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Summary of Wind Turbine Accident data to 31 March 2009

The 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 March 2009. 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 this 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.

The trend is as expected – as more turbines are built, the more accidents occur. Numbers of recorded accidents reflect this, with an average of **65.1** accidents found per year from 2002 to 2008 inclusive, and only an average of **15.7** accidents found per year in the previous seven years (1995-2001 inclusive). With few exceptions, before about 1997 only data on fatal accidents has been found.

There is a general trend upward in accident numbers over the past 10 years. This is predicted 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 (currently 2km in Europe), and declaring "no-go" areas to the public, following the 500m exclusion zone around operational turbines imposed in France.

Data on the detailed table is presented chronologically. It can be broken down as follows:

Number of accidents

Total number of accidents: 622

By year:

Year	70s	80s	90-94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09*
No.	1	8	17	5	9	16	8	33	28	11	64	50	52	54	54	83	99	20

**09 to 31 March 2009 only*

Fatal accidents

Number of fatal accidents: 55

By year:

Year	70s	80s	90-94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09*
No.	1	8	8		2	4		1	3		1	3	4	3	5	4	7	1

**09 to 31 March 2009 only*

Fatal accidents include 8 transport/driver distraction accidents and 2 unconfirmed accidents from 1996.

Of the 60 fatalities:

- 44 were wind industry or support workers (maintenance/engineers, etc) and one farmer attempting to maintain his own turbine. Most common cause - falls from turbines. Included is one apparent suicide.
- 16 were public fatalities, of which three were from road accidents attributed to "driver distraction of turbines" by police, two were from road accidents involving turbine component transport, one was in a transport accident in which the road collapsed and the driver drowned, one was in a transport accident in which a transport worker lost his leg when loading a trailer and later died, one was from an aircraft accident which hit a new and unmarked anemometer, four were from an further aircraft accident which flew into a turbine in fog (one incident killing four people), one was a 16-year old boy strangled after his necktie became tangled around an unprotected turbine shaft, one was a farmer who killed himself due to the pressure of public opposition to his proposed wind turbines, one was electrocuted, and the remaining accident was the collision of a parachutist with a turbine.

Human injury

A further 32 accidents regarding human injury are documented.

By year:

Year	70s	80s	90-94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09*
No.			2		1		1	1	3	1	2	2	1	2	4	3	8	1

**09 to 31 March 2009 only*

Twenty-four accidents involved wind industry or construction/maintenance workers, and a further eight involved members of the public: one lost a leg in a transport accident, two were hit by thrown ice, one suffered spinal injuries from a falling turbine part, one fell from 100m metre tower during an accompanied visit, one was injured but survived a fatal crash with a turbine transporter which killed his wife, one flew his aircraft into a windfarm site, and one had a "near miss" crashing his paraglider near turbines. Three of these injuries to members of the public were in the UK. One 2003 accident resulted in two industry workers receiving appalling burns.

Blade failure

By far the biggest number of incidents found were 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 147 separate incidences were found:

By year:

Year	70s	80s	90-94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09*
No.			3	3	3	6	1	18	3	5	15	13	14	9	12	17	18	7

**09 to 31 March 2009 only*

Pieces of blade are documented as travelling over 400m, typically from much smaller turbines than those proposed for use today. 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 line with other European countries - 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 129 fire incidents were found:

By year:

Year	70s	80s	90-94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09*
No.			1	1		1	1	2	3	1	24	16	15	14	12	20	16	2

**09 to 31 March 2009 only*

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 70 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	96	97	98	99	00	01	02	03	04	05	06	07	08	09*
No.			1				3	6	9	2	8	3	3	7	6	11	9	2

**09 to 31 March 2009 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. During November-December 2006, one school turbine collapsed and a second threw its blades, luckily at times outwith school hours. There has been a sharp rise in structural failures in the latter part of 2007 continuing into 2008.

Ice throw

28 incidences of ice throw were found (one of which has been classed as "human injury" above, in italics below):

By year:

Year	70s	80s	90-94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09*
No.					4	3		3	*1*		2		4	3	2		3	3

**09 to 31 March 2009 only*

Ice throw has been reported to 140m. Some Canadian windfarms 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 Pyhätunturi, Finland.)*

Transport (non-fatal)

There have been 36 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. One man lost his leg in 2006 following a transport accident off the Scottish coast. Most involve turbine sections falling from transporters, though turbine sections have also been lost at sea, along with a £50M barge. Two turbine sections fell from main roads in Scotland.

By year:

Year	70s	80s	90-94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09*
No.									1		4		2	4	4	14	8	0

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The "2000" incident refers to a newspaper report which reports 73 accidents over 4 years along a 4km piece of road, and attributes them to driver distraction by turbines and thrown ice and blade pieces landing on and over the road.

Environmental damage (including bird deaths)

Only 51 cases of environmental damage have been reported – the majority during 2008. 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. Eighteen instances include deaths of protected species of bird.

By year:

Year	70s	80s	90-94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09*
No.			1							1	1	6	1	5	7	7	20	2

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Other (miscellaneous)

Other types of accident are also present in the data. Component failure has been reported under "other" 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. One entry under "construction" covers accidents and at least one human injury during construction of the Horns Rev offshore windfarm in 2002. Lightning strikes have been included under "other" only 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)*

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