

2.16

NATURAL AND TECHNOLOGICAL DISASTERS



In recent years, there has been an increase in the violence, distribution and recurrence of extreme climatic phenomena, often resulting in major natural disasters. These disasters, particularly when they occur in developing countries, can destabilise a region's socio-economic balance and can constitute a major obstacle to attaining local development objectives.

The United Nations' International Strategy for Disaster Reduction (ISDR) considers Disaster Risk Reduction (DRR) to be the focal point of action. To address this, the Hyogo Framework was adopted in 2005. The main objective of this initiative was to reduce the loss of human life and social, economic and environmental assets caused by natural disasters over the next 10 years.

Between 1950 and 2009, there were a total of 285 major natural catastrophes worldwide, of which number 28% were earthquakes, tidal waves and volcanic eruptions, 41% were storms, 25% were floods, and 6% were heat waves caused by extreme temperatures. These catastrophes were responsible for two million fatalities (53% attributable to earthquakes, tidal waves and volcanic eruptions, 36% to storms, 7% to floods, and 4% to extreme temperatures).



A disaster becomes a ‘major catastrophe’ when the affected regions cannot cope with the emergency situation without external aid. According to Münchener Rück,

INDICATOR	GOAL	TREND
Fatalities due to natural disasters	Prevent disasters and industrial accidents in order to reduce the number of fatalities and the environmental impact caused by natural phenomena and technological processes through implementation of appropriate preventive measures, intervention, and information	In 2009, the number of fatalities due to natural disasters increased
Drought		Over 1941–2009, 33.3% of the years were dry and 66.7% were normal or wet
Forest fires		In 2009, the number of forest fires and the area affected were below the average for the last decade
Road and rail accidents causing possible environmental damage		Accidents in the transport of dangerous goods that may cause environmental damage continue to occur
Oil spills due to maritime accidents		In 2008, only one accident involving oil tankers occurred off the Spanish coast compared with 5 in 2007
Industrial accidents involving dangerous substances		In 2009, only one accident occurred within the scope of the Seveso Directive

WORLDWIDE NO. OF CATASTROPHES AND FATALITIES DUE TO NATURAL DISASTERS

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Events	890	701	698	699	641	648	850	960	750	850
Fatalities	10,300	25,063	10,576	77,886	183,000	100,995	20,000	16,000	160,000	10,500

Source: Munich Reinsurance Company (various years); Topics Geo Annual review: Natural catastrophes 2005, Topics Geo. Natural catastrophes 2006, 2007, 2008 and 2009. Website: www.munichre.com.

no major catastrophes occurred in 2009 (in contrast, 2008 was one of the worst years in recent memory and natural disasters caused over 160,000 fatalities). Even so, at least 10,500 people died in the 850 disasters registered in 2009. In addition, although the number of fatalities was lower, there were more events than in 2008 (when disasters claimed many more victims). Notably, 48% of the deaths recorded in 2009 occurred in the year’s 10 biggest disasters.

In Spain, the magnitude of the natural disasters that occur is not comparable with that of other global regions. In January 2009, extra-tropical (mid-latitude) cyclone Klaus struck northern Spain and southern France, generating winds of over 150 km/h and waves up to 26 metres high on the Spanish and French coasts. It caused 26 fatalities, 12 of them in Spain, and substantial material damage. It was an extraordinary phenomenon that had not occurred with such violence in Spain since 1997.

Other disasters are caused by accidents arising from industrial activity. The economic development of recent years has led to an increase in industry and transport of dangerous goods, especially in countries that, like Spain, have high levels of energy dependence.

Fatalities due to natural disasters

In 2009, natural disasters caused 35 fatalities in Spain

NUMBER OF FATALITIES IN SPAIN DUE TO NATURAL DISASTERS (1995–2009)

Type of natural disaster	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Floods	22	110	40	0	5	14	9	13	9	7	8	9	11	6	5	268
Storms	19	13	14	2	20	28	17	12	8	6	8	9	4	3	11	174
Forest fires	8	1	4	4	8	6	1	6	11	4	19	8	1	1	11	93
Landslides	7	8	2	0	0	0	1	1	2	0	0	5	2	1	2	31
Heat waves	0	0	0	0	1	0	0	0	60	23	4	14	0	0	0	102
Avalanches	7	1	0	0	0	4	2	4	4	5	1	0	0	4	3	35
Snow and cold	0	2	5	1	0	2	4	0	0	3	3	0	0	0	1	21
Fatalities on land due to maritime storms	19	13	13	36	17	37	27	15	5	20	SD	SD	SD	4	2	208
ANNUAL TOTAL	82	148	78	43	51	91	61	51	99	68	43	45	18	19	35	932

Source: Directorate-General for Civil Protection and Emergencies (MI)

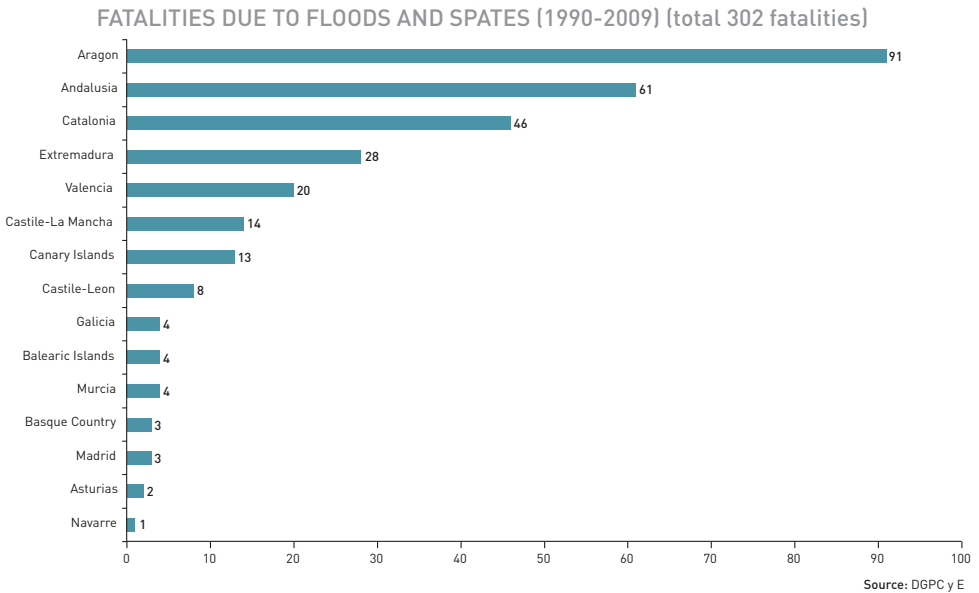
Most of the 932 fatalities due to natural disasters in Spain between 1995 and 2009 were a result of flooding, which caused 268 deaths (28.8% of the total). The next biggest causes were maritime storms, which produced 208 victims (22.3%), and terrestrial storms (including lightning and strong winds), which caused 174 deaths (18.7%). These natural phenomena, along with forest fires and heat waves, had the severest impact and resulted in most fatalities.

Forest fires are one of Spain's biggest environmental and social problems. They have a variety of causes; some are due to accidents and others to negligence, but many are started intentionally and in recent years these have had severe environmental, material and, unfortunately, human consequences. In 2009, there were 11 fatalities as a result of forest fires. This was the second-worst figure in the last 20 years and was only surpassed by 2005, when 19 lives were lost.

There was also a high number of deaths due to storms and strong winds in 2009 — damage to infrastructure and facilities, falling trees and branches, and landslides, among other events, caused 11 deaths in Spain in 2009.

Heat waves, which in the past have had severe consequences, did not result in any fatalities in the last three years of the period. In this regard, implementation of the National Preventive Action Plan to mitigate the effects of extreme temperatures on public health is fulfilling the scheme's main objective, which is to prevent extreme heat harming public health.

Floods are the most frequent natural phenomenon that occurs in Spain. Analysis reveals that floods caused 302 fatalities between 1990 and 2009, of which number 110 occurred in 1996. Aragon registered the highest number of deaths (30.1%), attributable mainly to the catastrophe in Biescas (Huesca) in 1996, which resulted in 87 fatalities, followed by Andalusia (20.2%), and Catalonia (15.2%). In 2009, there were 5 deaths (3 of them in Andalusia), as opposed to 6 in 2008 and 11 in 2007.



NOTES

- The landslides that caused casualties in Spain were closely associated with heavy rain, which also produced flooding and spates. The large majority of landslides occurred at the same time as rain or a short time after heavy rainfall.
- Fatalities due to maritime storms refer solely to victims on land due to falls, sea surges, etc. The figures do not include victims at sea (sinkings, 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.
- Spain's Maritime Safety and Salvage Agency, which reports to the Ministry of Public Works, responds to all emergencies at sea (rescue, search, medical transfer, towing, pollution control, issue of shipping warnings and implementation of measures to ensure the safety of maritime traffic).

SOURCES

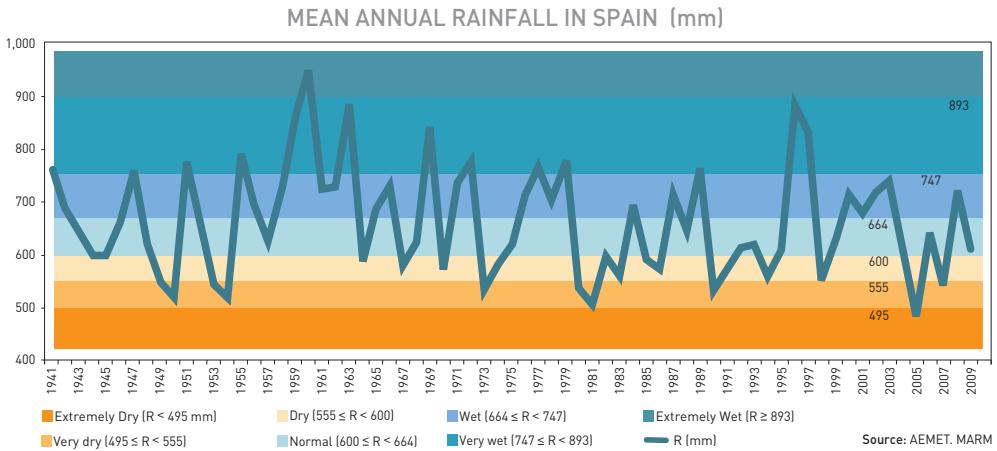
- Sub-Directorate-General for Planning, Operations and Emergencies. Directorate-General for Civil Protection and Emergencies. MI.
- Maritime Safety and Salvage Agency. MF.

FURTHER INFORMATION

- <http://www.eea.europa.eu>
- <http://www.proteccioncivil.org/>
- <http://natural-hazards.jrc.it>
- <http://nedies.jrc.it/>
- <http://www.emdat.be/>

Drought

Although the year's pronounced rainfall deficit was reduced by significant precipitation throughout December, 2009 was still slightly drier than normal



Average annual rainfall figures for the period 1941–2009 show that 33.3% of the years were dry, while the remaining 66.7% were normal or wet. In fact, 30.4% of those years were dry or very dry, 21.7% were normal, and 42% were wet or very wet. Only 2.9% were extremely dry or extremely wet.

PERCENTAGE OF YEARS, CLASSIFIED BY AVERAGE RAINFALL (1941–2009)

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)
2.9	15.9	14.5	21.7	24.6	17.4	2.9

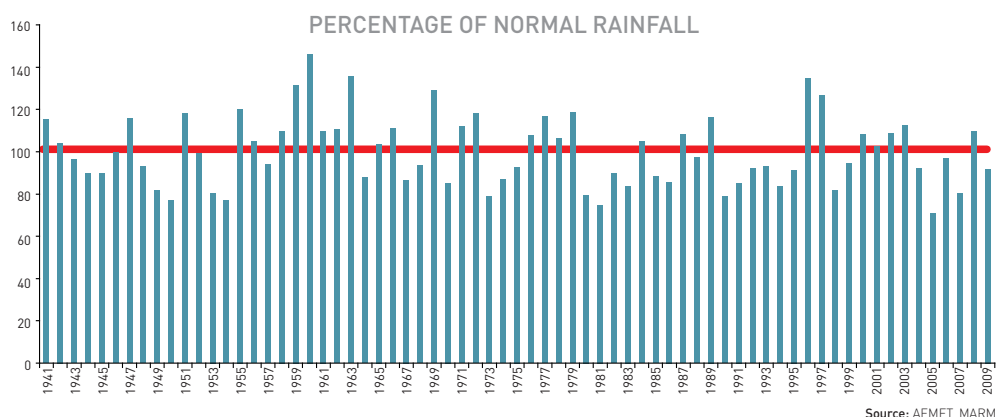
Source: Compiled in-house using data provided by the AEMET

Analysis of the Percentage of Normal Rainfall over the period 1941–2009 shows that in 55.1% of the years annual precipitation was below the average for the period, while in 44.9% of them it was above average.

Although the year's pronounced rainfall deficit that had built up steadily since March was reduced by significant precipitation throughout December, 2009 was still slightly drier than the year before. Even so, average rainfall in Spain stood at 608 mm. The lack of rainfall was particularly pronounced in the second half of the spring and the first half of the summer (May, June and July) and, in particular, in May, when rainfall was 40% below the usual average.

On the south-east coast and in Murcia, the Balearic Islands, most of Andalusia and small areas of Spain's northern third, rainfall over the year equalled or exceeded the average. However, in spite of the heavy rains in the last month of the year, there was still a rainfall deficit in Spain's other regions. This was most pronounced in the Canary Islands and, in particular, in the centre of the peninsula (from eastern Extremadura to southern Catalonia), where the year's rainfall was generally between 60% and 80% the normal annual amount.

As regards heavy rainfall, the most significant event occurred between 26 and 29 September around the Mediterranean coast and produced very heavy rain in parts of Valencia, Murcia, eastern Andalusia and the Balearic Islands.



NOTES

- For the purpose of 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 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 calculating average annual rainfall over a period of not 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).
- 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

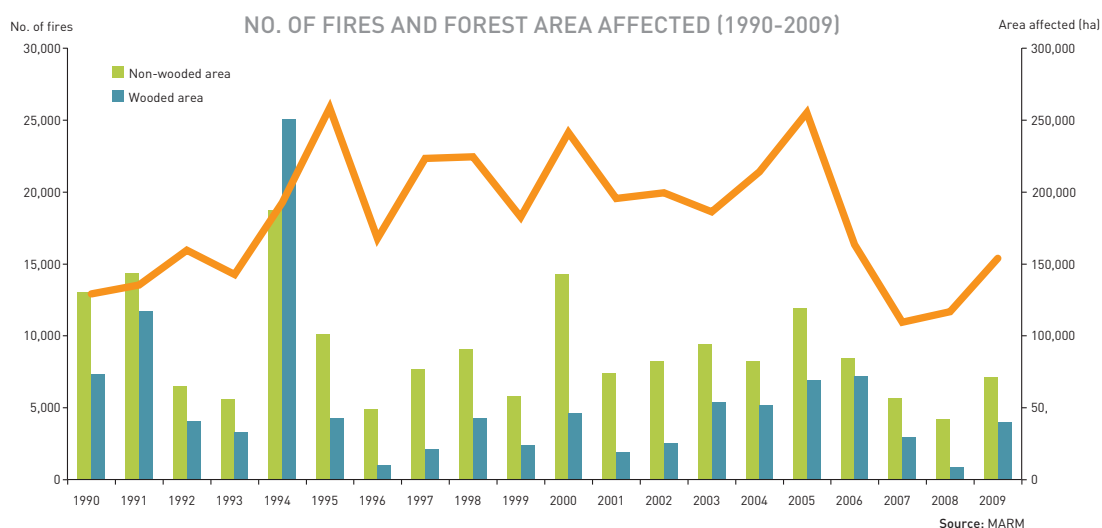
- Rainfall data provided by the AEMET. MARM.

FURTHER INFORMATION

- Agencia Estatal de Meteorología. MARM. <http://www.aemet.es/es/portada>

Forest fires

Although in 2009 the number of forest fires and the area affected increased, both of these were nonetheless below the average recorded over the last decade



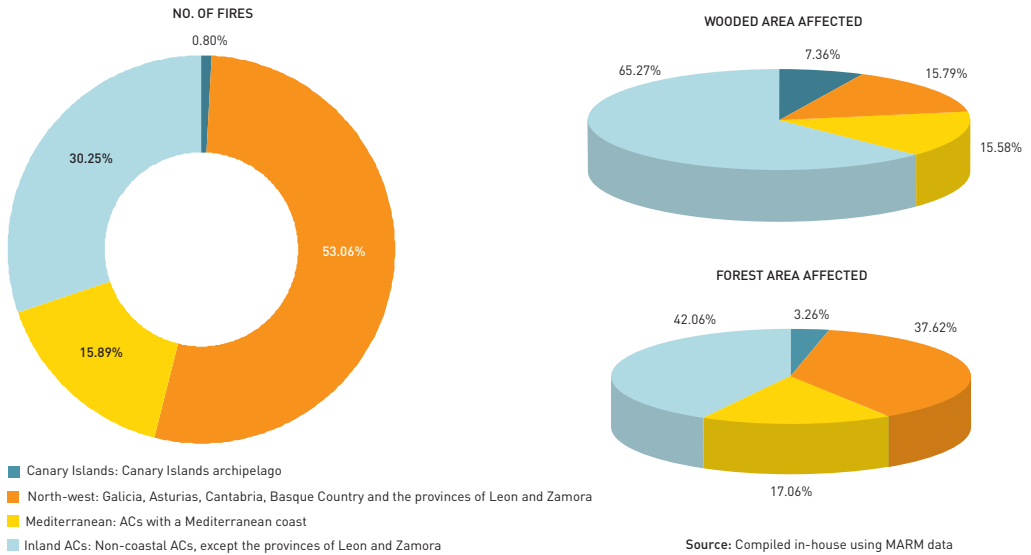
According to provisional data, in 2009 there was an increase in the number of forest fires and the area affected. Nevertheless, the number of forest fires in 2009 was 17.4% below the average of the preceding decade (1999–2008). In 2009, there were 15,391 forest fires, while the ten-year average stood at 18,626. The total forest area affected by fire, which includes both trees and scrub and pasture, was 10.8% lower than the average for the decade (1999–2008). In 2009, 110,783 hectares were affected, while the ten-year average was 124,187 hectares. In terms of percentage of forest area affected, the trend in recent years has remained stable at 35.68%.

	TEN-YEAR AVERAGE [1999–2008]	2009
No. of outbreaks (<1 ha)	11,853	9,849
No. of fires (>1 ha)	6,773	5,542
Total no. of forest fires	18,626	15,391
Wooded area affected (ha)	39,791.28	39,528.35
Total forest area affected (ha)	124,187.12	110,783.21
% area affected / % total forest area	0.479	0.428
No. of major fires (>500 ha)	29	34

Source: MARM

In 2009, the largest percentage of forest fires (53.06%) occurred in Spain’s north-west (the autonomous communities of the Basque Country, Cantabria, Asturias and Galicia, and the provinces of Leon and Zamora). It was followed in order of magnitude by the country’s inland autonomous communities (30.25% of fires), the Mediterranean Arc (15.89%) and the Canary Islands (0.80%).

FOREST FIRE BREAKDOWN (2009)



The percentage of forest area affected, which includes trees, scrub and pasture, describes the consequences and intensity of forest fires in terms of surface area. In 2009, by proportion of wooded area affected, Spain’s inland autonomous communities suffered most (65.27%), followed by the north-west (15.75%), the Mediterranean Arc (11.58%) and the Canary Islands (7.36%). In terms of total forest area, as in the previous case, although to a lesser extent, the worst affected areas were the inland autonomous communities (42.06%), followed by the north-west (37.63%), the Mediterranean Arc (17.06%) and the Canary Islands (3.26%).

It is important to highlight the outstanding contribution made at all levels by the various bodies responsible for preventing and extinguishing forest fires in the country’s autonomous communities and to underscore the extent of communication and collaboration that exists between operational management, Regional Co-ordination Centres and the National Forest Fire Co-ordination Centre. In addition, the Military Emergency Unit, created in 2005, is also actively engaged in combating this type of emergency.

In 2009, there were 34 major fires in Spain affecting 49.99% of the country's forest area. The large number of major fires in July was clearly associated with adverse weather conditions, prevalently high temperatures and a lack of humidity in the soil and vegetation. During the month in question, there were major fires in Alloza (Teruel) affecting 6,978.0 hectares, in Turre (Almeria) affecting 4,309.0 hectares, and in Arenas de San Pedro (Avila) affecting 3,975.8 hectares, which, together with the fire in Saragossa that affected 6,462.0 hectares in August, comprise the year's four largest forest fires.

NOTES

- The data for 2009 are provisional.

SOURCES

- Data provided by the Forest Fire Defence Department. Directorate-General for the Natural Environment and Forestry Policy. MARM.
- MARM, 2010. Incendios forestales del 1 de enero al 31 de diciembre de 2009. 2009 preview based on provisional data, published on the website.

FURTHER INFORMATION

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

Road and rail accidents causing possible environmental damage

In 2008, the number of accidents causing possible environmental damage was the lowest in five years

NO. OF ACCIDENTS CAUSING POSSIBLE ENVIRONMENTAL DAMAGE DURING THE TRANSPORT OF DANGEROUS GOODS BY ROAD AND RAIL (1997–2008)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Road	29	50	34	53	44	47	55	64	61	46	48	45	576
Rail	10	8	s.d.	4	2	1	5	4	2	1	2	1	40
TOTAL	39	58	34	57	46	48	60	68	63	47	50	46	616

Source: Directorate-General for Civil Protection and Emergencies. MI.

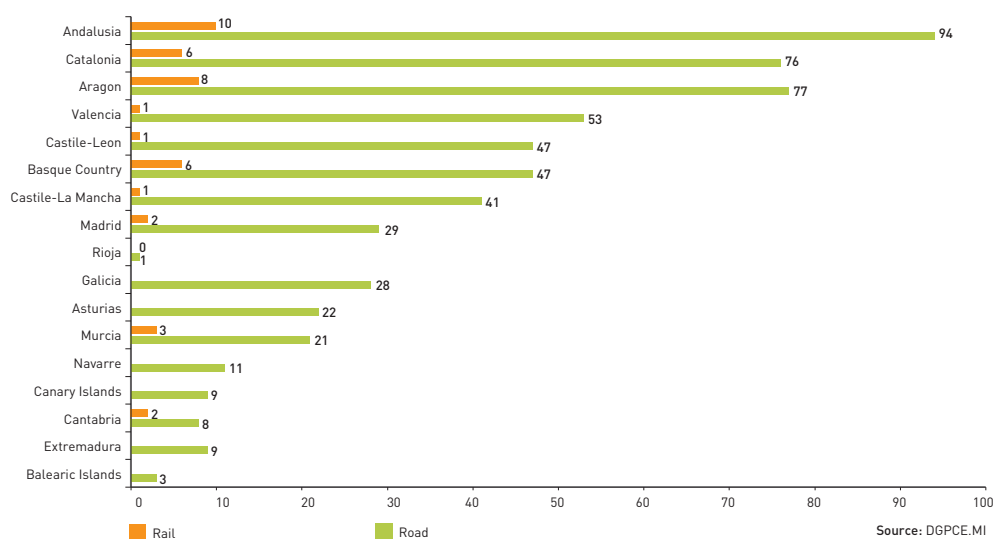
Over 1997–2008, there were 616 accidents causing possible environmental damage during the transport of dangerous goods by road and rail. However, in the last five years of the period the number of incidents decreased. In 2008, there were 46 accidents during the transport of dangerous goods causing possible environmental damage. Of that number, 45 occurred on the road network, while only one occurred during rail transport.

Over the same period, the autonomous communities that recorded the highest number of accidents during the transport of dangerous goods were Andalusia (94 road accidents and 10 rail accidents), Aragon (77 road accidents and 8 rail accidents), and Catalonia (76 road accidents and 6 rail accidents). The volume of goods transported, together with the size of the road network and its geographic location, are factors that contribute to the increase in freight and, therefore, to a possible increase in the risk of accidents occurring.

After an accident, possible environmental damage may affect either a single medium or a combination of several (air, water or soil). Usually, soil is the medium most affected, and from there the environmental damage can easily spread to the air or water (by leaching).

The total number of incidents affecting the environment, which is not the same as the total number of accidents, in the period 1997–2008 stood at 698. The annual breakdown by medium affected is shown in the table below. Soil was the environmental medium that suffered most (76.8% of incidents), while water was affected by 13.3% and air by 9.9%.

NO. OF ACCIDENTS CAUSING POSSIBLE ENVIRONMENTAL DAMAGE DURING THE TRANSPORT OF DANGEROUS GOODS BY ROAD AND RAIL (1997-2008)



NO. OF INCIDENTS AFFECTING EACH MEDIUM CAUSING POSSIBLE ENVIRONMENTAL DAMAGE DURING THE TRANSPORT OF DANGEROUS GOODS (1997-2008)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Air pollution	5	3	2	4	3	0	8	8	17	7	8	4	69
Water pollution	7	11	6	9	5	5	4	14	9	8	7	8	93
Soil pollution	36	49	29	51	41	46	57	55	49	41	43	39	536
TOTAL	48	63	37	64	49	51	69	77	75	56	58	51	698

Source: Directorate-General for Civil Protection and Emergencies. MI.

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 environmental media.

SOURCES

- Data provided by the Directorate-General for Civil Protection and Emergencies. MI.

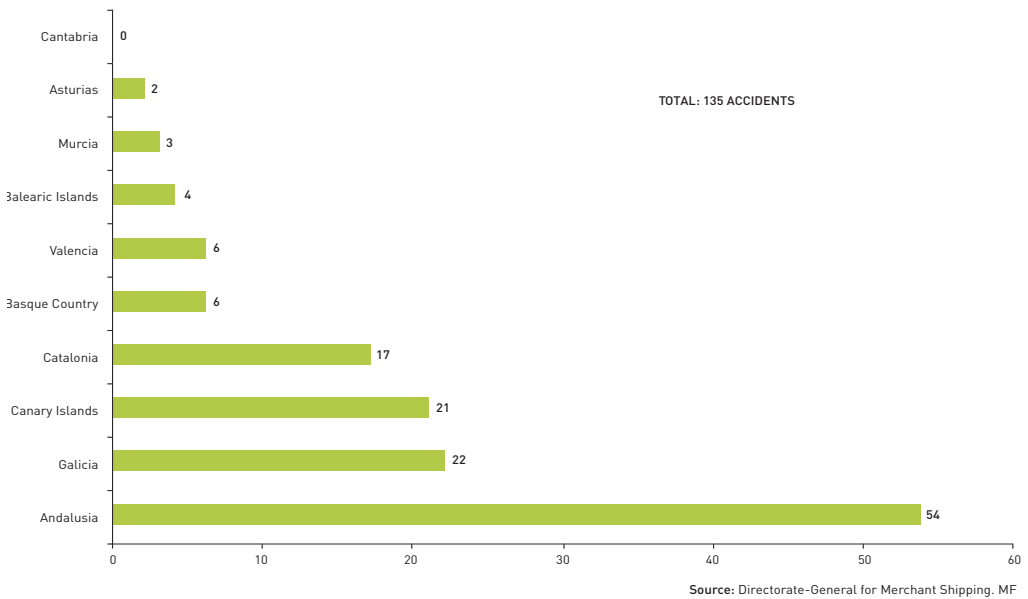
FURTHER INFORMATION

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

Oil spills due to maritime accidents

Only one accident involving oil tankers occurred off the Spanish coast in 2008, compared with five in 2007

NO. OF ACCIDENTS INVOLVING OIL TANKERS OFF THE SPANISH COAST (1991-2008)

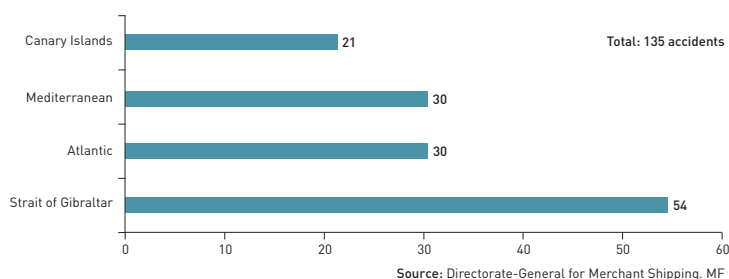


Over the period 1991–2008, there were a total of 135 accidents off the Spanish coast involving oil tankers, all of which resulted in oil spills of varying magnitudes.

In 2008, only one accident occurred (in the autonomous community of Valencia), the lowest number in the period (1991–2008). Andalusia, Galicia, the Canary Islands and Catalonia were the autonomous communities to suffer the highest number of accidents off their respective coasts in the period under consideration.

The Strait of Gibraltar was the maritime search-and-rescue zone with the highest number of accidents involving oil tankers between 1991 and 2008. It was followed in terms of volume by the Atlantic Zone, Mediterranean Zone and the Canary Islands Zone.

NO. OF ACCIDENTS INVOLVING OIL TANKERS OFF THE SPANISH COAST BY MARITIME SEARCH-AND-RESCUE ZONE (1991-2008)

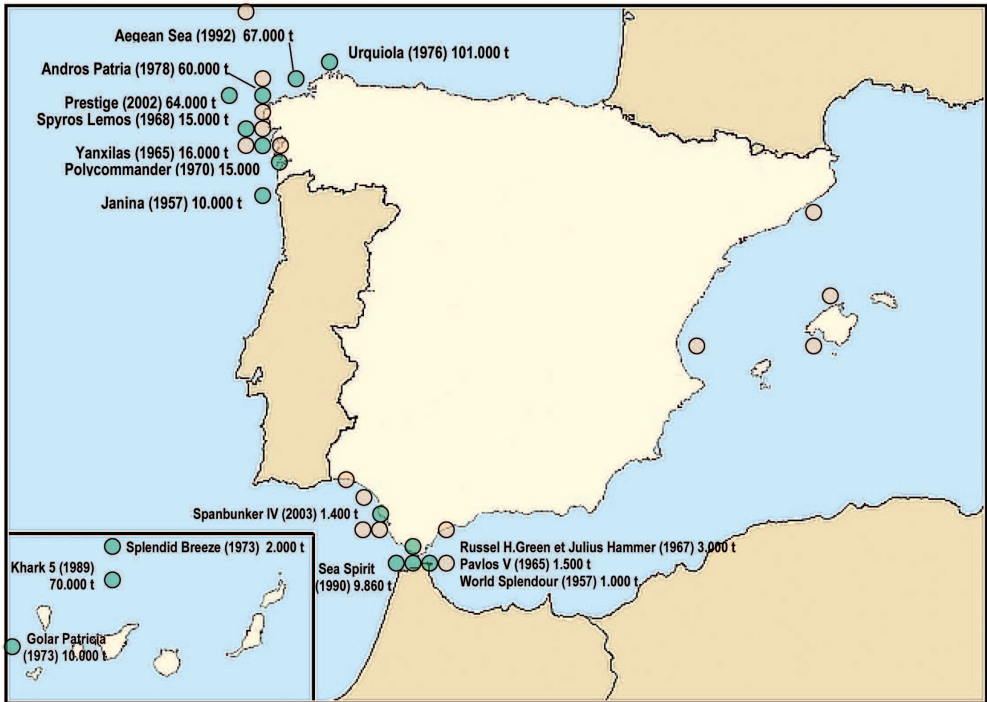


Major oil spills are not the only by-product of oil tanker accidents; sometimes tankers' own fuel is spilt. For example, in October 2008, the Fedra and Tawe cargo vessels were grounded in the Bay and Strait of Gibraltar following a violent storm and the oil spilt reached a number of beaches, among them the El Rinconcillo and Getares beaches in Algeciras.

Occasionally, oil spills are caused by direct leaks from coastal industrial plants. One such example occurred in Ceuta in September 2008, when a series of oil spillages were traced to a company located in the immediate vicinity of the port.

On other occasions, the oil spilled is the fuel used by the ships themselves that, in the event of accident or sinkage, leaks from their fuel tanks. This situation occurred in the port of Tarragona in September 2008, when a barge, the Savinosa, partially sank. In this case, it was possible to contain the oil spill and keep it within the port.

SITES OF MAJOR ACCIDENTS INVOLVING OIL TANKERS AND OIL SPILLS OFF THE SPANISH COAST



- Approximate site of oil tanker accidents involving spills of over 1,000 t, including vessel name, date of accident and amount of oil spill.
- Approximate site of oil tanker accidents involving spills of under 1,000 t.

Source: Compiled in-house using data provided by the CEDRE.

NOTES

- Created in 1978, the CEDRE is responsible for documenting, researching and performing experiments on pollutant products, their effects and the methods and means required to treat and dispose of them. Its remit covers both marine and inland waters.

SOURCES

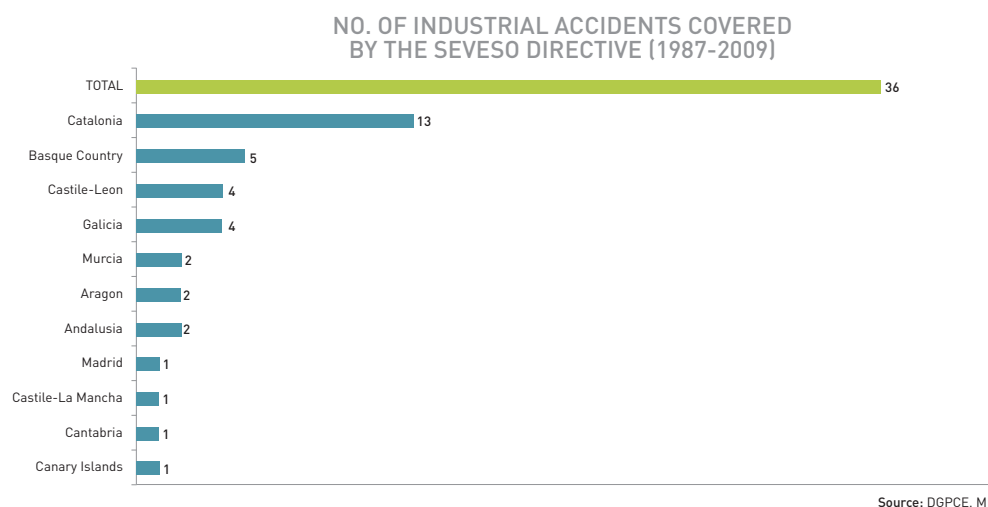
- Data provided by the Department for Maritime Safety, Sub-Directorate-General for Maritime Safety and Pollution, Directorate-General for Merchant Shipping, MF.

FURTHER INFORMATION

- <http://www.mfom.es>
- <http://www.eea.europa.eu>
- <http://www.itopf.com/>
- <http://www.cedre.fr/>

Industrial accidents involving dangerous substances

In 2009, only one accident occurred in industrial facilities covered by the Seveso Directive



There was only one accident in Spain (in Galicia) in 2009 that fell within the scope of the Seveso Directive. As regards the entire period (1987–2009), a total of 36 accidents occurred, with Catalonia recording the highest number (36.1%). Catalonia also had the largest number of industrial facilities covered by the Seveso Directive.

The Seveso Directive makes it compulsory for industrial facilities to draw up an internal emergency plan, which must then be submitted to the regional government. This plan defines the organisational requirements, means and procedures to prevent or minimise possible accidents.

The regional governments, through the relevant departments, then draw up an external emergency plan jointly with the organisation. This sets out the measures for prevention, information, organisation and action and establishes the framework for co-ordination with government resources and those of other public and private bodies.

In this regard, in 2009 eight Special Civil Protection Plans were approved by the National Civil Protection Committee for facilities covered by the Seveso Directive. Between July 1994 and April 2009, a total of 211 such plans were approved.

NOTES

- The accidents analysed are those covered by the Seveso Directive, i.e. accidents occurring in industry (chemical, pharmaceutical, energy industry, etc.) and include those occurring during storage, distribution and sale of dangerous substances and products.
- Directive 96/82/EC on the control of major-accident hazards involving dangerous substances (Seveso II) is intended to prevent major accidents and reduce their consequences for human health and safety and the environment. It replaces Directive 82/501/EEC (Seveso I). The Seveso II Directive was transposed to Spanish law by Royal Decree 1254/99, of 16 July, which approved measures to control major-accident hazards involving dangerous substances. This Royal Decree was amended by Royal Decree 119/2005, of 4 February, and by Royal Decree 948/2005, of 29 July. This regulatory framework is complemented by Royal Decree 1196/2003, of 19 September, which approved the Civil Protection Guidelines for the Control and Planning of Major-Accident Hazards involving Dangerous Substances [BOE no. 242, of 9 October 2003].
- Major accident: any incident, such as emissions in the form of leaks, spills, fires or major explosions, that is the consequence of an uncontrolled process during operation of any facility to which Royal Decree 1245/1999 is applicable and that represents a major-accident hazard, of either immediate or delayed effect, to the population, property or the environment, whether inside or outside the facility, and in which one or more dangerous substances are involved.
- It should be pointed out that other types of accident exist that, although no less serious for the environment, do not fall within the scope of the Seveso Directive. These include mining accidents, such as the one caused by failure of the Aznalcóllar Dam (Seville) in April 1998.

SOURCES

- Data provided by the Sub-Directorate-General for Planning, Operations and Emergencies. Directorate-General for Civil Protection and Emergencies. MI.

FURTHER INFORMATION

- <http://www.proteccioncivil.org>

