CHAPTER 6

EXPOSURE TO PHYSICAL AGENTS

Introduction

The term “physical agents” refers to those factors governed by physical laws that trigger a transformation in the environmental conditions in the setting where they take place. This category includes noise, electromagnetic fields, vibrations, light pollution, ultraviolet (UV) radiation, and ionizing radiation. The data collected and processed in the European Community, aimed at estimating the numbers of persons exposed to specific noise levels, identify noise pollution as one of the leading environmental problems, with high and widespread impact on the population and the environment. The effects, in terms of disturbance and deterioration of quality of life, are well documented and have been induced the European Commission to pursue, as a priority objective, the progressive reduction of the number of persons exposed to noise by implementing a policy based on sharing analysis of the phenomenon and the measures to be adopted.

Despite the contributions made to resolving the phenomenon by the EC and the national legislative structure in force, by more in-depth studies, and by implementing actions aimed at prevention and remedy, the issue still requires attention and shared, effective responses.

As regards electromagnetic pollution, in society we are still seeing a decline in the population’s intense perception of the risk connected with exposure to electromagnetic fields at radio frequencies. This is also the result of the extensive monitoring and information activity carried out during these years by the environmental Agencies system, a major driving force in this area. The radio and telecommunications industry is currently experiencing a phase of deep technological development, which has already shown its first effects in recent adjustments of national and regional industry regulations.

NOISE

The problem

The latest studies by the World Health Organization (WHO) document the effects of noise on human health, recognizing its seriousness and other investigations show that in Europe, environmental noise exposure is recording a growth trend in comparison with other stress factors.

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1 WHO-JRC, 2011; Report on “Burden of disease from environmental noise”
The data collected and processed in the first implementation phase of Directive 2002/49/EC relating to the assessment and management of environmental noise, aimed at defining a common approach with a view to avoiding, preventing, or reducing – depending on the respective priorities - the harmful effects of exposure to environmental noise, highlight the presence of a significant number of persons exposed to noise levels affecting the quality of life.

In Europe, about 56 million persons in agglomerations are exposed to $L_{\text{den}}$ values greater than 55 dB, while about 40 million persons are exposed to $L_{\text{night}}$ values greater than 50 dB, considering major road transport infrastructures, inside the agglomerations. In Italy, according to the data published by the European Commission in the NOISE (Noise Observation and Information Service for Europe) database, the number of persons exposed to $L_{\text{den}}$ values greater than 55 dB, within agglomerations, equals approximately two million, seven hundred thousand, for 27% of the total population residing in the considered agglomerations whose strategic noise mapping was delivered to the Commission.

The implementation of Directive 2002/49/EC and the availability of broader and more accurate information highlights a critical situation, inducing the European Commission to strengthen the action of directive by making the commitments and deadlines that are introduced more stringent.

Directive 2002/49/EC, adopted into Italian law through Legislative Decree no. 194/2005, proposes determining exposure to environmental noise by requiring the Member States’ competent authorities to draw up noise maps for agglomerations and major road, railway, and airport transport infrastructures, using the indicators $L_{\text{den}}$ and $L_{\text{night}}$ introduced to establish the number of persons exposed respectively to noise-induced annoyance or sleep disturbance. Member States are also required to produce measures regarding the adoption of Action Plans with the following purposes: preventing and reducing environmental noise where effects harmful to health may occur; protecting good acoustic quality in areas where it is already present; informing the public and ensuring its involvement with regard to environmental noise and its effects.

The implementation status in Italy of the requirements put in place by Legislative Decree no. 194/2005, in turn implementing the initial phase of Directive 2002/49/EC on agglomerations with more than 250 thousand inhabitants, road infrastructure with more than 6 million vehicle passages/year, railway infrastructure with more than 60 thousand train passages/year, and major airports with more than 50 thousand movements/year, is marked by numerous failures to respect the established deadlines.

The second round of the directive implementation process regards agglomerations with a population in excess of 100,000 persons.

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4 NOISE, Noise Observation and Information Service for Europe

The implementation status in Italy of the requirements put in place by Legislative Decree no. 194/2005 is marked by delays and failure to respect the established deadlines.
major roads with more than 3 million vehicle passages/year, and
railways with more than 30,000 train passages/year. The deadline
for drawing up and transmitting the noise maps, the strategic noise
maps, and the information as per Annex VI to Directive
2002/49/EC was set for 30 June 2012 for the competent authority (Ministry of the Environment) and 30 December 2012 for
Communication to the Commission. The next deadline regards
drawing up and delivering the Action Plans and the summaries as
per Annex VI, and is set for 18 July 2013.
Prior to Directive 2002/49/EC, the European Parliament and the
Council issued Directive 2000/14/EC on the noise emission in the
environment by equipment for use outdoors, transposed into Italian
law by Legislative Decree no. 262 of 2002. This directive, and
consequently the decree adopting it, requires those responsible for
placing on the market 57 types of machines to subject these
products to a conformity assessment procedure. In the event of a
positive outcome, the equipment is then sold accompanied by the
EC declaration of conformity, bearing the EC marking and a label
indicating the Guaranteed Sound Power expressed in dB(A).
Analysis of the activities performed by the Environmental Regional
Agencies System in 2011 shows 2,958 noise sources that were
controlled with measurements by ARPA/APPA, with distinct
percentages in the various sectors.
The sources that were most measured, for 2011 as well, were
service and/or commercial activities (57.5%), followed by
productive activities (27.4%); road infrastructure remains the most-
controlled transport source (6.8%) (Figure 6.1). Compared with
2010, service and/or commercial activities have increased as a
percentage of the total of controlled sources (52.5% in 2010), and
productive activities controlled by ARPA/APPA (31.5% in 2010)
have shown a decrease.
The control activity is carried out mainly after reports/complaints
by citizens: in 2011, overall, about 85.5% of controlled sources
were controlled following complaints. In particular, the greatest
number of sources controlled upon complaint is found for service
and/or commercial activities (96% of the total of controlled service
activities). Out of the total of the complaints lodged by citizens,
following which controls were performed by ARPA/APPA, 95% is
represented by all activities (productive, commercial, and/or
services and temporary activities). The high number of complaints
and of cases of exceeding the regulatory limits recorded in 2011
(42.2% of the controlled sources exceed the limits) shows a
constant attention to noise pollution and a demand for greater
protection by citizens in dealing with a truly critical situation.

There is clearly
great attention by
citizens and demand
for personal and
environmental
protection: 85
controls out of 100
are triggered by
citizens’ complaints,
and 42.2% of the
sources reported by
citizens shows that
the limits have been
exceeded.
Data for the Regions of Veneto, Campania, Calabria, Sicily, and Sardinia are unavailable

**Figure 6.1: Distribution of controlled sources (2,958) in the various types of activities/infrastructure (2011)**

**Major noise sources**

The main noise sources, which may be identified as road, railway, and air traffic, are showing different trends. Specifically, while air traffic and railway traffic (passengers) are growing, road traffic has been holding steady in recent years. In particular, airport traffic, after the 17.7% increase recorded between 2003 and 2007, has shown, over the past five years (2007-2011), a 5.4%, reduction, a trend that resumed growth after 2009, with an approximately 5% rise over the three-year period from 2009 through 2011. Vehicle traffic, on the other hand, after a 61% increase between 1990 and 2007, since 2008 has held steady at 83 million vehicles/km, with a slight decrease (-1%) between 2010 and 2011.

As regards railway traffic, in 2011 about 321 million trains/km for passenger transport circulated on the State Railway (+7.4% against 2004) and 42 million trains-km for cargo transport (-34.2% against 2004).

The obligation for transport infrastructure operating bodies to draw up Plans for noise containment and abatement interventions, as provided for by the ministerial decree of 29 November 2000, has yet to be fulfilled, although in recent years many operators have delivered their studies. The aforementioned elements of pressure, although diminishing, along with the faulty implementation of the regulations and the lack of synergies and forms of dialogue between the major players, are obstacles to an organic, shared definition of actions. Car traffic is the main source of noise pollution in an urban setting, but we must not neglect such other sources as, for example: industrial and handicraft activities, commercial activities with their installations (air conditioning, refrigerators, etc.) and discotheques, which generate significant impacts in urban settings. The noisy machinery operating in road

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5 Source: ARPA/APPA data processed by ISPRA
and construction work sites, and gardening apparatus, which are the main object of Directive 2000/14/EC, also influence the acoustic climate of the surrounding environment, and for this reason are no minor cause for disturbance.

**Actions to contain noise pollution**

The progressive implementation of Directive 2002/49/EC, albeit with the differences that may be found in the among Member States, shows a greater awareness of the state of the environment in the matter of noise pollution at Community and Member State level, and a greater sharing of problems encountered and of actions performed.

The need to carry out the directive’s implementation process and the pursuit to harmonize Community legislation with the complex national legislative system, whose basic reference is Framework Law on noise pollution no. 447/95, are privileged areas of activity, capable of creating an occasion for reflection and developments in the legislative structure.

Analysis of the state of implementation of and the experiences in implementing Directive 2002/49/EC by the Member States\(^6\) has made it possible to identify the possible opportunities and critical areas produced by the directive, thus allowing different scenarios and alternative proposals for solving the problems occurring in implementation to be foreseen\(^7\). Moreover, in order to permit accuracy and comparison of data originating from the Member States (in implementation of art. 6 of Directive 2002/49/EC) for estimating the exposed population, the CNOSSOS (*Common Noise Assessment Methods*) project is in its final phase, with the aim of defining a common model for determining the noise generated by the road, railway, airport, and industrial noise sources.

At national level, attention is aimed at guaranteeing full integration between the provisions of Directive 2002/49/EC and the complex structure of noise legislation, through the definition of harmonization criteria; however, there is an absence of implementation decrees dedicated to enforcing the directive, which were provided by Legislative Decree no. 194 of 2005.

Numerous projects cofinanced by the European Commission address various aspects of the directive\(^8\). In particular, as part of the HUSH project, methodological and technical contributions and proposals for legislative review were made with regard to harmonizing European, National, and Regional requirements\(^9\). The main critical areas remain: lack of organic treatment of the sector’s legislative regulations at the various levels of enforcement; the failure to complete the implementation decrees provided by the Framework


\(^9\) Project HUSH [http://www.hush-project.eu/it]
Law, and in particular the one on defining the criteria for designing, carrying out, and renovating building constructions and transport infrastructure; the disregarded application of the decree dedicated to buildings’ passive noise requirements; the failure to strengthen those legislative instruments in force that are dedicated to managing environmental noise but are constantly neglected. Moreover, actions aimed at preventing and mitigating the effects produced by noise pollution are still clearly fragmented. In particular, even if signs of change are recorded, especially in construction, there are still discontinuities between sectors. An appropriate number of actions (transport infrastructures) is devoted to some, and less attention is paid to others, as found in the integration between territorial and acoustic planning.

As regards the actions aimed at environmental communication and information and getting citizens involved, greater attention is seen, due also to the principles and instruments introduced in a European Community setting.

In this setting, ISPR A has carried out the Catasto Nazionale delle Sorgenti di Rumore (national noise sources registry) project, which consists of an archive of data for characterizing noise sources, designed to contain the information of use for the acoustic characterization of the chief sources on the national level (industries, roads, railways, airports, and ports) and any noise measurements connected with them. There are still clear differences regarding implementation status in the various sectors and local settings. The institutional activities conducted by the Environmental Agency System are intensified and attentive to citizens’ needs, in both monitoring and information.

Analysis of the data regarding the requirements established by the regulations in the various sectors shows a situation holding steady with respect to years past, as well as a fulfilment of certain obligations in the area of transport infrastructure. In particular, the absence of a regional law, in certain Regions, with provisions regarding noise pollution, as established by the Framework Law, underscores the insufficient response that characterizes the national picture.

Five Regions are still without their own regional law (Molise, Campania, Basilicata, Sicily, and Sardinia); the last region to have issued a regional law implementing art.4 of Law no. 447/95 is Calabria (Regional Law no. 34 of 19 October 2009 “Regulations in the matter of noise pollution for the protection of the environment in the Region of Calabria”), while Tuscany recently, with Regional Law no. 39/2011, issued the measure modifying the prior regional law in the matter of noise pollution dating back to 1998, further supplemented by the provisions present in regional laws no. 29 and no. 69 of 2012.

It bears mentioning that often, through Regional Council Deliberations, measures are issued regarding individual procedural acts, as guidelines for drawing up the acoustic classification or procedures for recognizing the figure of acoustics technician, to work around the lack of an organic handling of the matter on the regional level.
The approval of the acoustic classification of the municipal territory, a priority instrument of acoustic planning, which defines the territory’s use and permits subsequent actions for protection and the remedying of critical areas, was implemented, as of 31 December 2011, for 49.1% of Italy’s municipalities, as against 46% the year before. There are still considerable distinctions among the various Regions. Those with the highest percentage of zoning municipalities are Marche and Tuscany (97%), Aosta Valley (93%), Liguria (84%), the Province of Trent (76%), Piedmont and Lombardy (73%), Emilia-Romagna and Veneto (64%), while those with percentages under 10% are Abruzzo (7%), Sardinia (3%), and Sicily (1%).

The acoustic classification Plan is not a municipal planning currently used in the Province of Bolzano, in Friuli-Venezia Giulia, in Basilicata, or in Molise. Information regarding the region of Calabria, on the other hand, is lacking.

Similarly, considerable increases have been seen in the percentage of population residing in municipalities with approved acoustic classification - equalling 55.8%, as against 52% for the previous year; the same trend holds for the percentage of zoned area out of the entire national area (from 39.9% in 2010 to 42.1% in 2011). (Figures 6.2, 6.3, 6.4).

The increased number of municipalities that have approved acoustic classification is due to the slight increases found in those Regions with high percentages of municipalities that have adopted the plan, further underscoring the gap that exists between local settings with almost all the territory zoned, and others where there is no municipality with approved zoning.

The percentage of Italian municipalities with classification (49.1%), and the excessive local differences, highlight a still insufficient application of the instrument, and an uneven spread in national territory, with effective policies in some Regions and a stalled situation in other areas.

Critical points regard the citizens’ scant knowledge of the Plan and of its incidence on the territory and on the quality of the environment; this results from insufficient information and the excessively sectoral nature of the instrument, which has yet to be fully integrated with the chief territorial planning devices and with the other plans connected with environmental issues.
Figure 6.2: Percentage of municipalities that approved the acoustic classification out of the total number of municipalities in each Region/Autonomous Province (data updated as of 31 December 2011)\textsuperscript{10}

The percentage of Italian municipalities that have approved the acoustic classification, as of 31 December 2011, equals 49.1%. Marche and Tuscany (97%), Aosta Valley (93%), Liguria (84%), the Province of Trent (76%), Piedmont and Lombardy (73%).

Figure 6.3: Percentage of population resident in municipalities that approved the acoustic classification out of the total population of each Region/Autonomous Province (data updated as of 31 December 2011)\textsuperscript{11}

The percentage of the population residing in municipalities that approved the zoning is equal to 55.8%.

\textsuperscript{10} Source: ARPA/APPA data and ISTAT data processed by ISPRA

\textsuperscript{11} Source: Ibidem
The percentage of territorial area of municipalities that have approved the classification equals 42.1%, against 40% in 2010.

The drawing up of the biennial report on acoustic status of municipality, introduced by law no. 447/95 as an instrument of analysis and management of the "noise pollution" problem in a municipal setting, has been largely disregarded. In fact, no variations with respect to previous years are recorded: out of the total of 149 municipalities with a population exceeding 50,000 with the obligation to write the report, as of 2011 only 21 had complied; the greatest number is recorded in Tuscany, with 11 compliant municipalities out of 13, and in Lombardy with 5 municipalities out of 15.

The adoption of the municipal acoustic remedy plan, provided for by Law no. 447/95, is also little used: according to the available data, only 61 municipalities, equalling 1.5% of the municipalities that approved the acoustic classification, also approved the noise abatement Plan. This planning instrument is used chiefly in Tuscany, which has 43 approved noise abatement Plans.

The acoustic characterization of the airport surrounding, required by the decrees implementing Law no. 447/95 in the matter of airport noise, was approved, as of 2011, in 19 out of 40 domestic airports for which data are available, and is being assessed in 8 more.

The remedial actions provided for by the Framework Law for operators/owners of transport infrastructures show distinctions: for railways and almost all motorways, studies of the criticalities present in their infrastructure network have been completed, and an

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12 Source: ARPA/APP data and ISTAT data processed by ISPRA
initial series of mitigation interventions has been designed and planned; for roads and airports, studies are clearly delayed. As regards the state of implementation of the noise containment and abatement interventions plans (Piani degli interventi di contenimento e abbattimento del rumore – PCAR) pursuant to the Ministerial Decree of 29 November 2000, as pertains to the operators of motorway infrastructures under concession, 18 have delivered these plans to the Ministry of the Environment and Protection of Land and Sea and to the affected Regions/municipalities; 3 operators have not delivered the PCAR, having declared that their sections under concession, by respecting the limit values in force, do not require new interventions; lastly, a single operator has yet to deliver its PCAR (Table 6.1).

ISPRA has seen to the technical examination of the plans that were delivered, sixteen of which were approved by the Ministry of the Environment downstream of the agreement reached at the unified Conference.

ISPRA, in compliance with art. 4 of Legislative Decree no. 262/2002, is responsible for overseeing the market established under Directive 2000/14/EC. Thus, in order to guarantee compliance with requirements, it has thus far carried out more than four hundred document checks, resulting in the regularization of more than three thousand models of noisy machines and equipment, and the first activities provided for by the Ministerial Decree of 04 October 2011 have been carried out at the companies.

Table 6.1: Delivery of noise containment and abatement interventions plans, pursuant to the Ministerial Decree of 29 November 2000, by operators of motorway infrastructures under concession (December 2011)\textsuperscript{13}

<table>
<thead>
<tr>
<th>PCAR</th>
<th>km</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivered</td>
<td>5,230.30</td>
<td>94.2</td>
</tr>
<tr>
<td>To be delivered</td>
<td>218.00</td>
<td>3.9</td>
</tr>
<tr>
<td>Declared unnecessary by operator</td>
<td>106.60</td>
<td>1.9</td>
</tr>
<tr>
<td>TOTAL</td>
<td>5,554.90</td>
<td>100</td>
</tr>
</tbody>
</table>

For 94.2% of the kilometres of motorway infrastructure under concession, PCARs were delivered; for 3.9%, the PCAR has yet to be delivered; and 1.9% requires no interventions by the operator.

In the current phase, it is necessary to concentrate activities on harmonizing the methods and instruments for preventing and mitigating noise pollution, through the opportunities introduced by the legislative acts in the matter of reorganizing the regulations, emphasizing the critical aspects that have persisted for too long and reinforcing awareness of the dynamics inside the country and in the European Community. The prevention, planning, and remedy instruments present in the national legislation must be made harmonized and effective, along with those introduced by Directive 2002/49/EC, accompanied by clear, proper, and comprehensive information to the public on the main aspects of the issue, and above all on the effects on people and the environment.

\textsuperscript{13} Source: ISPRA
Specific regional characteristics

The state of progress of the acoustic classification in the regional territory of Friuli Venezia Giulia has, as of late May 2013, reached 88 zoned municipalities (or municipalities that are in an advanced state of defining the PCCA), out of a regional total of 218.

With these partial data, an interesting initial assessment may be made on the urban planning choices in the noise component made by the Local Administrators of Friuli Venezia Giulia: the clearest set of data refers to the choice of assigning most of the municipal territory to the classes that most greatly limit noise emissions: in fact, the first three acoustic classes (I, II, III) account for 97.3% of the zoned territory; in greater detail, it is noted that II is far more representative of the regional territory (67.1%), followed by class I (27.0%). The latter figure even further confirms the choice of a greater protection of the territory to the benefit of the environment and the resident population.

As regards the population distribution, although the sample taken as a reference is still quite limited (20.0%) and does not include the four provincial capitals, it may be stressed that class III is the most representative (66.3%), with an even distribution over the remaining classes II and IV reserved for residence by sectoral legislation.

ELECTROMAGNETIC POLLUTION

The problem

In recent years, as regards electromagnetic fields, numerous actions have been undertaken both nationally and regionally, in terms of monitoring and developing information instruments. These actions have made it possible to somehow contain the scaremongering among the citizens and to improve their trust in institutions. Currently, in Italy, a phase of great technological development involving radio and telecommunications systems is being seen, starting with the passage from analogue to digital signal, and then following the wake of the future technologies that will be appearing over the next two-three years on national territory (UMTS 900, LTE, Single Ran apparatus). This has already brought about a nationwide regulatory adjustment, creating quite a few difficulties in application on the regional level. These changes in the types of apparatus and in regulatory acts must, however, continue to be supported by the same instruments as those that in years past have made it possible to give positive impetus to the social management of this problem. The great steps forward in the legislative and technical/scientific field to protect the population’s health continue to be the basis for further actions to be undertaken in order to obtain a better knowledge of the repercussions on the environment of certain electromagnetic sources present in national territory.
The main sources of electromagnetic fields

The following information regards the sources of electrical, magnetic, and electromagnetic fields, represented by power lines and radio and telecommunications systems (radio/television broadcasting antennas (RTV) and base transceiver station (BTS)), which are the object of the “EMF Monitoring Unit” a database annually populated by regional and provincial environmental agencies (ARPA/APPA) contacts. For 2011 (Figure 6.5), it is noted that the BTS show a density of facilities over the entire national area that is 2.4 times greater than that for RTV systems (respectively, 0.29 and 0.12 systems per km²), while the density of BTS sites (0.15 sites per km²) is about circa 4 times greater than that of RTV sites (0.04 sites per km²). The environmental impact in terms of pressure exerted by the facilities of said systems on national territory, underwent, from 2010 to 2011, a variation connected chiefly with BTS systems, which grew by 6%, while RTV and their total power fell by 8% and 13% respectively. This information was gleaned from the Regions, which provided the complete data for the two years in consideration for both types of systems (Piedmont, Aosta Valley, Lombardy, Veneto, Emilia-Romagna, Umbria, Marche, Molise, and the autonomous province of Bolzano).

![Figure 6.5: Density of systems and sites; comparison between RTV and BTS, for Regions where the complete set of data is available (2011)\textsuperscript{14}](image)

The total power of the BTS systems (3,779.35 kW) is about 3 times lower than that of the RTV systems (10,300.82 kW). The lower total power associated with the BTS systems results in greater pressure on the territory than the RTV systems, as shown earlier, in order to guarantee at any rate coverage of the territory based on the service requirements of mobile telephony.

\textsuperscript{14} Source: ARPA/APPA data (EMF Monitoring Unit) processed by ISPRA
The most substantial environmental pressure in terms of power is exercised by the RTV systems. These systems, in fact, are marked by a total power level about 3 times greater than that of the BTS systems.

Figure 6.6: Total power, compared between RTV and BTS, for the Regions where the complete set of data is available (2011)\(^\text{15}\)

In this setting, another important pressure is exerted by the high and very high voltage power lines. With regard to the updated data, a slight increase (1.9\%) in lines with voltages under 40 kV from 2010 to 2011 may be noted. As regards the information on the size of the national electrical grid, broken down by voltage, only the data for the power lines with voltages under 40 kV and part of the electrical substations (those for which ENEL Distribuzione is responsible) have been updated to 31 October 2011. The remaining data (power lines with voltages of 40-150 kV, 220 kV, 380 kV and Terna substations, data on the Aosta Valley and Trentino-Alto Adige) are updated to 31 December 2010.

**Actions to contain electromagnetic pollution**

The control and oversight activities regarding ELF (Extremely Low Frequency), RTV, and BTS systems, entrusted by law (art. 14 of Framework Law n. 36/2001) to ARPA/APPA, provide an important support to municipal and provincial administrations in the authorization phase (preventive opinions) and in the operation phase (post-activation controls with forecasting and instrumental models) of the radio telecommunications systems. The environmental Agencies exploit the results of these activities not only for the primary purpose of verifying compliance with the limits established by the regulations in force (DPCM of 08 July 2003), but also to collect, over the years, information for a better understanding of the repercussions on the environment of the emissions of certain electromagnetic sources and to promote more complete and transparent information to the population. From 2010 to 2011, considering the Regions that provided the complete and updated set of data for both types of source (Piedmont, Aosta Valley, Lombardy, Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia, Tuscany, Umbria, Marche, and Molise), there has been an increased number of preventive opinions, equal to 23\% for BTS and 33\% for RTV. The total number of controls performed on

\(^{15}\) Source: ARPA/APPA data (EMF Monitoring Unit) processed by ISPRA

Between 2010 and 2011, there has been an increased number of preventive opinions, equal to 23\% for BTS and 33\% for RTV. As regards post-activation controls, there has
BTS has increased by 18%, while the controls made at the citizens’ request declined by 4%. In the case of RTV systems, there has been an increase, albeit slight, in the total number of controls, equal to 1%; the controls carried out upon request have, on the other hand, seen a considerable decline, equal to about 7.5%. As regards the opinions and checks regarding power lines (ELF), between 2010 and 2011 a substantial increase was recorded, both in the number of preventive opinions (10.5%) and in the number of controls carried out (32%). This information was obtained from the Regions that supplied the complete set of data for the two years in consideration for both types of system (Piedmont, Aosta Valley, Lombardy, Trentino-Alto Adige, Veneto, Tuscany, Umbria, Marche, and Molise). It is specified that the trend shown in Figure 6.7 refers to the Regions for which a complete set of 1999-2011 data is available: Aosta Valley, Lombardy, the autonomous Province of Bolzano, Veneto, Emilia-Romagna, Tuscany, Umbria, Marche, Abruzzo, Molise, and Basilicata).

From 1999 to 2011, the number of controls on electromagnetic field sources has shown a rather variable trend which, since 2005, has recorded a general decline from previous years (2000-2004).

Notes
The data are those regarding only the Regions/Autonomous Provinces for which there is a complete set.

Figure 6.7: Trend in the number of opinions and controls for sources of ELF fields in Italy

Based on the data contained in “EMF Monitorin Unit” the cases of overcoming the legal limits for RTV systems (equal to 603) are about 7 times greater than those regarding the BTS systems (equal to 85). For the Regions for which the set of information has already been updated (Piedmont, Aosta Valley, Lombardy, Bolzano, Veneto, Friuli-Venezia Giulia, Liguria, Emilia-Romagna, Umbria, Marche, Molise, Abruzzo, Basilicata, and Calabria), the percentage of remedial actions concluded with regard to RTV systems is 63% of the total, against 85% for the BTS systems (Figure 6.8). It bears mentioning that the information regarding the status of the remedial actions corresponds to the environmental.

The cases of exceeding the legal limits regarding the RTV systems (equal to 603) are about 7 times greater than those regarding the BTS systems (equal to 85).

Notes
The data are those regarding only the Regions/Autonomous Provinces for which there is a complete set.

Source: ARPA/APPA data (EMF Monitoring Unit) processed by ISPRA
Agencies System’s state of current knowledge. As for the BTS systems, a high percentage of concluded remedial actions has been recorded in comparison with RTV systems, for which the complexity of the remedial action (involvement of a number of systems, difficulty in maintaining the same service quality as per the concession documents) results in a greater presence of remedial actions to be concluded. The regional regulatory scenario presents no new elements with regard to protecting the population from exposure to electromagnetic fields. For the Regions for which the information was updated (Piedmont, Aosta Valley, Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia, Tuscany, Umbria, Marche, Molise, Apulia, Basilicata, and Calabria), no variations from 2011 are recorded. There are still but a few Regions with a registry for both high and low frequency; in fact, only 11 Regions (Aosta Valley, Liguria, Emilia-Romagna, Tuscany, Umbria, Marche, Abruzzo, Campania, Apulia, Calabria, and Sardinia) have an RF/ELF registry either developed or being developed.

Notes
The data are those regarding only the Regions/Autonomous Provinces for which there is a set updated to 31 December 2012 for both types of RF source.

Figure 6.8: Status of remedial actions at sites where excess due to RTV and BTS systems was surveyed (1998-2012)\(^7\)

For RTV systems, the remedial action is technically more complex. In fact, the relative percentage of concluded remedial actions (63%) is lower than BTS systems (85%).

\(^7\) Source: ARPA/APPA data (EMF Monitoring Unit) processed by ISPRA
Specific regional characteristics

In the last months of 2012, in Friuli Venezia Giulia, the process still underway began for the formation of the Regional Plan for the Recovery of Radio Electric Systems pursuant to Law no. 36/01 and the corresponding Strategic Environmental Assessment Procedure. This Plan should enable the gradual adjustment, in accordance with certain procedures, of the systems currently involved in situations of exceeding the limits. The remedial procedures provided for by the Plan will in substance be reduction to compliance on site and removal to sites with characteristics responding to the urban planning, radio electric, healthcare, and environmental compliance requirements in force.

The “La Spezia-Acciaiolo” (line 314) power line has an 89 km route that takes it to the provinces of Massa Carrara, Lucca, and Pisa, traversing the territory of 15 municipalities. Taking as a reference the average currents recorded on line 314 in the years 2005-2010, it may be pointed out that in 14 of the households monitored by ARPA Tuscany (ARPAT) the average level of exposure of 1 µT has been exceeded. This situation has suggested starting a project for activating an ongoing control system making it possible to update exposure levels virtually in real time.

The objective of the project led by the Province of Lucca is to be able to provide to public administrations and citizens an estimate of the exposure levels to the magnetic fields produced by the line, employing mathematical models that use the results of measurements made continuously at a fixed station. Through appropriate calibrations, it is in fact possible to know the current circulating on the line at a given instant. The physical laws that relate the current to the magnetic field are at the basis of the PLEIA-EMF model ver. 1.6, developed for ARPAT by FAC-CNR, Florence, and validated by the Agency.

The information on the exposure levels generated by the power line at receivers along the power line’s entire route, was made available to citizens and local bodies by means of a monthly bulletin (http://www.arpat.toscana.it/datiemappe/bollettino-elettrodotto-la-spezia-acciaiolo).

Since 2004, ARPA in the Aosta Valley has undertaken a solar radiation monitoring programme. Starting up a set of accurate measurements trackable to international references is in fact an essential condition for identifying medium- and long-term trends (linked, for example, to the phenomena of the variations in the ozone layer and to global dimming/brightening), in order to deepen knowledge of the dynamics of air quality, of the natural contribution to fine dusts, and of the radiative balance in the atmosphere (photo-chemical pollution, concentrations of gases identifiable by solar absorption spectroscopy, optical, microphysical, and properties of aerosols), and to study the positive and negative effects of exposure to the sun by residents and tourists, especially at high elevations, as well as the effects on flora, fauna, flora, and materials. Underway at the Aosta Valley ARPA are investigations in broad and spectral, ultraviolet and visible band, ozone layer estimates, sulfur and nitrogen...
dioxide by means of Brewer spectrophotometer, and measurements of the optical properties of aerosols with narrowband solar photometry. The Agency belongs to the leading international networks on solar data (WOUDC, EuroSkyRad, etc). Advances are planned for estimating natural infrared radiation and the vertical profile of aerosol.

TERMS AND DEFINITIONS

**Physical agents:**
Those factors that trigger emissions of energy into the environment that are potentially harmful to human health and to ecosystems. This category includes noise, electromagnetic fields, vibrations, light pollution, ultraviolet (UV) rays, and ionizing radiation.

\(L_{den}\):
Day-evening-night noise indicator, for overall annoyance, introduced by Directive 2002/49/EC.

\(L_{night}\):
Night-time noise indicator, for sleep disturbance, introduced by Directive 2002/49/EC.

**NOISE:**
*Noise Observation and Information Service for Europe*, maintained by the European Environment Agency (EEA) and the European Topic Centre on Spatial Information and Analysis (ETC-SIA, previously ETC-LUSI) on behalf of the European Commission. It contains data related to strategic noise maps delivered in accordance with European Directive 2002/49/EC relating to the assessment and management of environmental noise.

**Decibel (dB):**
The decibel (symbol dB) is one tenth of a bel (symbol B): 10 dB = 1 B. Although the bel has now fallen into disuse, it remains the fundamental unit of measurement from which the decibel derives; moreover, corresponding measurements are pure numbers and are precisely obtained as a logarithm of the ratio between two values of a physical quantity (which is to say, they can be expressed in the same unit of measurement, and thus such that their ratio is a pure dimensionless number).

**Catasto Nazionale sorgenti di rumore (national noise sources registry):**
Developed by ISPRA, at the mandate of the Ministry of the Environment, it is an archive of data for characterizing noise sources of national importance, such as transport infrastructure or systems subject to integrated environmental authorization (Autorizzazione Integrata Ambientale - AIA). The register lends itself to being a tool of great usefulness in the area of environmental impact studies, but above all as a public-targeted component of environmental information processes.
Osservatorio CEM (electromagnetic field monitoring unit):
The “Osservatorio CEM” database was born from the need to develop an adequate knowledge base regarding the number of systems present on the territory (RTV systems and cell sites for high frequency, and power lines for extremely low frequencies ), the control activity performed by regional and provincial environmental protection agencies (ARPA/APPA), and the existence of critical situations on the territory, connected with exceeding the limits provided for by the legislation in force.

System (RF):
The number of antennas operating at a given frequency equals an impact (this definition is in line with the technical specifications of the osservatorio CEM).

Site (RF):
Geographic location where telecommunications systems are installed. The site may be simple - a pole or pylon, for example - complex, with many poles and/or pylons, generally fenced in (this definition is in line with osservatorio CEM’s technical specifications).

Radio television systems (RTV):
Systems for radio and television broadcasting transmit electromagnetic waves at radio frequency, with frequencies between a few hundred kHz and a few hundred MHz.

Cell sites (CS):
Cell sites (CS) are mobile phone systems that receive and retransmit cellphone signals. These systems operate in various frequency bands, between 900 and 2,100 MHz, depending on the technological system used.