

Summary of Wind Turbine Accident data to 31 December 2009

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The summary may be downloaded in printable form by clicking [here](#)

The full accident list may be downloaded by clicking [here](#)

The attached 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 2009. CWIF believe that this compendium of accident information may be the most comprehensive available anywhere.

Data in the detailed table attached is by no means fully comprehensive – CWIF believe that what is attached 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 **72.1** accidents found per year from 2002 to 2009 inclusive, and only an average of **16.0** 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 attached is presented chronologically. It can be broken down as follows:

Number of accidents

Total number of accidents: 715

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 | 29 | 12 | 63 | 51 | 52 | 55 | 55 | 83 | 112 | 106 |

Fatal accidents

Number of fatal accidents: 60

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 | 9 | 4 |

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

Of the 66 fatalities:

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

Human injury

A further 38 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 | 4 | 1 | 2 | 2 | 1 | 2 | 4 | 3 | 8 | 6 |

Twenty-nine accidents involved wind industry or construction/maintenance workers, and a further nine involved members of the public. Four of these injuries to members of the public were in the UK.

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 167 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 | 2 | 18 | 4 | 5 | 15 | 12 | 14 | 10 | 13 | 17 | 18 | 24 |

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 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 138 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 | 17 | 15 | 14 | 12 | 20 | 16 | 10 |

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 84 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 | 4 | 3 | 7 | 6 | 11 | 9 | 15 |

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. There has been a sharp rise in structural failures from the latter part of 2007 continuing through 2008 to present.

Ice throw

27 incidences of ice throw were found. 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 | 96 | 97 | 98 | 99 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 |
|------|-----|-----|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| No. | | | | | 3 | 3 | | 3 | | | 2 | 1 | 4 | 3 | 2 | | 3 | 3 |

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.)

Transport

There have been 45 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. | | | | | | | | | | | 4 | | 2 | 4 | 3 | 14 | 8 | 10 |

Environmental damage (including bird deaths)

Only 60 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. Twenty-seven 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 | 7 | 1 | 5 | 3 | 8 | 20 | 13 |

Other (miscellaneous)

95 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 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 | 96 | 97 | 98 | 99 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 |
|------|-----|-----|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| No. | | | 1 | 1 | | 2 | 1 | 2 | 6 | 2 | 6 | 5 | 8 | 7 | 7 | 6 | 21 | 21 |