

# 2.16 NATURAL AND TECHNOLOGICAL DISASTERS



Natural disasters, such as earthquakes and floods affect the normal functioning of a country. They can result in high death rates and extensive damage to infrastructure and services. There are a varying number of victims and deaths in Spain as a result of such disasters.

The earthquake recorded in the town of Lorca (Murcia) on 11 May was the most serious disaster in 2011. The epicentre of the earthquake was in the mountain range of Tercia and was estimated at 5.1 on the Richter scale. It was felt in several towns in the region. The earthquake caused 9 deaths and more than 200 people were injured, while thousands had to be evacuated and there was severe personal and material damage in a radius of 5 to 10 kilometres of Lorca. Buildings and public infrastructures, cultural heritage assets and numerous residential properties suffered damage.

Another unique phenomenon that caused huge environmental and financial losses, albeit without death, was the underwater volcano eruption that affected the waters and seabed along the entire southern coast of Hierro Island. More specifically, the eruption affected an area known as the Sea of Calm (Mar de las Calmas in Spanish), which is located in the "Punta de la Restinga-Mar de Las Calmas" Marine Reserve (1996), a 750-hectare area of enormous environmental value and with great potential for the local traditional fishing industry.



Apart from natural disasters, others such as environmental pollution or over-exploitation of natural resources are either the result of or fostered by human activity.

### KEY MESSAGES

In 2011, 41 deaths were caused by natural disasters (7 less than in 2010). Of the total number of deaths, 9 were the result of the earthquake in Lorca (Murcia).

2011 was dry in most of Spain. Average rainfall was 575.5 mm (13.5% below the normal average).

According to provisional data, there were 10,655 incipient fires and 5,373 forest fires in Spain in 2011, a total of 16,028. A total area of 84,490 hectares was affected by fires, of which 26% was wooded.

In 2010, the number of accidents causing possible environmental damage during the transport of dangerous goods by road and rail decreased by 46.5%.

In 2011, no accidents occurred in industrial activities covered by the Seveso Directive, compared to the seven accidents registered in 2010.

In 2011, no major maritime accidents involving fuel spillages occurred. The only incident involved the Deneb, which is not an oil tanker, near the Strait of Gibraltar and the subsequent spillage involved its fuel not its cargo.

### INDICATORS

- Fatalities due to natural disasters
- Drought
- Forest fires
- Road and rail accidents causing possible environmental damage

## Fatalities due to natural disasters

In 2011, there were 41 fatalities due to natural disasters, 9 of which were caused by an earthquake

NUMBER OF FATALITIES IN SPAIN DUE TO NATURAL DISASTERS. 1995-2011

Type of natural disaster	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Floods	22	110	40	0	5	14	9	13	9	7	8	9	11	6	5	12	9	289
Storms	19	13	14	2	20	28	17	12	8	6	8	9	4	3	11	6	2	182
Forest fires	8	1	4	4	8	6	1	6	11	4	19	8	1	1	11	9	12	114
Landslides	7	8	2	0	0	0	1	1	2	0	0	5	2	1	2	2	3	36
Heat waves	0	0	0	0	1	0	0	0	60	23	4	14	0	0	0	2	1	105
Snow avalanches	7	1	0	0	0	4	2	4	4	5	1	0	0	4	3	11	2	48
Snow and cold	0	2	5	1	0	2	4	0	0	3	3	0	0	0	1	1	1	23
Fatalities on land due to maritime storms	19	13	13	36	17	37	27	15	5	20	SD	SD	SD	4	2	5	2	215
Earthquakes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	9
ANNUAL TOTAL	82	148	78	43	51	91	61	51	99	68	43	45	18	19	35	48	41	1.021

Source: Directorate-General for Civil Protection and Emergencies. Ministry of the Interior.

As can be seen in the table, there have been 1,021 fatalities as a result of natural disasters in Spain over the period 1995-2011. By cause of death, most of them were due to floods (28.3%), followed by maritime storms (21.1%) and terrestrial storms, including lightning and strong winds (17.8%) and forest fires (11.2%).

Throughout 2011 there have been various situations that have led damage to infrastructure, facilities and the environment and which have also caused 41 deaths, seven less than in the previous year. By cause of death, in 2011 forest fires were responsible for 12 fatalities, three more than the previous year, while nine people died in floods, three less than in 2010 and 9 deaths were caused by earthquake.

The earthquake suffered in the town of Lorca (Murcia) on 11 May was the most serious incident in 2011. No deaths had ever been registered before in the period of reference (1995-2011) due to this cause. At the epicentre, the earthquake registered 5.1 on the Richter scale and was preceded by a seismic movement of 4.5 degrees in the mountain range of Tercia in the municipal area of Lorca.

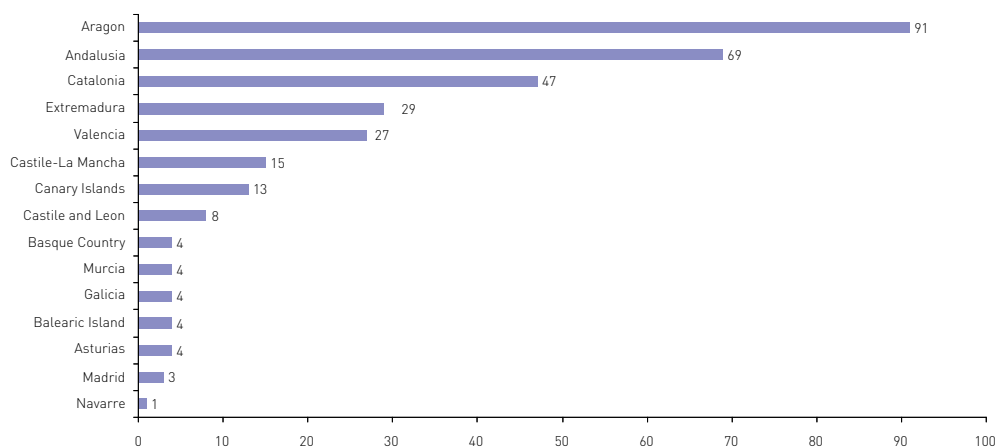
The earthquake, in addition to the 9 fatalities and two hundred people injured as a result of falling debris, caused a great deal of personal and material damage to buildings and public facilities, cultural heritage assets and numerous private houses and was also felt in several towns in the region.

Floods are the most frequent natural phenomenon in Spain. Analysis of flood data shows that 323 people died as a result of floods between 1990 and 2011. The

Autonomous Community to record the largest number of deaths was once again Aragon (22.8%), as has been the case since the catastrophe in Biescas (Huesca), followed by Andalusia (21.4%), Catalonia (14.5%) and Extremadura (9%).

Floods and flash floods resulted in 9 deaths in 2011, 7 of which occurred in the Autonomous Community of Valencia.

DEATHS DUE TO FLOODS AND SPATES IN SPAIN. 1990-2011  
(Total 323 fatalities)



Source: DGPC and E

#### NOTES

- The landslides that have caused victims in Spain are closely associated with heavy rains that cause flooding or freshets. The vast majority of landslides occur either while it is raining or after rains or as a result of them.
- Fatalities due to maritime storms refer solely to victims on land due to falls, sea surges, etc. These figures do not include fatalities at sea (drowning, falls, etc.) due to these phenomena.
- The indicator does not include volcanic eruptions, droughts and earthquakes, since although these phenomena may occur in Spain (drought recurrently and minor earthquakes periodically in certain areas), they have not caused any deaths in the period under consideration. The Canary Islands are the only part of Spain with active volcanoes and, therefore, the only area in which risk associated with this phenomenon exists. The last eruptions were that of Chinyero (a lateral volcano on the Pico del Teide) on Tenerife in 1909 and those of Nambroque in 1949 and Teneguía in 1971, both on the island of La Palma.
- The Spanish Maritime Safety Agency, under the Spanish Ministry of Public Works, responds to all the emergencies that take place at sea (rescues, searches, medical evacuations, towing, combating pollution, broadcasting sailing warnings and promoting maritime traffic safety), as well as attending maritime SOS calls.

#### SOURCES

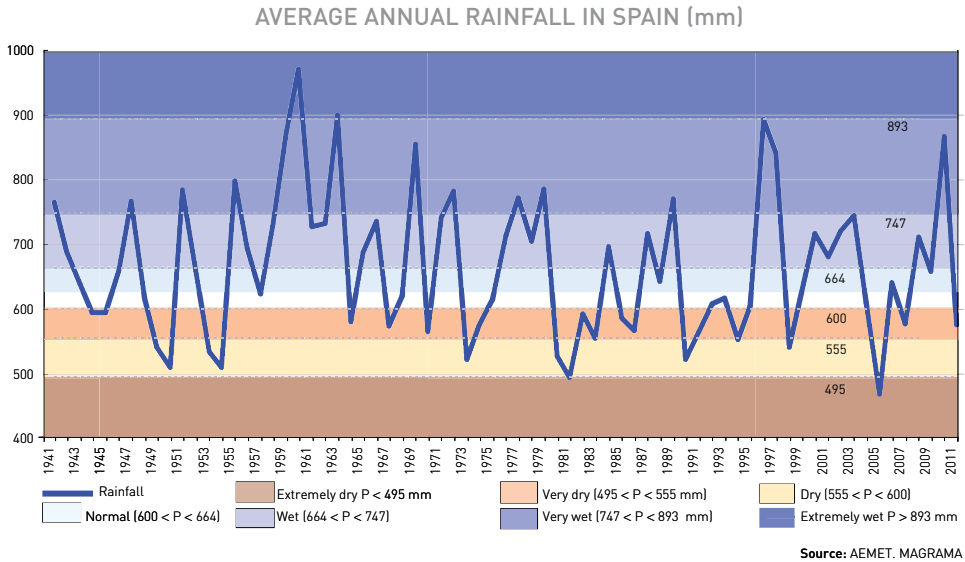
- Sub-Directorate General for Planning, Operations and Emergencies. Directorate General for Civil Protection and Emergencies. Ministry of the Interior.
- Spanish Maritime Safety Agency. Ministry of Public Works.

#### FURTHER INFORMATION

- <http://www.proteccioncivil.org/>
- <http://www.eea.europa.eu>

# Drought

Average rainfall in Spain in 2011 was 13.5% below the normal average



2011 was dry in most of Spain. The most pronounced shortage of rainfall was recorded in the far north of Spain and in some inland areas in the southern half of the country. Average rainfall in Spain in 2011, 575.5 mm, was 13.5% below the normal average (period of reference 1941-2011).

Over the period 1941–2011, and taking into account the Normal Percentage of Rainfall, 45.7% of the years were wetter than average, while in 54.9% of the years annual rainfall was below the average for the period. Analysing the average annual rainfall recorded during this period of reference in more detail reveals that 66.1% of the years were normal or wet, while the remaining 33.8% were dry.

In particular, using the classification based on average annual rainfall and as can be observed in the following table, 31.0% of the years have been dry or very dry, 21.1% normal and 45.0% wet or very wet. In addition, the percentage of years that were either extremely dry or extremely wet are similar - 2.8%.

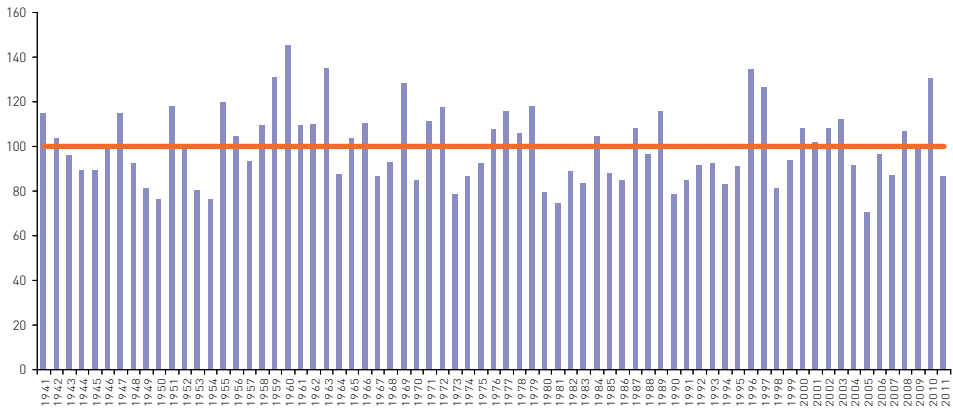
PERCENTAGE OF YEARS, CLASSIFIED BY AVERAGE RAINFALL (1941-2011)

Extremely dry R<495 (mm)	Very Dry (495<R<555) (mm)	Dry (555<R<600) (mm)	Normal (600<R<664) (mm)	Wet (664<R<747) (mm)	Very Wet (747<R<893) (mm)	Extremely Wet R>893 (mm)
2.8	14.1	16.9	21.1	23.9	18.3	2.8

Source: Compiled in-house using data from AEMET.

Some periods of heavy rain were recorded in 2011. The heaviest rains fell in the Basque Country and the Northwest of Navarra at the beginning of November, where some places recorded more than 200 mm. Furthermore, and also during the month of November, there was very heavy rainfall in the Autonomous Communities of Murcia and Valencia and in the south of Catalonia. San Javier in Murcia recorded the highest daily rainfall figure of all the main observatories in 2011, with 144.9 mm.

PERCENTAGE OF NORMAL RAINFALL (PNR)



Source: AEMET. MAGRAMA

**NOTES**

- In calculating the indicator, a year or several years are classified as drought years when average annual rainfall is significantly below the average for the period. Under the Spanish Water Information System (Hispagua), the Percentage of Normal Rainfall (PNR) is one of the indicators used to study drought. It is calculated as the ratio between accumulated rainfall in a year and average annual rainfall for a particular region and period and is expressed as a percentage. Average annual rainfall is also referred to as normal rainfall and is obtained by averaging annual rainfall over a period of no less than 30 years.
- For the AEMET, the 1971–2000 reference period (30 years) is representative of rainfall in Spain and is used to establish the following ranges and create a generic classification within which to place each year in accordance with its average annual rainfall:
  - Extremely Dry: rainfall is below the minimum amount recorded in the reference period (495 mm).
  - Very Dry: rainfall is less than or equal to the reference period's 20 percentile and is greater than the minimum amount recorded in the reference period ( $495 \text{ mm} \leq R < 555 \text{ mm}$ ).
  - Dry: rainfall is greater than the 20 percentile and less than or equal to the 40 percentile ( $555 \text{ mm} \leq R < 600 \text{ mm}$ ).
  - Normal: rainfall is greater than the 40 percentile and less than or equal to the 60 percentile ( $600 \text{ mm} \leq R < 664 \text{ mm}$ ), in other words, it is around the median.
  - Wet: rainfall is greater than the 60 percentile and less than or equal to the 80 percentile ( $664 \text{ mm} \leq R < 747 \text{ mm}$ ).
  - Very Wet: rainfall is greater than the 80 percentile and less than the maximum amount recorded in the reference period ( $747 \text{ mm} \leq R < 893 \text{ mm}$ ).
  - Extremely wet: rainfall is equal to or greater than the maximum amount recorded in the reference period (893 mm).
- SCarcity of precipitation (meteorological drought) may cause a shortage of water resources (hydrological drought) needed to supply existing demand. Consequently, there is no universally accepted definition of drought, as it varies from place to place and every water user has their own definition.
- Previous editions of the Report included extensive information on the definition, type and consequences of drought. The EU differentiates clearly between "drought" as a temporary drop in water availability due to lack of precipitation and "water scarcity," which arises when demand for water exceeds the water resources exploitable under sustainable conditions.

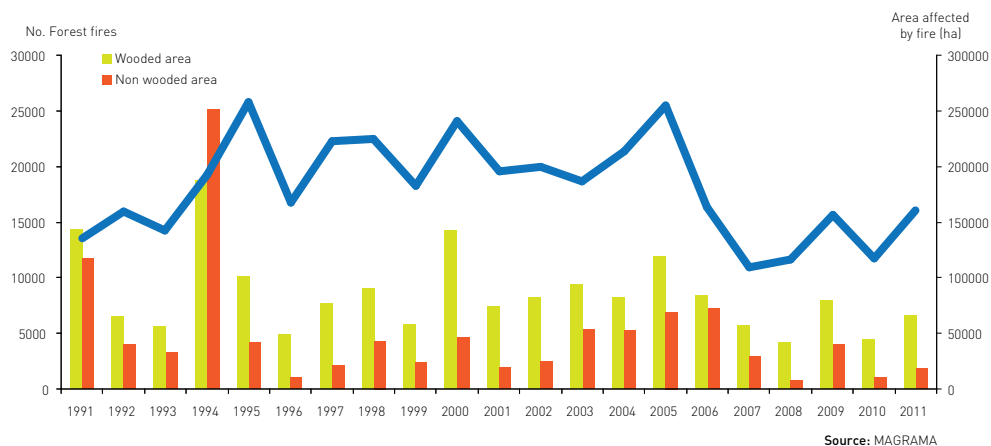
**SOURCES**

- Rainfall data provided by AEMET. Ministry of Agriculture, Food and Environment (MAGRAMA). <http://www.aemet.es/es/portada>

## Forest fires

In 2011, 16,028 forest fires were reported, which affected 84,490 ha of forest area, below the average for the previous decade

FOREST AREA AFFECTED BY FIRE AND NUMBER OF FIRES (1991-2011)



According to provisional data, in 2011 the number of both incipient fires and fires was slightly below the average for the previous decade (2001-2010). In 2011 there were 10,655 incipient fires and 5,373 forest fires, resulting in a total of 16,028 forest fire events, that is, a decrease of 6.4%. Similarly, monthly figures throughout the year remained at lower values nearly every month, except in April and particularly in October. There were 3,462 incidents in October, which is many more than the average for the same month over the decade 2001-2011, which stands at 731.

Likewise, the (wooded and forest) area affected was 52% and 26% below the average for the decade 2001-2011. A total of 84,490 hectares were affected in 2011, while the average for the previous ten years was 113,848 hectares. The trend in the area affected has been similar to that of the number of forest fire events, particularly in the case of October, when some 35,457 hectares were affected, 42% of the annual total.

In 2011, the north-west of Spain (Galicia, Asturias, Cantabria and the Basque Country, together with the provinces of Leon and Zamora) suffered 60.84% of all forest-fire events, while the inland Autonomous Communities suffered 25.63%, the Mediterranean area suffered 12.92% and the Canary Islands suffered 0.61%.



FOREST FIRES. 2011 AND PREVIOUS DECADE

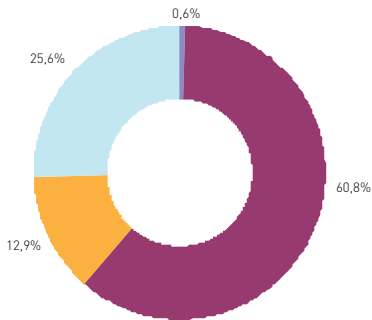
	TEN-YEAR AVERAGE 2001-2010	2011
Nº of incipient fires (< 1 ha)	11,001	10,655
Nº of fires (> 1 ha)	6,126	5,373
<b>Total Nº of forest fire events</b>	<b>17,127</b>	<b>16,028</b>
Wooded area affected (ha)	37,886.7	18,363.1
Forest area affected (ha)	113,847.7	84,490.1
<b>% area affected / % total forest area</b>	<b>0.412</b>	<b>0.305</b>
Nº of major fires (> 500 ha)	27	18

Source: Compiled in-house using data from MAGRAMA

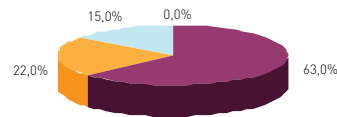
The percentage of forest or wooded area affected describes the consequences of forest fires in terms of surface area. In 2011, by proportion of wooded area affected, north-western Spain suffered most (63.01%), followed by the Mediterranean area (22%), the inland autonomous communities (14.96%) and the Canary Islands (0.03%). In terms of forest area, as before (albeit to a greater extent), the worst affected area was north-western Spain (77.29%), followed by the inland autonomous communities (12.44%), the Mediterranean area (10.19%) and the Canary Islands (0.08%).

NUMBER OF FOREST FIRE EVENTS AND AFFECTED AREA. 2011

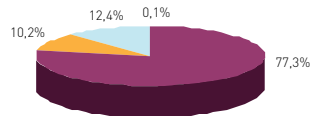
NUMBER OF FOREST FIRE EVENTS



WOODED AREA



FOREST AREA



- Canary zone: Canary islands archipelago
- Mediterranean zone: ACs of the Mediterranean coast
- Northwest zone: Galicia, Asturias, Cantabria, Basque Country and provinces of León y Zamora
- Comunidades Interiores: no coastal ACs except provinces of León y Zamora

Source: MAGRAMA

The five largest fires in 2011 occurred in Allande (Asturias), Manzaneda (Orense), San Joan de Labritja (Balearic Islands), Benicolet (Valencia) and Maceda (Orense) affecting 2,012 ha, 2000 ha, 1,576 ha, 1,449 ha and 1,175 ha, respectively. In 2011 there were 19 major fires (defined as affecting more than 500 hectares) in Spain, which affected 21.9% (18,508 hectares) of the country's forest area.

**NOTES**

- The data for 2011 are provisional.

**SOURCES**

- Data provided by the Forest Fire Defence Department. Directorate General for Rural Development and Forest Policy. Ministry of Agriculture, Food and Environment.
- Ministry of Agriculture, Food and Environment, 2011. "Forest fires in Spain, 1 January - 31 December 2011. Advance information, January 2011." Published on the website.

**FURTHER INFORMATION**

- <http://www.magrama.es>
- <http://www.incendiosforestales.org>

# Road and rail accidents causing possible environmental damage

In 2010 the number of accidents causing possible environmental damaged decreased by 46.5%

Nº OF ACCIDENTS CAUSING POSSIBLE ENVIRONMENTAL DAMAGE DURING THE TRANSPORT OF DANGEROUS GOODS BY ROAD AND RAIL

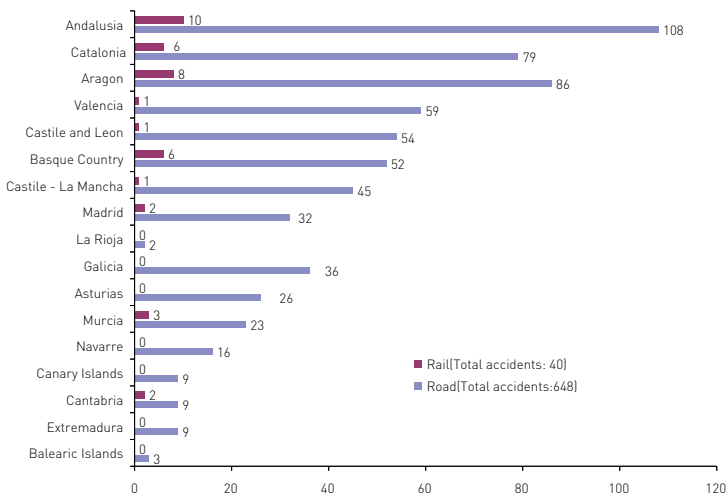
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Road	29	50	34	53	44	47	55	64	61	46	48	45	47	25	648
Rail	10	8	s.d.	4	2	1	5	4	2	1	2	1	0	0	40
TOTAL	39	58	34	57	46	48	60	68	63	47	50	46	47	25	688

Source: Directorate General for Civil Protection and Emergencies. Ministry of the Interior.

During the period of reference 1997-2010, there was a total of 688 accidents causing possible environmental damage during the transport of dangerous goods, 648 road accidents and 40 rail accidents.

The difference in the amount of freight transported by the two modes means that the vast majority of accidents causing possible environmental damage take place on the road, while the number of rail accidents is much smaller. In fact, no rail accidents were reported in 2010.

NUMBER OF ACCIDENTS CAUSING POSSIBLE ENVIRONMENTAL DAMAGE DURING THE TRANSPORTATION OF DANGEROUS GOODS BY ROAD AND RAIL (1997-2010)



Source: DGPCE.MI

The Autonomous Communities that recorded the highest number of accidents during the transport of dangerous goods were Andalusia (108 road accidents and 10 rail accidents), Aragon (86 road and 8 rail) and Catalonia (79 road and 6 rail) during the period 1997-2010. The Communities that registered the lowest number of accidents (excluding La Rioja for which the full annual series was not available) were the Balearic Islands (3 road accidents), the Canary islands (9 road accidents) and Extremadura (9 road accidents), which clearly indicates that the number of accidents is largely influenced by the size of the road network and its geographical location, either as a transport hub or due to being strategic location.

#### N° OF INCIDENTS CAUSING POSSIBLE ENVIRONMENTAL DAMAGE DURING THE TRANSPORT OF DANGEROUS GOODS (1997-2010)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Air pollution	5	3	2	4	3	0	8	8	17	7	8	4	5	7	81
Water pollution	7	11	6	9	5	5	4	14	9	8	7	8	2	4	99
Soil pollution	36	49	29	51	41	46	57	55	49	41	43	39	44	18	598
<b>TOTAL</b>	<b>48</b>	<b>63</b>	<b>37</b>	<b>64</b>	<b>49</b>	<b>51</b>	<b>69</b>	<b>77</b>	<b>75</b>	<b>47</b>	<b>50</b>	<b>46</b>	<b>47</b>	<b>29</b>	<b>752</b>

Source: Directorate General for Civil Protection and Emergencies. Ministry of the Interior

The total number of incidents affecting the environment does not match the total number of accidents, as a single accident may affect several environments. Between 1997 and 2010, the number of incidents affecting the environment totalled 752, of which 598 caused soil contamination, 99 affected water and 81 caused air pollution. In 2010, soil was the environmental medium that suffered most (62.1%), while air was affected by 24.1% and water by 13.8%.

#### NOTES

- When categorising road and rail accidents, dangerous goods are considered those substances that, in the case of an accident during transport, may represent a hazard to the population, property and the environment. Possible environmental damage is considered to occur when the existence of a leak or spillage (on land, in water or into the atmosphere) with a potentially pollutant effect is reported.
- It is necessary to emphasise that the number of incidents is not the same as the number of accidents, as a single accident may affect several environments.

#### SOURCES

- Data provided by the Directorate General for Civil Protection and Emergencies. Ministry of the Interior.
- White paper on Transport.

#### FURTHER INFORMATION

- <http://www.proteccioncivil.org/>
- <http://mahbsrv.jrc.it/> (Major Accident Hazards Bureau –MAHB. Comisión Europea)
- <http://www.eea.europa.eu>