

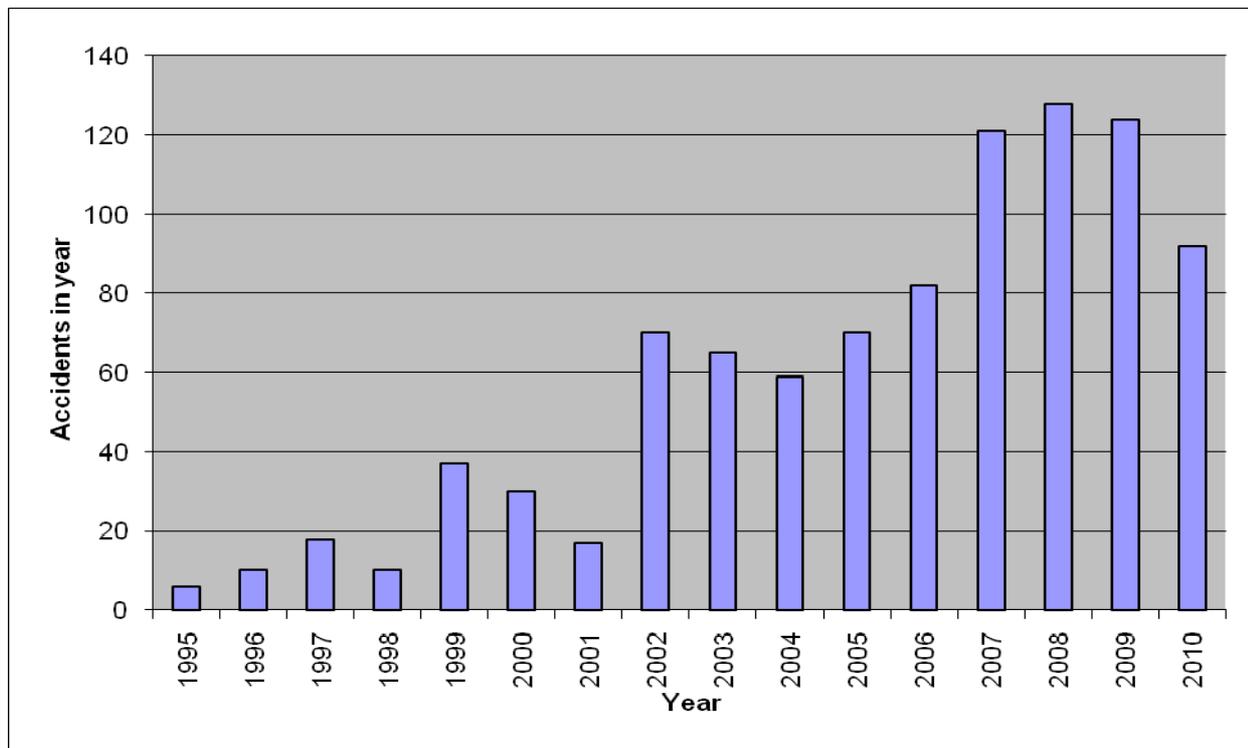
Summary of Wind Turbine Accident data to 31 December 2010

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The accompanying detailed table includes all documented cases of wind turbine related accidents which could be found and confirmed through press reports or official information releases up to 31 December 2010. 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. However, the data gives 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 16 accidents per year from 1995-99 inclusive; 48 accidents per year from 2000-04 inclusive, and 103 accidents per year from 2005-10 inclusive.



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 (around 2km in Europe), and declaring “no-go” areas to the public, following the 500m exclusion zone around operational turbines imposed in France.

Detailed data is presented chronologically. It can be broken down as follows:

Number of accidents

Total number of accidents: 966

By year:

Year	70s	80s	90-94	95-99	00	01	02	03	04	05	06	07	08	09	10
No.	1	9	17	81	30	17	70	65	59	70	82	121	128	124	92

Fatal accidents

Number of fatal accidents: 67

By year:

Year	70s	80s	90-94	95-99	00	01	02	03	04	05	06	07	08	09	10
No.	1	8	8	7	3		1	4	4	3	5	4	9	5	5

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

Of the 73 fatalities:

- 52 were wind industry and direct support workers (maintenance/engineers, etc), or small turbine owner /operators.
- 21 were public fatalities, including workers not directly dependent on the wind industry (e.g. transport workers).

Human injury

77 accidents regarding human injury are documented.

By year:

Year	70s	80s	90-94	95-99	00	01	02	03	04	05	06	07	08	09	10
No.			2	3	4	1	2	2	2	6	10	14	15	7	9

64 accidents involved wind industry or construction/maintenance workers, and a further 13 involved members of the public or workers not directly dependent on the wind industry (e.g. transport workers). Five of these injuries to members of the public were in the UK.

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 201 separate incidences were found:

By year:

Year	70s	80s	90-94	95-99	00	01	02	03	04	05	06	07	08	09	10
No.			3	32	4	6	15	13	15	12	16	22	20	25	18

Pieces of blade are documented as travelling up to 1300 meters. 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 154 fire incidents were found:

By year:

Year	70s	80s	90-94	95-99	00	01	02	03	04	05	06	07	08	09	10
No.			1	5	3	2	24	17	15	14	12	21	17	16	7

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. Two fire accidents have badly burned wind industry workers.

Structural failure

From the data obtained, this is the third most common accident cause, with 108 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	70s	80s	90-94	95-99	00	01	02	03	04	05	06	07	08	09	10
No.		1	1	13	9	3	9	7	4	7	9	13	9	16	7

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

31 incidences 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	70s	80s	90-94	95-99	00	01	02	03	04	05	06	07	08	09	10
No.				9			2	2	4	4	3		3	4	

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 Pyhäunturi, 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.

Transport

There have been 68 reported accidents – including a 45m turbine section ramming through a house while being transported, a transporter knocking a utility pole through a restaurant, and a turbine section falling off in a tunnel. 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.

By year:

Year	70s	80s	90-94	95-99	00	01	02	03	04	05	06	07	08	09	10
No.							4		3	6	6	19	10	11	9

Environmental damage (including bird deaths)

82 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. 32 instances include confirmed deaths of protected species of bird.

By year:

Year	70s	80s	90-94	95-99	00	01	02	03	04	05	06	07	08	09	10
No.			1			1	1	7	1	6	5	10	21	13	16

Other (miscellaneous)

178 miscellaneous accidents are also present in the data. Component 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) and planning “accidents” where towers have been installed closer than permitted to housing, 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	70s	80s	90-94	95-99	00	01	02	03	04	05	06	07	08	09	10
No.			1	12	7	4	12	13	11	12	16	18	24	27	21

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