic management** - the movement of feet, of two wheels, three wheels and four wheels, whether it be players or the greenkeeping team, needs to be considered and optimised in convenient routings.

This ensures speed of play is sustained and wear and tear and erosion is not allowed to develop in the playing area

• **Its irrigation,** not just how water is applied and what kind of system that is and where the sprinklers are, but a consideration of water management, from where the water is sourced to where it is stored

• **The setting of the golf course in its natural environment** - the management of the tree stock.

Not just endless planting exercises but balanced management, looking at areas around greens and tees to allow adequate air and light circulation.

Planned and structured new planting of appropriate, indigenous species to enhance the landscape quality and character.

• **The resourcing of the green-**keeping effort and the accompanying presentation of the course - the shaping of greens to be consistent with the length of hole and the type of incoming shot. The framing of each green with collars and surrounds of increasingly graded heights of cut at ratios to maximise their differentials.

Hopefully, this type of exhaustive approach will provide any club with a blueprint for the future, by which the golf course might be operated.

This should lead to the production of a comprehensive Course Policy Document.

James Lindsay, keen to see the course at Stirling improved in the short-term and long-term, is looking forward to working with the golf course architect in a collaborative approach to the task in hand.

However, no matter how good that approach might be, the membership need to be kept informed with the whole renovation programme.

So what is required from the greenkeeper to keep the membership on side?

Amongst other things – courage in your convictions, careful management to minimise disruption, information being given in the right form at the right time.

Above all – communication; from the architect and the greenkeeper. If this communication is unsuccessful, the membership will not be on board and it is doomed to failure without their support.

It has always been my view that helping the greenkeeping profession to understand more about what golf course architects strive to do and the basis upon which they try to do it will always bear fruit - and over 25 years of design and renovation seminars and workshops at BTME that has always been the intent.

Understanding more means a better result.

about the author

Howard Swan is one of Europe's most senior professional golf course architects. His career spans over 40 years and he has worked on over 400 projects in close to 40 countries from USA to China, from Iceland to South Africa. He worked with his father for 20 years, now with his son, William, for the last ten. He is a Past President of the Institute of the British Institute of Golf Course Architects and Chairman of the Golf Consultants' Association. He works extensively in golf education, being a GTC Quality Assured Training Specialist and has been a presenter at BTME for many years.

Choices, choices...

Natural hardwood signs or PVC timber signs? This used to be an easy decision: natural hardwood was chosen for its top quality image, whereas plastic was ideal where budget mattered more than presentation.

Then Eagle's new Eagle-Plex arrived and its innovative chemical structure led many club and course managers to see a black-stained oak sign, whereas it was in fact Eagle's new and realistic PVC timber material. We sort out the strengths and misconceptions in pursuit of clarity.

Natural Timber

Presentation:
Widely agreed to be the best material for a natural setting like a golf course, with a range of stains to suit different environments, e.g., links, heathland, parkland etc, has the edge when it comes to attracting sponsors looking for quality exposure.

Design:
Hardwood timber can be made to any design specification, and Eagle's standard range is comprehensive. Bespoke requirements are encouraged as Eagle have their own machining and finishing plant.

Substrate:
The experience gained in operating and managing their own timber plant has led to the utilisation of Iroko hardwood – which has proved to be the most stable of timbers for all outdoor situations, well able to last 25 years even if in contact with the ground.

Graphics:
Natural timber signs looks great with all substrates, zinc, granite and aluminium. Engraved and paint-filled course information is also very distinctive.

Maintenance:
The Teknos two coat system has reduced maintenance needs dramatically. The Teknos base coat chemically impregnates the skin of the timber, forming a perfect base for the top, water-based coat, ensuring far longer lifetime.

Eagle-Plex

Presentation:
Eagle-Plex's appearance is highly realistic with its 'wood grained' finish. Eagle-Plex signs and furniture are only available in black, but this still suits any course environment. Certainly good enough for sponsorship requirements.

Design:
PVC Timber has to be moulded, but Eagle have a large range of profiles available ensuring different sizes of sign frame which cannot be differentiated from old Oak.

Substrate:
The raw material is shredded and subjected to iron separation and made ready for injection moulding. The required volume of plastic material is poured into an Eagle mold and brought into the desired shape by hydraulic pressure to avoid warping. The results create super strong profiles ready for any environment, however harsh.

Graphics:
Like natural timber, Eagle-Plex works and looks great with aluminium plates. This option is not as size sensitive and therefore larger structures are very cost effective.

Maintenance:
None, other than 'keep it clean' with an occasional wipe with a damp cloth.