

Summary of Wind Turbine Accident data to 31 May 2017

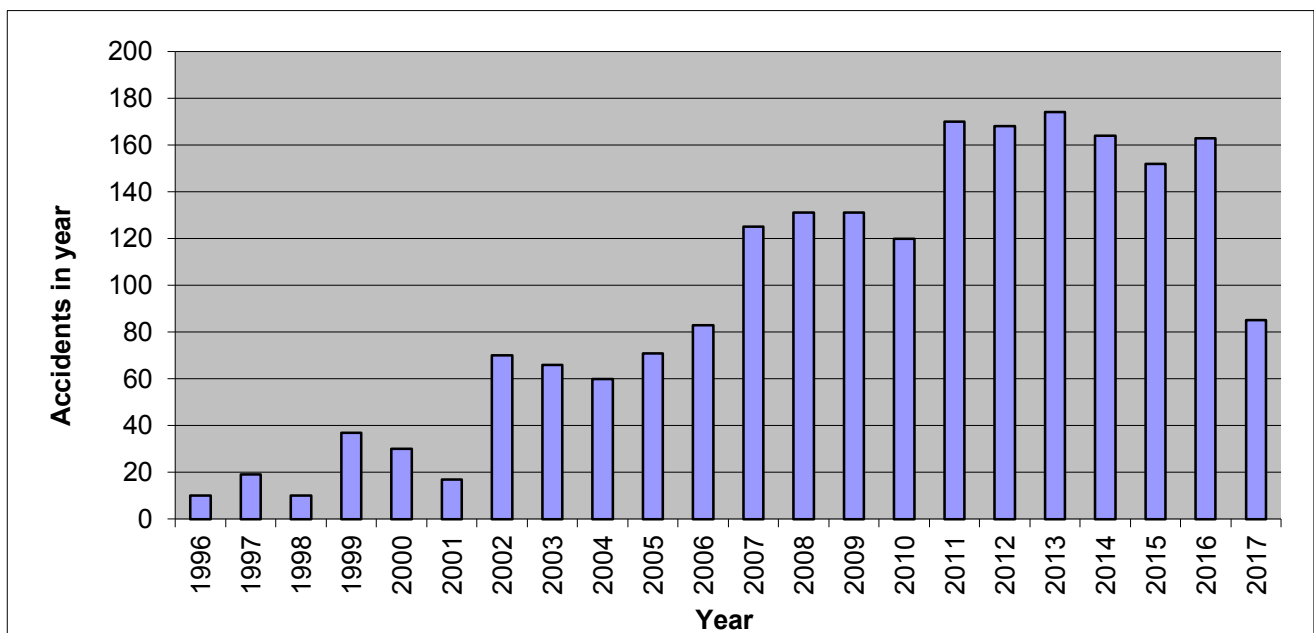
These accident statistics are copyright Caithness Windfarm Information Forum 2017. The data may be used or referred to by groups or individuals, provided that the source (Caithness Windfarm Information Forum) is acknowledged and our URL www.caithnesswindfarms.co.uk quoted at the same time. Caithness Windfarm Information Forum is not responsible for the accuracy of Third Party material or references.

The detailed table includes all documented cases of wind turbine related accidents and incidents which could be found and confirmed through press reports or official information releases up to 31 May 2017. CWIF believe that this compendium of accident information may be the most comprehensive available anywhere.

Data in the detailed table is by no means fully comprehensive – CWIF believe that it may only be the “tip of the iceberg” in terms of numbers of accidents and their frequency. Indeed on 11 December 2011 the Daily Telegraph reported that RenewableUK confirmed that there had been 1500 wind turbine accidents and incidents in the UK alone in the previous 5 years. Data here reports only 142 UK accidents from 2006-2010 and so the figures here may only represent 9% of actual accidents.

The data does however give an excellent cross-section of the types of accidents which can and do occur, and their consequences. With few exceptions, before about 1997 only data on fatal accidents has been found.

The trend is as expected – as more turbines are built, more accidents occur. Numbers of recorded accidents reflect this, with an average of 23 accidents per year from 1997-2001 inclusive; 70 accidents per year from 2002-2006 inclusive; 135 accidents per year from 2007-11 inclusive, and 164 accidents per year from 2012-16 inclusive.



2017: To 31 May 2017 only

This general trend upward in accident numbers is predicted to continue to escalate unless HSE make some significant changes – in particular to protect the public by declaring a minimum safe distance between new turbine developments and occupied housing and buildings.

In the UK, the HSE do not currently have a database of wind turbine failures on which they can base judgements on the reliability and risk assessments for wind turbines. Please refer to <http://www.hse.gov.uk/research/rrpdf/rr968.pdf>.

This is because the wind industry “guarantees confidentiality” of incidents reported. Please refer to <http://www.renewableuk.com/en/our-work/health-and-safety/incidents--alerts.cfm> No other energy industry works with such secrecy regarding incidents. The wind industry should be no different, and the sooner RenewableUK makes its database available to the HSE and public, the better. The truth is out there, however RenewableUK don't like to admit it.

Some countries are finally accepting that industrial wind turbines can pose a significant public health and safety risk. In June 2014, the report of the Finnish Ministry of Health called for a minimum distance of 2 km from houses by concluding: *"The actors of development of wind energy should understand that no economic or political objective must not prevail over the well being and health of individuals."* In 2016 Bavaria passed legislation requiring a minimum 2km distance between wind turbines and homes, and Ireland are considering a similar measure.

The Scottish government has proposed increasing the separation distance between wind farms and local communities from 2km to 2.5km (<http://www.bbc.co.uk/news/uk-scotland-scotland-politics-26579733>) though in reality the current 2km separation distance is often shamefully ignored during the planning process.

Our data clearly shows that blade failure is the most common accident with wind turbines, closely followed by fire. This is in agreement with GCube, the largest provider of insurance to renewable energy schemes. In June 2015, the wind industry's own publication "WindPower Monthly" published an article confirming that "Annual blade failures estimated at around 3,800", based on GCube information. A GCube survey in 2013 reported that the most common type of accident is indeed blade failure, and that the two most common causes of accidents are fire and poor maintenance. <http://www.gcube-insurance.com/press/gcube-top-5-us-wind-energy-insurance-claims-report/> A further GCube report in November 2015 states that there are an average 50 wind turbine fires per year. <http://www.gcube-insurance.com/en/press/gcube-tackles-turbine-fires/> This is over double the reported CWIF data below, further underpinning that data presented here may only be "the tip of the iceberg".

Data below is presented chronologically. It can be broken down as follows:

Number of accidents

Total number of accidents: 2089

By year:

Year	Before 2000	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	*17
No.	109	30	17	70	66	60	71	83	125	131	131	120	170	168	174	164	152	163	85

* To 31 May 2017 only

Fatal accidents

Number of fatal accidents: 132

By year:

Year	Before 2000	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	*17
No.	24	3	0	1	4	4	4	5	5	11	8	8	15	16	4	2	7	5	6

* To 31 May 2017 only

Please note: **There are more fatalities than accidents as some accidents have caused multiple fatalities.**

Of the 179 fatalities:

- 108 were wind industry and direct support workers (divers, construction, maintenance, engineers, etc), or small turbine owner /operators.
- 71 were public fatalities, including workers not directly dependent on the wind industry (e.g. transport workers). 17 bus passengers were killed in one single incident in Brazil in March 2012; 4 members of the public were killed in an aircraft crash in May 2014 and a further three members of the public killed in a transport accident in September 2014.

Human injury

152 accidents regarding human injury are documented.

By year:

Year	Before 2000	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	*17
No.	5	4	1	2	2	2	6	10	16	16	9	14	12	15	9	8	8	9	4

* To 31 May 2017 only

Please note: **There are more injuries than accidents as some accidents have caused multiple injuries.**

During the 152 accidents, 168 wind industry or construction/maintenance workers were injured, and a further 74 members of the public or workers not directly dependent on the wind industry (e.g. fire fighters, transport workers) were also injured. Eight of these injuries to members of the public were in the UK.

Human health

Since 2012, 102 incidents of wind turbines impacting upon human health are recorded.

By year:

Year	12	13	14	15	16	*17
No.	6	27	19	13	17	20

* To 31 May 2017 only

Since 2012, human health incidents and adverse impact upon human health have been included. These were previously filed under “miscellaneous” but CWIF believe that they deserve a category of their own. Incidents include reports of ill-health and effects due to turbine noise, shadow flicker, etc. Such reports are predicted to increase significantly as turbines are increasingly approved and built in unsuitable locations, close to people’s homes.

Blade failure

By far the biggest number of incidents found was due to blade failure. “Blade failure” can arise from a number of possible sources, and results in either whole blades or pieces of blade being thrown from the turbine. A total of 370 separate incidences were found:

By year:

Year	Before 2000	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	*17
No.	35	4	6	15	13	15	12	17	23	20	26	20	20	28	35	31	19	21	10

* To 31 May 2017 only

Pieces of blade are documented as travelling up to one mile. In Germany, blade pieces have gone through the roofs and walls of nearby buildings. This is why CWIF believe that there should be a minimum distance of at least 2km between turbines and occupied housing, in order to adequately address public safety and other issues including noise and shadow flicker.

Fire

Fire is the second most common accident cause in incidents found. Fire can arise from a number of sources – and some turbine types seem more prone to fire than others. A total of 299 fire incidents were found:

By year:

Year	Before 2000	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	*17
No.	7	3	2	24	17	16	14	12	21	17	17	13	20	19	24	19	18	28	7

* To 31 May 2017 only

A GCube report in November 2015 states that there are an average 50 wind turbine fires per year. <http://www.gcube-insurance.com/en/press/gcube-tackles-turbine-fires/> This is over double the reported CWIF data above, further underpinning that data presented here may only be “the tip of the iceberg”.

The biggest problem with turbine fires is that, because of the turbine height, the fire brigade can do little but watch it burn itself out. While this may be acceptable in reasonably still conditions, in a storm it means burning debris being scattered over a wide area, with obvious consequences. In dry weather there is obviously a wider-area fire risk, especially for those constructed in or close to forest areas and/or close to housing. Four fire accidents have badly burned wind industry workers.

Structural failure

From the data obtained, this is the third most common accident cause, with 189 instances found. “Structural failure” is assumed to be major component failure under conditions which components should be designed to withstand. This mainly concerns storm damage to turbines and tower collapse. However, poor quality control, lack of maintenance and component failure can also be responsible.

By year:

Year	Before 2000	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	*17
No.	15	9	3	9	7	4	7	9	13	9	16	9	13	10	14	13	12	11	6

* To 31 May 2017 only

While structural failure is far more damaging (and more expensive) than blade failure, the accident consequences and risks to human health are most likely lower, as risks are confined to within a relatively short distance from the turbine. However, as smaller turbines are now being placed on and around buildings including schools, the accident frequency is expected to rise.

Ice throw

39 reports of ice throw were found. Some are multiple incidents. These are listed here unless they have caused human injury, in which case they are included under “human injury” above.

By year:

Year	Before 2000	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	*17
No.	9	0	0	2	2	4	4	3	0	3	4	1	1	1	0	1	1	3	0

* To 31 May 2017 only

Ice throw has been reported to 140m. Some Canadian turbine sites have warning signs posted asking people to stay at least 305m from turbines during icy conditions.

These are indeed only a very small fraction of actual incidences – a report* published in 2003 reported 880 icing events between 1990 and 2003 in Germany alone. 33% of these were in the lowlands and on the coastline.

* ("A Statistical Evaluation of Icing Failures in Germany's '250 MW Wind' Programme – Update 2003, M Durstwitz, BOREAS VI 9-11 April 2003 Pyhänturi, Finland.)

Additionally one report listed for 2005 includes 94 separate incidences of ice throw and two reports from 2006 include a further 27 such incidences. The 2014 entry refers to multiple YouTube videos and confirmation that ice sensors do not work.

Transport

There have been 177 reported accidents – including a 45m turbine section ramming through a house while being transported, a transporter knocking a utility pole through a restaurant, and various turbine parts falling off and blocking major highways. Transport fatalities and human injuries are included separately. Most accidents involve turbine sections falling from transporters, though turbine sections have also been lost at sea, along with a £50M barge. Transport is the single biggest cause of public fatalities and injuries.

By year:

Year	Before 2000	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	*17
No.				4		3	6	6	19	10	11	11	24	17	12	17	14	15	8

* To 31 May 2017 only

Environmental damage (including bird deaths)

212 cases of environmental damage have been reported – the majority since 2007. This is perhaps due to a change in legislation or new reporting requirement. All involved damage to the site itself, or reported damage to or death of wildlife. 66 instances reported here include confirmed deaths of protected species of bird. Deaths, however, are known to be far higher. At the Altamont Pass windfarm alone, 2400 protected golden eagles have been killed in 20 years, and about 10,000 protected raptors (Dr Smallwood, 2004). In Germany, 32 protected white tailed eagles were found dead, killed by wind turbines (Brandenburg State records). In Australia, 22 critically endangered Tasmanian eagles were killed by a single windfarm (Woolnorth). Further detailed information can be found at: www.iberica2000.org/Es/Articulo.asp?Id=3071 and at: www.iberica2000.org/Es/Articulo.asp?Id=1875

600,000 bats were estimated to be killed by US wind turbines in 2012 alone. 1.4 million bird fatalities per annum are estimated if the US reaches it's 20% target for wind generation.

1,500 birds are estimated to be killed per year by the MacArthur wind farm in Australia, 500 of which are raptors.

By year:

Year	Before 2000	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	*17
No.	1	0	1	1	8	1	6	5	10	21	13	19	20	20	16	21	18	22	9

* To 31 May 2017 only

Other (miscellaneous)

417 miscellaneous accidents are also present in the data. Component or mechanical failure has been reported here if there has been no consequential structural damage. Also included are lack of maintenance, electrical failure (not led to fire or electrocution), etc. Construction and construction support accidents are also included, also lightning strikes when a strike has not resulted in blade damage or fire. A separate 1996 report** quotes 393 reports of lightning strikes from 1992 to 1995 in Germany alone, 124 of those direct to the turbine, the rest are to electrical distribution network.

** (Data from WMEP database: taken from report "External Conditions for Wind Turbine Operation – Results from the German '250 MW Wind' Programme", M Durstewitz, et al, European Union Wind Energy Conference, Goeteborg, May 20-24, 1996)

By year:

Year	Before 2000	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	*17
No.	13	7	4	12	13	11	12	16	18	24	27	25	43	36	33	33	42	32	15

* To 31 May 2017 only

Caithness Windfarm Information Forum
31 May 2017