Green Book

On Workstation Adaptation for People with Multiple Chemical Sensitivity and/or Electrohypersensitivity

CONFESQ
COALICIÓN NACIONAL
FIBROMIALGIA
ENCEFALOMIELITIS MIÁLGICA/ SFC
SENSIBILIDAD QUÍMICA MÚLTIPLE
ELECTROHIPERSENSIBILIDAD

Fundación ONCE

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Multiple Chemical Sensitivity and/or Electrohypersensitivity

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We would like to thank all those associated with CONFESQ member organizations who have shared their cases for the study, as well as those who have contributed with their reviews and input, including Julio Carmona, Vanessa Basurto, Anabel Tenorio, and Isabel Muñoz, whose support has been essential to the improvement of this work.

Translation into English was done by Mon González Ferrán, member of EQSDS.

Design and layout: David Diaz and Irati Herrera Ros.

Publication funded by FUNDACIÓN ONCE.

Unless otherwise stated, all illustrations included in this work have been generated using artificial intelligence processes, specifically with the GPT-5 model developed by OpenAI (2025). The images do not correspond to photographic records of reality, but rather to visual representations created for illustrative and conceptual purposes.

ISBN-13: 978-84-09-86837-7

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Translator's note for clarity purposes

Whereas the term *electromagnetic fields* (EMFs) is clear, the impairment caused by them, **EHS**, can stand in English for electromagnetic hypersensitivity, electromagnetic sensitivity, electro-hypersensitivity, or **electrohypersensitivity***,* depending on the author. We have decided to use *electrohypersensitivity*, mirroring the Spanish term "*electrohipersensibilidad"*.

On the other hand, the word ***disability*** has been used as an umbrella term, and also as the term linked to the recognized degree of disability (as a percentage), on which a wide array of benefits is built.

Nevertheless, for the sake of precision, the preferred terms have been: ***impairment,*** when the term *disability* refers to the body level; *activity limitation* when it refers to the personal level; and *participation restriction*, when it refers to societal level. *Degree of impairment* is thus used in the above-mentioned context.

However, when referring specifically to the effects of disability on the occupational domain*,* ***incapacity for work*** has been the term selected, mirroring the Spanish term. That same term has also been applied to its different gradations according to the Spanish system: *temporary, total permanent, absolute permanent or great.* It has also been the term used when translating the *non-contributory incapacity pension*, the *degree of incapacity*, or the *supervening incapacity*.

Furthermore, the specific translation used for the terminology employed in the occupational field is set out below: ***work activity*** for "*actividad laboral"*; ***work environment*** for "*ámbito o entorno laboral*"; ***workforce*** for "*plantilla*"; ***workplace*** for "*centro o lugar de trabajo*"; ***workstation*** or ***job*** (applied when referring to the action being performed) for "*puesto de trabajo*".

Definition of Green Book:

A Green Book is an official document of an advisory and consultative nature, generally produced by public institutions or specialized entities, which aims to present proposals, recommendations, and courses of action on a specific topic, with the aim of promoting debate, reflection, and the development of policies or practical measures.

In this case, the **"Green Book on Workstation Adaptation for People with Multiple Chemical Sensitivity and/or Electrohypersensitivity"** seeks to offer guidance and best practices for adapting work environments to the needs of people affected by these conditions. Its purpose is to foster inclusive, safe, and healthy environments by promoting awareness, accessibility, and risk prevention in the work environment.

Foreword

It is an honor for me to present this ***Green Book on Workstation Adaptation for People with Multiple Chemical Sensitivity (MCS) and/or Electrohypersensitivity (EHS)***, prepared by the National Coalition of Fibromyalgia, Chronic Fatigue Syndrome, Multiple Chemical Sensitivity, and Electrohypersensitivity Organizations (CONFESQ), with the support of our institution, Fundación ONCE.

The decision to support and finance this work was not made lightly. It is part of our mission as a foundation, which is none other than to contribute to the full social and labor inclusion of people with disabilities, promoting projects that not only address established realities but also consider emerging challenges. In this sense, Multiple Chemical Sensitivity and Electrohypersensitivity are clear examples of emerging and little-recognized disabilities that pose significant challenges at the legislative, social, and labor levels.

For too long, people with these diagnoses and conditions have had their life experiences questioned, their needs and difficulties belittled, and, on too many occasions, their right to participate in society on equal terms violated. Among these rights, access to decent work and job security are particularly important, ensuring that the employment is of high quality. This also includes occupational health, prevention, and protection against risks, which are fundamental pillars of inclusion.

At Fundación ONCE, we believe that every person with a disability, regardless of its type, rarity, or whether it is emerging or minority in nature, has the right to work and contribute to the common good, and that it is the responsibility of all stakeholders—public administrations, companies, and organized civil society—to create the conditions that make this right possible.

This *Green Book* is part of that logic: to provide rigorous knowledge, practical tools, and criteria for action that facilitate the adaptation of workplaces to the needs of people with MCS and/or EHS.

Its development responds to an increasingly visible social and labor demand, and it does so from a scientific, technical, and regulatory approach that is essential for progress.

This is a novel publication, the first of its kind in our country, which opens the way for reflection on how work environments and jobs should be organized to be safe, healthy, and respectful of diversity in abilities and sensitivities. The novelty of this initiative lies in its ability to set out in black and white a framework of solutions and adaptive proposals, which until now had hardly any systematized references in our academic, business, or regulatory environment.

The quality of the work is indisputable. The rigor with which the various chapters have been approached, the balance between scientific evidence, testimonials, and technical recommendations, as well as the broad view of the legal and organizational implications, give this document first-rate academic and practical value. We are convinced that it will not only be a useful tool for those who live with these conditions, but also a reference tool for human resources professionals, occupational health and safety experts, lawyers, public policy makers, and, in general, anyone committed to equal opportunities in the workplace.

We also trust that this *Green Book* will have a positive impact on companies, helping them to become aware of the need to adapt to an emerging reality that, far from being marginal, is part of the present and future of our societies. In a context in which occupational health, sustainability, and corporate social responsibility are becoming strategic priorities, business organizations will find here extremely valuable material for improving their practices and anticipating changes that will undoubtedly set the agenda in the coming years.

Similarly, it is to be hoped that this work will serve as inspiration for future legislative developments that provide a clear and stable legal framework guaranteeing the rights of people with MCS and EHS, while at the same time guiding institutions and companies on how to comply with those rights.

Experience in other areas shows us that legislative changes are often based on pioneering initiatives such as this one, which provide knowledge and raise awareness of realities that were previously insufficiently recognized.

Allow me, at this point, to express my sincere congratulations to CONFESQ for its initiative and strategic vision in promoting this project. Its commitment to the people it represents, its capacity for dialogue with institutions, and its rigor in defending the rights of this group are an example of how organized civil society can be a driving force for change and social progress.

Similarly, I would like to acknowledge the work of the authors of this *Green Book*, whose efforts have made a document of this magnitude possible. Their contribution is not only academic or technical: it is, above all, an act of responsibility and commitment to the dignity of thousands of people who aspire to live and work in fair conditions.

Fundación ONCE is proud to have collaborated in the realization of this project. We do so with the conviction that every step toward workplace inclusion is a step toward a more just, equitable, and humane society. By supporting this publication, we reiterate our commitment to stand alongside all people with disabilities, including those who represent lesser-known or less visible realities, but who are equally legitimate and in need of recognition.

I conclude with an invitation: may this *Green Book* be read, disseminated, and applied. May it serve as a starting point for debates, research, policies, and business practices that contribute to improving the lives of people with Multiple Chemical Sensitivity and Electrohypersensitivity. And may its impact transcend the sphere of those of us gathered here today for its publication, reaching every corner of society.

I am convinced that this is only the beginning of a journey that we must take together.

Virginia Carcedo Illera
Secretary General and Director of Transformation, Excellence and Equality

ONCE Foundation

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Abbreviations

AHU – Air Handling Units
AQuAS - Catalan Agency for Health Quality and Assessment
ASANACEM/EEKNE - Association of People Affected by Electromagnetic Fields in Navarra
BDGP – Scale of Global Disability for Individuals
BFE - Bacterial filtration efficiency

BLAM – Scale of Limitations in Mobility Activity

BREESI - Brief Environmental Exposure and Sensitivity Inventory

BRP- Scale of Participation Restrictions

CESCR Committee – Committee on Economic, Social and Cultural Rights

CJEU – Court of Justice of the European Union

COCEMFE – Spanish Confederation of People with Physical and Organic Disabilities
CONFESQ – National Coalition of Fibromyalgia, Myalgic Encephalomyelitis/ Chronic Fatigue Syndrome, Electrohypersensitivity, and Multiple Chemical Sensitivity Organizations
CRPD – United Nations Convention on the Rights of Persons with Disabilities

CRPD Committee – UN Committee on the Rights of Persons with Disabilities
CTE – Technical Building Code

DECT – Digital Enhanced Cordless Telecommunications

ECHA - European Chemicals Agency
EHS - Electromagnetic hypersensitivity
ELF - Extremely low frequency electromagnetic fields
EMFs – Electromagnetic Fields

EPRS – European Parliament Research Service

EQSDS – Electro and Chemically Sensitive for the Right to Health

ET – Workers' Statute

EUROPAEM – European Academy for Environmental Medicine
IARC – International Agency for Research on Cancer
IBN – Institute for Bioconstruction and Sustainability IBN

ICD – International Classification of Diseases

ICESCR – International Covenant on Economic, Social and Cultural Rights

ICNIRP - International Commission on Non-Ionizing Radiation Protection
IDA – Indoor Air Quality
IEB - Spanish Institute of Baubiologie
IEI - Idiopathic Environmental Intolerance
ILO - International Labor Organization
INSHT- National Institute for Security and Hygiene at Work
INSS – National Social Security Institute
INSST – National Institute for Safety and Health at Work
LPRL or PRL - Occupational Risk Prevention Law
ME/CFS - Myalgic Encephalomyelitis/ Chronic Fatigue Syndrome
MCS – Multiple Chemical Sensitivity
MW – Microwave
OD – Organic Disability
ODA - Outdoor Air Quality
ORP – Occupational Risk Prevention
PACE - Parliamentary Assembly of the Council of Europe
PPE - Personal Protective Equipment
PSWs– Particularly Sensitive Workers
QEESI – Quick Environmental Exposure and Sensitivity Inventory
RF - Radiofrequency
RITE – Regulations on Thermal Installations in Buildings
TILT – Toxic-Induced Loss of Tolerance
TIW – Temporary incapacity for work
TRLGSS – General Social Security Law
VLF – Very Low Frequency Magnetic Fields
VOCs – Volatile Organic Compounds
WHO – World Health Organization
WSA- Workstation Adaptation

CHAPTER

1

Multiple Chemical Sensitivity and Electrohypersensitivity,

what are we talking about?

Biomedical perspective

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Alborada Foundation

1.1

Multiple Chemical Sensitivity

Multiple Chemical Sensitivity (MCS) is an acquired disease in which sufferers experience a series of adverse symptoms when exposed to low levels concentrations of a wide range of toxic chemicals that, unfortunately, are very common in today's everyday environments. Patients suffer in the presence of such chemicals even at concentration levels that other people without this condition seem to "tolerate."

As scientific literature shows, MCS is a condition that **predominantly affects women**. Some studies indicate that more than 80% of people who suffer from it are women. The causes of this may be diverse and may also interact with each other. Causes may range from the possible concurrence of certain hormonal factors that could lead to greater sensitivity, among other possible elements, to the different nature of the chemical exposures to which women are exposed compared to men.

A significant development in relation to MCS was undoubtedly its official recognition in Spain in 2014. This came about through the assignment of a code for MCS within the list of pathologies in the national health system. In other words, through its incorporation into the Spanish **International Classification of Diseases** (ICD-MC). In subsequent years, the disease continued to be included in successive updates to the classification under code T78.40.

The recognition of this pathology at the national level, which the MCS community had been demanding for a long time, followed parameters similar to those adopted in other countries, which have also included MCS in their respective ICEs[1]. This has been the case, for example, in Germany (2000), Austria (2001), Japan (2009), Switzerland (2010), Denmark (2012), and Finland (2014).

The inclusion of the disease in the ICD in Spain was a positive development for people suffering from it in this country, as it represented **official recognition of its existence as a physical ailment** in a context in which patients often faced inadequate treatment and a notable lack of understanding. The fact that the disease finally had a code in the official list of pathologies gave those affected another tool to defend their rights in society, particularly in areas such as legal, labor, and health matters.

However, the inclusion of MCS in the ICD in Spain was only one step among many others that have been taken and many more that still need to be taken. We are still a long way from ensuring that the growing number of people suffering from this condition receive the adequate care they deserve.

> The road traveled so far in understanding and addressing this condition has been long. Of particular importance has been the work carried out by many scientists and medical professionals who have made increasingly accurate contributions to the parameters that characterize this disease.

This path has run parallel to the progressive development of environmental medicine.

Although the earliest references to this health problem are more remote[2], it is generally considered that it was not until the 1950s that the first significant scientific publications on this disease appeared, written by scientists such as **Theron Grant Randolph**[3]**,** whom some sources consider, in a way, to be a pioneer in clinical ecology. Randolph carried out extensive research into the various consequences that could result from exposure to certain toxic substances.

This work would be of great importance in understanding these pathological phenomena[4]. Subsequently, authors such as **William J. Rea**[5]**,** among others, would continue to make significant contributions.
It was in the 1980s when another researcher, **M. R. Cullen**[6] defined Multiple Chemical Sensitivity as an acquired disorder characterized by a series of recurrent symptoms that manifested in multiple organ systems and occurred in response to exposure to chemically unrelated compounds at doses well below those generally considered "harmless" in the general population.

Somewhat later, as the 1990s approached, experts from different medical specialties established agreed criteria[7] setting out five requirements that must be met in order for a person to be diagnosed with MCS. Ten years later, these criteria were improved upon with another consensus definition[8]. This added one more parameter to be taken into account in the diagnosis, in addition to the previous five.
This **consensus definition**, published in 1999, established that a person could be diagnosed with MCS if the following six points were met:

1. That the symptoms recur when exposure to the triggering agent is repeated.
2. The condition is chronic.
3. On the other hand, symptoms appear with exposure to low levels of concentration of the substances, lower than those that were previously tolerated (or lower than those usually considered to be "tolerated" by a large part of the general population).
4. That symptoms improve or resolve when triggers are eliminated.
5. That responses occur to multiple chemically unrelated substances.
6. That the symptoms affect multiple organ systems (a multisystemic disease).

If a patient met all six of the conditions listed, a diagnosis of Multiple Chemical Sensitivity was made. The last factor, the sixth added to the list, was precisely the one added in 1999. This factor was very important because it served to differentiate this pathology from others that can specifically affect an organ (asthma or migraine, for example). Subsequently, it was suggested that, to further clarify the case definition, it should also be specified at all times that the central nervous system is always one of the multiple systems involved[9].

The drafting of this improved consensus statement in 1999 was influenced by the flood of people who had been affected by Multiple Chemical Sensitivity as a result of their participation in the Gulf War. A large number of new patients joined the already high number of people who, for various reasons, were already suffering from the disease. This made a number of specialists feel even more strongly that a clearer definition was needed in order to properly diagnose so many people.

Various studies had found that military personnel who had participated in that offensive were much more likely to have this condition. For example, there were studies[10] showing that veterans of that conflict were between two and four times more likely to have MCS than personnel who had not been deployed.

The signatories of the consensus statement did not consider it reasonable that so many thousands of people should have to wait for a standard diagnosis to be developed while further research was conducted into the possible cause of a series of specific symptoms. The disease was a stark reality and needed to be properly addressed.

Symptomatology

The list of substances or **chemicals** that can trigger the symptoms of this systemic disease is extraordinarily long and, unfortunately for patients, many of these chemical compounds are extremely common in today's society. As mentioned above, they are often present in many everyday environments[11], which can have a profound impact on the quality of life of many patients. These products include a wide variety of perfumes and colognes, air fresheners, solvents, cleaning products, detergents, fabric softeners, personal hygiene products, deodorants, lotions, hairsprays, inks, adhesives, paints, nail polish removers, nail polish, shaving lotions, cosmetics, lacquers, pesticides, and many other items that may contain or release countless substances, often of known toxicity.

When exposed to environments where triggering factors such as those described above are present, patients may experience **a wide range of symptoms** affecting different systems of the body. There is a vast array of possible symptoms. It would be difficult to attempt to list them all. The following is a list[12] of some of those that may occur, as described in the scientific literature. Symptoms related to the central nervous system include headache, extreme fatigue, tiredness, weakness, irritability, loss of memory and concentration, mental confusion, dullness, disorientation, cognitive dysfunction, insomnia, mood swings, depression, and anxiety. In relation to the musculoskeletal system: numbness, weakness, muscle pain, muscle tension, lack of coordination, joint pain.

Related to the respiratory system: breathing difficulties, irritation of the respiratory tract, dry cough, loss of voice, hoarseness, recurrent ear infections, rhinitis, loss of voice. Related to the cardiovascular system: chest pain, palpitations, irregular heartbeat, tachycardia, hypertension.

In the gastrointestinal system: esophageal spasm, nausea, vomiting, recurrent diarrhea, constipation, changes in appetite, anorexia.

In relation to the skin, mucous membranes, and eyes: pruritus, skin and mucous membrane irritation, facial swelling, itching and/or sore throat, odynophagia, dysgeusia, dry mouth, eye irritation and pain, tearing, blurred vision. And in the genitourinary system: menstrual disorders, vaginitis, pain, dysuria, urinary retention, impotence.

When exposed to triggering chemicals, often at low concentrations, some of the symptoms may appear suddenly and unexpectedly, or they may develop more gradually. **When the person removes themselves from the triggering agents, there is usually a gradual improvement.**

In view of the possible symptoms, such as those listed above, it is clear that the degree of **suffering** of some affected individuals, especially those with severe Multiple Chemical Sensitivity, can be very considerable and limiting. In many cases, it can severely affect their ability to lead a more or less normal life.

Multiple Chemical Sensitivity (MCS)

A systemic illness in which exposure to common chemicals can trigger a wide range of symptoms.

Common triggers

- Perfumes and colognes
- Cleaning products
- Personal Care
- Paints and Inks
- Pesticides
- Environmental Contaminants

Estimated Prevalence in the Population

United States
12.8% diagnosed with MCS (2016)
25.9% degree of sensitivity to chemicals (2016)

Australia
6.5% diagnosed with MCS (2016)
18.9% degree of sensitivity to chemicals (2016)

Japan
7.5% prevalence of MCS (2015)

Germany
0.5% diagnosed with MCS (2005)
9% degree of sensitivity to chemicals

Canada
3% diagnosed with MCS (2007)

Denmark
1.95% estimated MCS (2011–2015)

Symptoms by System:

Central Nervous System

Headache.
Extreme fatigue, tiredness, weakness.
Irritability, mood swings, depression, anxiety.
Memory loss and poor concentration, mental confusion, dullness, disorientation, cognitive dysfunction.
Insomnia.

Musculoskeletal System

Numbness, weakness.
Muscle pain, muscle tension.
Lack of coordination.
Joint pain.

Respiratory System

Difficulty breathing.
Irritation of the respiratory tract.
Dry cough, dysphonia, hoarseness.
Recurrent otitis, rhinitis.

Cardiovascular system

Chest pain.
Palpitations, irregular heartbeat, tachycardia.
Hypertension.

Gastrointestinal System

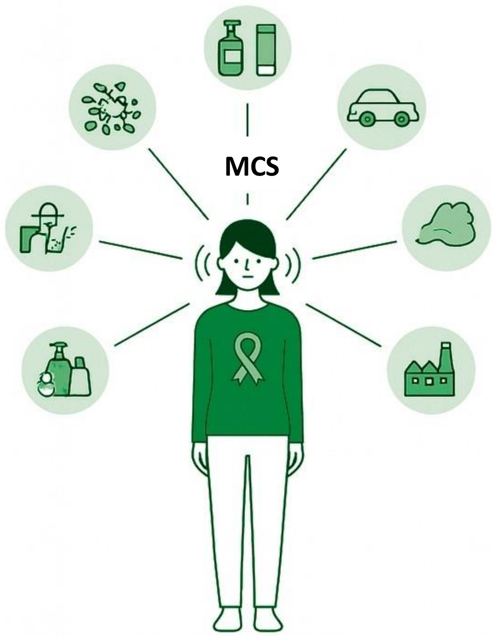
Esophageal spasm.
Nausea, vomiting.
Recurrent diarrhea, constipation.
Changes in appetite, anorexia.
Related to the skin, mucous membranes, and eyes:
Pruritus, skin and mucosal irritation, facial swelling, itching and/or sore throat, odynophagia, dysgeusia, dry mouth, eye irritation and pain, tearing, blurred vision.

Genitourinary system

Menstrual disorders. Vaginitis.
Pain, dysuria.
Urinary retention. Impotence.

For example, in areas such as the workplace, which can often be chemically hostile and trigger recurring symptoms. But obviously, this can happen not only at work, but also in other everyday settings, such as at home, on public transport, in shops, on the street, in leisure venues, etc.

A complex disease



MCS is a complex disease that can manifest itself in extraordinarily varied ways. This diversity can be expressed in different ways. For example, in the way it progresses in different patients or even within the same person, in how it expresses itself at different stages of the disease's evolution. There are also, of course, differences in relation to the degree of impact it can have.

This is something that must always be considered when making a diagnosis. It reflects the level of severity. Consequently, it establishes the possible **degrees of incapacity for work**, whether minimal, partial, or, if necessary, total. There may be people who experience symptoms less frequently and with less intensity, as well as people who have MCS that is highly debilitating and continuous. It is important to differentiate whether it is clearly chronic or whether it occurs in more specific situations. It is also important, for example, to establish the intensity of the symptoms (whether they are mild, moderate, or severe), as well as their frequency and the nature of possible sensory impairments (smell, taste, hearing, sight, touch). Factors such as pain should be taken into account and elements such as sensitivity changes and the extent to which a series of stimuli are tolerated or not should be determined. It is advisable to make individualized diagnoses that are updated according to the evolution of the problem over time in each person.
It is also important to consider that other problems that may also occur concurrently and overlap with MCS should be diagnosed, such as chronic fatigue syndrome, fibromyalgia, electrohypersensitivity, migraines, allergies, asthma, etc.

Diagnosis.
The QEESI and BREESI questionnaires

The QEESI (Quick Environmental Exposure and Sensitivity Inventory[13]) questionnaire is particularly useful in the diagnosis of MCS. It provides standardized objective clinical criteria that can be used to determine which agents cause the symptoms and to measure their severity.
The QEESI is a validated questionnaire that addresses the chemical exposures to which the subject may have been exposed and which may have caused intolerances, as well as the symptoms they experience and, among other factors, the level of deterioration in their quality of life[14]. The questionnaire is used worldwide to assess intolerances to chemicals, foods, and drugs.

A version translated and adapted to the national cultural context has been published in Spain.[16]

Subsequent to the QEESI, another questionnaire has also been used, the BREESI (Brief Environmental Exposure and Sensitivity Inventory). This is a shorter but very useful questionnaire, as it is often used to determine, at an early stage, whether it is appropriate for a person to take the more comprehensive QEESI.
One of the objectives of BREESI is precisely to facilitate and speed up the diagnosis of MCS in primary care. Unfortunately, such diagnoses have been largely absent from conventional medical practice, despite the notable prevalence of this type of pathology. Having a questionnaire as simple and quick as the BREESI in primary care can encourage more diagnoses, as it is much less cumbersome to complete than the QEESI.
It is very easy to administer, as it only has three items that can be answered with a simple yes or no. It allows us to predict, with a fairly high degree of accuracy, whether a person is likely to suffer from MCS. This should then be confirmed by administering the QEESI (which has 50 items).
In reality, the BREESI is, to some extent, a highly condensed and synthesized version of the QEESI. However, it should be clearly noted that it is not intended to replace it but, on the contrary, to serve as a detector of individuals who should subsequently undergo the QEESI because they are likely to suffer from MCS[18]. The BREESI offers "a high degree of confidence in case detection," so it is always recommended to perform screening with the BREESI and then confirm with the QEESI[19].

Prevalence

When discussing the number of people who may be affected by MCS in relation to the total population of a country, it is always important to distinguish between cases that can be fully classified as MCS and other manifestations of hypersensitivity to exposure to a range of chemicals that may be more common and may or may not be related to MCS. This is because only a percentage of people who report hypersensitivity to chemicals meet the criteria for a diagnosis of MCS.

Several estimates have been made in the United States over time. One published in 2004 reported that **11.2%** of Americans interviewed expressed unusual **hypersensitivity** to common chemicals such as fragrances, paints, pesticides, and others[20]. However, "only" **2.5%**, a figure that a study conducted somewhat later[21] increased to **3.9%,** reported having been medically diagnosed with Multiple Chemical Sensitivity.

However, an estimate made years later[22] yielded worrying results. In 2016, a survey was conducted on a representative sample of the general adult population in the United States, and it was found that **12.8%** reported having been diagnosed with MCS and **25.9%** reported having some degree of sensitivity to chemicals. In short, according to that study, the prevalence of diagnosed MCS had increased by more than 300% and self-reported chemical sensitivity by more than 200% in a decade.

If these conclusions are confirmed, they would reveal a frankly worrying reality. Not only in relation to the United States, but to a greater or lesser extent, this may be happening in other countries, always taking into account the differences that may exist in chemical exposure and other circumstances in different nations. Unfortunately, not enough research is being done.

Some studies are already several years old, such as one conducted in **Canada and** published in 2007, which estimated an approximate prevalence of **3%** of people who had been diagnosed with MCS[23]. In 2005, a report by **the Danish** Ministry of the Environment estimated that around **1%** of the population could suffer from MCS. A subsequent study based on data collected between 2011 and 2015, referred to **1.95**%. In **Germany**, a study also published in 2005 put the percentage of people diagnosed with MCS at **0.5%** and the percentage of people who reported being particularly sensitive to exposure to certain chemicals at 9%.

A study conducted in **Japan**[27] and published in 2015 showed a prevalence of **7.5%** in that country[28]. Another study[29] showed that 9.0% of high school students in Japan are at high risk of developing MCS. Research in **Australia**[30] with data collected in 2016 on a representative sample of the general adult population showed that **6.5%** of people were medically diagnosed with MCS and 18.9% were unusually sensitive to a range of everyday chemicals.

Even if we look at the lowest prevalence rates among those cited, it is clear that MCS is a condition that affects many people, millions worldwide.

In Spain, no studies have been conducted that would allow for an estimate based on data obtained directly from the population, so the only option is to make a cautious estimate based on a nuanced translation of data obtained in other countries[31].

This, of course, cannot replace the need for a national study to provide reliable data.

Mechanisms

MCS has been defined as a **central sensitization** disorder[32]. This type of disorder is characterized by a change in the normal functioning of neurons in the central nervous system. These hypersensitized neurons would have a greater extension of sensory receptors and would manifest lower activation thresholds than normal neurons. They would tend to generate more intense and prolonged responses over time, even after the triggering stimulus has ceased[33].

Some research[34] suggests that among the pathophysiological mechanisms underlying Multiple Chemical Sensitivity, certain chemo sensitive receptors in the nervous system[35] appear to play a significant role. These are nociceptive receptors, i.e., receptors designed to detect potentially harmful elements that could affect the body, such as certain toxic chemicals.

This theory is reinforced by the fact that the same type of mechanism is also found in other pathologies that are often comorbid with MCS, such as migraine, fibromyalgia, chronic cough, asthma, and chronic fatigue syndrome.

The authors of the aforementioned studies report that there is significant evidence showing that **"exposure to chemical pollution can induce sensitization of chemo sensitive receptors in susceptible individuals, which provides a solid basis for the premise that receptor sensitization to chemicals is the main etiological mechanism in MCS."** Sensitization has been described as a progressive increase in the level of response to repeated exposures to identical stimuli[36].

This and other research refer to different studies based on functional brain imaging technologies—single photon emission computed tomography (SPECT[37]), positron emission tomography (PET[38]), etc.—

which have revealed changes in certain regions of the brain in people with the condition. These effects would involve the sensory receptors mentioned above. These receptors are associated with the molecular physiology of chemical perception and are widely present in the nervous system, from the brain to the olfactory nerve pathways. Such receptors can be activated by chemicals, oxidative stress, and systemic inflammation[39] (both factors, oxidative stress and systemic inflammation, having been observed to occur to a greater degree in people with MCS). Repeated and chronic activation of these receptors could lead to hyperexcitability in the response to harmful substances. This could cause a more intense and prolonged reaction to lower concentrations of such substances.
Sensitization mainly affects the central nervous and respiratory systems, but also involves other systems in the body. Scientists insist that MCS is a complex pathology with a multifactorial etiology, in which the following factors may converge: chronic exposure to many different types of chemical pollutants (often in combination), as well as the level of sensitization of chemo sensitive receptors and other factors such as the better or worse functioning of organic detoxification systems, the effect of oxidative stress, systemic inflammation, the effects of comorbidities, the existence in some cases of genetic predisposition, etc.

It has been observed that these chemosensory receptors respond when exposed to low concentrations of substances such as certain volatile organic compounds (VOCs) or other substances that can be very common pollutants in some everyday environments. These are substances to which people with MCS are known to be particularly sensitive, such as formaldehyde or benzene, among many others.
As the pathophysiological basis of the problem various authors have pointed to a **central corticolimbic sensitization** that would become greater with repetition of a series of chemical exposures, ultimately leading to a loss of tolerance.

It should be clarified that "the concept of sensitivity should not be confused with those of allergy, inflammation, autoimmunity, or somatization, with which it has symptomatic similarities but clear pathogenic differences." These processes of sensitization of the nervous system are the most widely established mechanism in the scientific literature on MCS. Much has been published on these events, which lead to substances that previously did not generate a series of responses in people when exposed to them at certain concentrations, eventually generating them after repeated exposure, greatly increasing the intensity of the reaction[42]. Various ways in which this can happen have been described, along with possible reasons that explain why multisystemic symptoms are observed[43].

Basically, there is a general pathological process, widely discussed in the scientific literature and known as **"toxic-induced loss of tolerance (TILT),"** which is related to a wide variety of symptoms and intolerances to chemicals, foods, or medications[44].
This loss of tolerance occurs in two phases. In the first phase (initiation), the person is exposed intensely (acutely) to a toxic chemical or repeatedly to a series of substances of lesser intensity. The chemicals involved can be very varied (pesticides, some cleaning products, solvents, etc.). In the second stage (triggering), the person begins to experience adverse physical symptoms when exposed to certain substances to which they had previously been exposed without generating these adverse reactions.
The reactions occur even though the chemicals are at apparently low levels of concentration that the person previously seemed to tolerate.
Hypersensitivity may initially be to a specific type of substance, then to other related substances, and finally to more compounds.

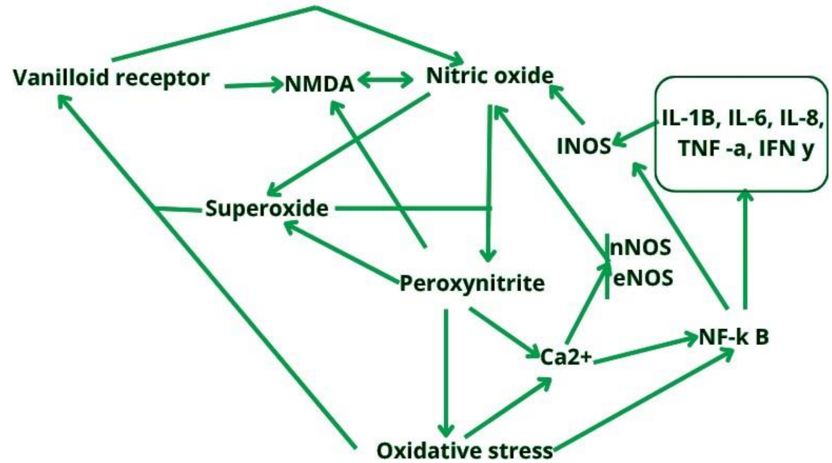
Some authors have drawn attention to the enormous growth in the prevalence of various pathologies linked to TILT around the world, associating this with a series of environmental changes that have led to increased exposure of the population to numerous harmful elements[45].

One of the aspects that has been most highlighted by researchers in relation to Multiple Chemical Sensitivity is the effect on **the limbic system.** Reference has been made, for example, to "limbic kindling" in MCS, which would consist of three stages[46]. A first level in which induction would occur, a second (which could still be reversible), and a third that would already be practically irreversible because limbic sensitization would have already been generated[47]. As one moves from one stage to another, the concentration of the toxic substance needed to provoke the reaction would become increasingly lower.
It has been proven that exposure to certain toxic substances causes high electrical activity in the limbic system of people with MCS. This system, at the center of which is the hypothalamus, regulates countless involuntary functions that are vital to the body. Damage to this system can have multiple and very diverse effects. For example, it has been shown to be linked to some of the symptoms experienced by people with MCS, such as prolonged reactions, memory problems, and, notably, a heightened olfactory response to certain chemical stimuli[48].
Apart from observations in humans, there have also been laboratory studies that have added evidence obtained in animal experiments regarding the sensitization processes of the nervous system as a result of exposure to low concentrations of a series of toxic substances such as certain volatile organic compounds or pesticides[49].

Studies suggest that chemicals that are, in principle, very different from each other can nevertheless produce similar effects on the limbic system. These include an alteration in the functioning of the hypothalamus, which could be related to various organic symptoms observed in people with MCS.

Some research has addressed the role that a dysfunction of the olfactory-limbic system caused by exposure to toxic substances could play in MCS[50]. Various laboratory studies have shown how aggressive substances can reach the brain and sensitize the limbic system through the olfactory pathway[51].
The possible mechanisms involved in the development of MCS have been addressed at different levels.

NO/ONOO CYCLE



For example, scientist **Martin L. Pall** has suggested that the increase in the activity of NMDA (N-methyl-D-aspartate) receptors, found in the limbic system, among other places, may play a role in the disease, leading to an increase in the presence of **nitric oxide** in the brain[52].

The stimulation of certain receptors in the central nervous system due to exposure to different toxic substances is linked to an increase in nitric oxide concentration and peroxynitrite and the generation of a vicious circle of biochemical reactions that would tend to continue generating some of the effects that characterize MCS and other related pathologies[54]. On the other hand, it has been seen that such an increase in nitric oxide levels is associated with a **reduction in the body's detoxification capacity**, which can aggravate the toxic load. Furthermore, a greater presence of peroxynitrite can cause more harmful substances to reach the brain by making the blood-brain barrier more permeable, making it possible for more toxic chemicals to access the brain[55].

Various studies have confirmed the complexity of this pathology, in which various alterations can be observed in different organs and systems, from the nervous system—including the brain, limbic system, peripheral nervous system, and autonomic nervous system—to the liver, immune system, and porphyrin metabolism, among others[56].

Given the many aspects that can contribute to MCS and the complex interactions that can occur between different processes and organ systems, it is essential to approach it from a non-reductionist perspective that can integrate this complexity. To achieve this, it is important to take into account some valuable contributions made in the field of clinical ecology by different professionals. Particularly noteworthy are those made by authors such as William J. Rea[57], which are based on many years of experience caring for thousands of people with the disease. It should always be borne in mind that, in addition to mechanisms such as those described above, a wide variety of factors that may overlap in a patient must be considered. Factors such as, for example, the body's ability to maintain homeostasis, toxic load, those associated with the functioning of organic detoxification systems, basic nutrient levels, individual biochemical specificities, or, among others, those linked to immunity through the neuroendocrine system[58].

Treatment

The complexity of MCS means that the therapies used to improve patients' quality of life can also be complex and involve different medical disciplines. This is especially true when frequent comorbidities are also taken into account. On the other hand, the changing nature of the disease in terms of its symptoms over time requires careful monitoring to ensure that the appropriate therapeutic measures are applied at all times.

If there is one thing that all the research agrees on, it is that the most effective way to help people with MCS experience improvement is **to avoid exposure** to the toxic substances that trigger their symptoms[59]. Given the omnipresence of a series of chemical stressors in today's society and the difficulty of eliminating their presence in many cases, this makes it necessary for patients to develop a series of avoidance habits, regardless of the improvements that may be made by third parties in some areas.

In this regard, guidance from healthcare professionals who are adequately trained in environmental medicine can be invaluable, as they can not only provide appropriate guidelines to patients themselves, but also supply information to those around them (e.g., family or work colleagues).

The scientific literature provides some useful guidelines for helping people with MCS reduce their daily exposure to harmful substances[60]. A strategy for avoiding toxins requires attention to multiple factors, ranging from the air we breathe and the water we drink to the food we eat, as well as avoiding certain chemicals such as cleaning products, personal hygiene products, cosmetics that may contain harmful substances, air fresheners, etc.

Attention should also be paid to certain situations, such as rooms that have undergone recent renovations and where there may be a high concentration of certain volatile pollutants. The possibilities are many.

Without proper environmental control, any other measures that may be taken to improve the situation of people with MCS may be extremely difficult or completely ineffective. The avoidance strategy is therefore a central pillar of any treatment that may be provided.

However, as mentioned above, successfully avoiding exposure in today's society, where a range of chemical pollutants are so ubiquitous, can be extremely difficult. People with MCS are often forced to live in confinement, almost like "bubble people," because it is impossible for them to function in environments that are less aggressive for them. However, although avoiding exposure, for example by creating spaces free of stressors, has always been found to be the most effective approach for people with MCS, this does not mean that it is the only thing that can benefit them. Patients can also receive certain therapies that contribute to their improvement, developed especially in the field of environmental medicine, such as nutritional and vitamin supplements, enhancement of detoxification and biochemical homeostasis of the body, etc.

A good example of treatment for MCS that should perhaps be taken as a reference is the work that has been carried out for a long time at the Environmental Health Center in Dallas, in the United States[62], where thousands of people with MCS have been treated. At this institution, founded by the aforementioned Dr. William J. Rea, in addition to taking extreme care to create facilities that avoid any factors that could negatively affect patients, elements are provided that can improve, in different ways, the response of systems such as the endocrine, immune, and nervous systems.

It also promotes the improvement of the body's detoxification system through various methods. **The treatment is based on a combination of different elements, including the avoidance of triggering substances, progressive desensitization, the provision of essential nutrients, the introduction of a rotation diet, oxygen therapy, sauna, etc.**

Unfortunately, environmental medicine practices such as those mentioned above have little to do with the treatment that many patients have been receiving. Nothing like, for example, what has happened in so many conventional hospital facilities that have not exactly offered the best environment for people with MCS. It has been sadly common for patients to encounter serious difficulties, such as hostile chemical barriers, in places where they should have expected to receive adequate care.

There is still a long way to go[63], although it is true that in some centers, both within[64] and outside[65] Spain, protocols have been established to treat patients with MCS, some better than others.

Comorbidities

An important factor in relation to MCS is that it very often does not occur in isolation, but is accompanied by other pathologies. Thus, a wide range of studies[66] have shown that in a significant percentage of cases, people with MCS may also suffer from, for example, **Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS) and Fibromyalgia (FM).** Some research showed that only 10% of cases suffered from MCS without it overlapping with ME/CFS and FM. It was more common, specifically in 47% of cases, for people with MCS to also suffer from Chronic Fatigue Syndrome and Fibromyalgia, or, in 41% of cases, MCS and ME/CFS. The overlap of MCS with FM alone, without ME/CFS, was somewhat rarer (only 2%)[67].

As we can see, these are very frequently associated pathologies.

Patients with diseases such as Chronic Fatigue Syndrome or Fibromyalgia often have the misfortune of also suffering from Multiple Chemical Sensitivity.

Research has shown, for example, that more than 50% of people with FM[68] and more than 60% of people with ME/CFS also suffered from MCS[69]. These overlaps between different pathologies in the same patient have led some authors to suggest common or related etiologies or mechanisms in many cases[70]. However, comorbidities are not limited to ME/CFS and FM, but also occur with other health problems, which can be attributed to various causes. Consider, for example, **asthma,** a health problem that also frequently overlaps with MCS. One study[71] showed that just over 27% of people diagnosed with asthma also showed some degree of hypersensitivity to exposure to certain chemicals and that more than 7% had, in fact, been diagnosed with MCS. On the other hand, more than 40% of people with MCS had a diagnosis of asthma.

Another significant finding in the aforementioned study was that a notable percentage of people with asthma experienced respiratory problems or irritation when exposed to chemicals that are common triggers of MCS symptoms.
Specifically, in more than 37% of cases, perfumed products caused irritation, and in more than 29% of cases, air fresheners caused some degree of difficulty in breathing. The authors of the study noted that although MCS and asthma are not always linked, it seemed clear that at least in some common types of asthma, there could be causal links and common manifestations.

The study also referred to specific examples of substances that caused adverse symptoms in both people suffering from common types of asthma and people with MCS. One example cited was formaldehyde, a volatile organic compound (VOC) that is gaseous at room temperature and can be present in certain concentrations in enclosed spaces as a result of, among many other possibilities, the use of certain air fresheners[72].

The link between many cases of asthma and exposure to chemicals that can be inhaled in various environments provides evidence of something that is very important to bear in mind: the objectively harmful nature of certain substances. Regardless of whether or not there is comorbidity with MCS in some cases, this leads us to see that it is not only people with MCS who can react to low levels of these pollutants and that, ultimately, it should not be seen as something so strange, as it sometimes seems to some people, that it also happens in the case of MCS.

It is well known that asthmatics can suffer a certain degree of reaction when exposed to certain substances that may be released when fragrances are used. Even if such exposure is at low concentrations. Affecting, for example, their breathing capacity[73]. A study conducted on a representative sample of the US population showed that more than 60% of people with asthma had adverse effects due to their exposure to products containing fragrances, such as some air fresheners and cleaning products[74].

In many cases (more than 40%), asthmatics experienced respiratory problems or (in almost 30%) migraines or asthma attacks. It is significant that more than 46% of asthmatics experienced problems, for example, when they were near someone wearing perfume. Also, more than 42% had problems when staying in a room where fragranced cleaning products had been used, 41% experienced problems with air fresheners or deodorants, and almost 29% suffered when they smelled the fumes from laundry that had been washed with fragranced detergents.

Various studies show how exposure to fragrances can cause asthma symptoms. For example, in one in five people with asthma evaluated in a study, this was associated with wheezing and chest tightness, which, in the case of people with severe asthma, occurred in more than one in three cases[75].

On the other hand, the large number of asthma cases caused by exposure to chemicals in the workplace has also been noted[76] or, to mention just one example, the known adverse effects that certain substances can have on childhood asthma[77].

In addition to what has been mentioned in relation to chronic fatigue syndrome, fibromyalgia, and asthma, other health problems have been cited that may overlap with MCS, such as irritable bowel syndrome, allergies, rhinitis, food intolerances, celiac disease, migraines, hypothyroidism, chronic pain, dry mucous membrane syndrome, irritative cystitis, neuromyasthenia, multiple endocrine dysfunction, arthritis, emotional lability, symptoms of depression, etc.[78]

Finally, MCS can also overlap in many cases, of course, with **electrohypersensitivity (EHS[79])**, the condition we will discuss in the next section.

Electrohypersensitivity

The rapid expansion of some new technologies in recent decades has led to a dramatic increase in human exposure to a range of electromagnetic artificial fields. These technologies were implemented without due consideration of the possible short-, medium-, and long-term effects they could have on human health[80].

Today, millions of people are increasingly exposed daily to various types of electromagnetic radiation with different signal patterns and intensities.

Radio and television transmission antennas, Wi-Fi access points, routers, smartphones, tablets, cordless and mobile phones, including their base stations, Bluetooth devices, wiring and electrical devices, wireless smart meters, etc.[81] are some possible sources of exposure that have raised health concerns[82]. These electromagnetic fields have characteristics that are essentially different from those to which living beings have been naturally exposed on the planet over the millennia. This may be the basis for their toxicity[83].

It has long been known that these exposures can have health consequences[84], and a considerable number of scientific studies have been accumulated on the subject, with numerous position papers[85] by scientists and doctors on the effects of such electromagnetic fields[86].

Important reports such as that of the BioInitiative Working Group, made up of dozens of experts from different countries, have long been calling for preventive measures to be taken in light of the existing scientific knowledge. These reports reviewed the most diverse effects associated, with varying degrees of evidence, with exposure to low-intensity electromagnetic radiation.

The aforementioned documents strongly denounced the inadequacy of the official measures adopted to supposedly protect citizens' health from such non-ionizing radiation. They urged the prompt adoption of a necessary precautionary principle. This was also recommended by entities such as the European Environment Agency itself[89]. The European Parliament[90] also made a similar statement, unsuccessfully requesting that exposure levels to this type of radiation be established to better protect people's health.

Unfortunately, until now, the proper application of the precautionary principle has been conspicuous by its absence. At the official level, incredibly permissive exposure levels have been established, such as those set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP[91]), a non-governmental organization recognized by the World Health Organization (WHO), which has been developing international guidelines on exposure limits to electromagnetic fields[92]. These guidelines have been repeatedly criticized, as in the case of the more than 200 scientists who in 2016 signed an appeal to the WHO urging better protection of human health from the effects of this type of radiation[93].

Nor has due consideration been given to **Resolution 1815 of the Parliamentary Assembly of the Council of Europe of May 2011 on "the potential dangers of electromagnetic fields and their effects on the environment [94]."**
This resolution recognized that this type of radiation can have harmful effects below the levels that had been officially established as

supposedly "safe[95]", regretting that effective preventive measures were not being taken and recommending that, in the interests **of applying the Precautionary Principle**, more restrictive standards should be established. It even mentioned that "special attention should be paid to 'electrosensitive' people suffering from electromagnetic field intolerance syndrome" and recommended "introducing special measures to protect them, including the creation of wave-free zones not covered by the wireless network."

As in other areas of environmental health, the actions of some authorities have largely ignored the voice of science in order to serve other interests, such as those linked to the large economic profits obtained by a number of large companies.

To this end, they have established levels of exposure to this radiation[96] that are highly unlikely to provide adequate health protection.
A scientific evaluation found, for example, that 80% of epidemiological studies conducted on mobile phone base stations showed an increased risk of adverse health effects at exposure levels below those considered "safe" by the ICNIRP.

Unfortunately, most countries simply followed the guidelines issued by the ICNIRP, although others adopted criteria that were only slightly more stringent in some respects[98]. The overall picture in the European Union and the rest of the world is that citizens are still not adequately protected against these environmental risks.

Among the health problems associated with the situation described above, **electrohypersensitivity (EHS[99])** is particularly noteworthy. This is a condition caused by exposure to artificial electromagnetic fields and which, in fact, began to manifest itself strongly precisely after the emergence of the widespread use of a series of technologies on a global scale[100]. This disease, whose naming as such is usually attributed to **Dr. William Rea[101]** in 1991, has been defined by scientific literature as a clearly well-defined and objectively characterized **neurological** pathological disorder, not psychological, which causes a **decrease in the tolerance threshold** to exposure to a series of non-ionizing radiation, even if these are below the maximum permitted limits.

As some of the scientists who have researched the disease in greater depth assert, "EHS is a pathological neurological disorder that can be diagnosed, treated, and prevented[102]."
For them, EHS and MCS "can be characterized clinically by a similar set of symptoms[103] and biologically by mild inflammation and an autoimmune response involving autoantibodies against O-myelin." These researchers also note that 80% of EHS patients have one, two, or three oxidative stress biomarkers detectable in peripheral

blood, which means that, in general, these patients have a genuine **objective somatic disorder.** In addition, using ultrasonic cerebral tomosigmography[104] and transcranial Doppler ultrasound, they found that those affected had a localized hemodynamic defect in the middle cerebral artery and a deficiency in the tissue pulse index in the capsulothalamic area of the temporal lobes, suggesting **involvement of the limbic system and thalamus.**

The various molecular[105] and radiological[106] abnormalities observed in people with EHS clearly show that this is a real somatic disease with a consistent neurological basis. Therefore, as with MCS, it is important that the condition be properly diagnosed and treated. This is because the condition could worsen if measures are not taken to avoid or reduce the degree of exposure and/or to counteract some of the effects that such exposures produce.
The condition can be diagnosed and treated using a series of biomarkers and brain imaging technology, as recognized in an **international scientific consensus report published in 2020[107].**

Numerous well-designed provocation studies have evaluated whether various types of artificial electromagnetic fields—radio frequencies, wireless communication, etc.—cause clinical and biological effects in people with EHS. They have found objective effects that manifest in various sympathetic and parasympathetic neurological symptoms.
These range from alterations in heart rate or blood pressure[108] to effects on sleep quality[109], including changes in the pupillary response to light[110] or visual perception[111].
For example, physio pathological effects have been observed as a result of exposure to GSM mobile phone wireless signals or pulsed radiofrequency electromagnetic fields, which can affect the quality of nighttime rest, with a reflection in the electroencephalogram[112]. There has also been an altered electromyogram[113] after exposure to a wireless local area network (WLAN), as well as other alterations[114].

Various epidemiological studies have shown that some of the symptoms most frequently associated with EHS derive from this type of electromagnetic exposure[115]. Likewise, many people with EHS have a number of characteristics, such as inflammation, oxidative stress, or alterations in the blood-brain barrier and brain neurotransmitters[116], which have been linked to exposure to electromagnetic fields in laboratory experiments[117].
Many in vitro and in vivo studies show alterations in the natural electric fields that are characteristic of normal cellular functioning in living organisms[118]. When applied to the human body, this can cause distortions in endogenous bioelectricity, alter cellular functions, and have adverse effects on health, particularly in relation to the central nervous system, the heart, and the muscles[119].

Unfortunately, despite scientific evidence supporting the existence of a significant health problem, authorities in many countries continue to fail to address the issue adequately[120].
The harmful effect that different types of non-ionizing radiation can have is undeniable and for this reason they are included, for example, under codes W90.0 and W90.8, in the section on factors causing damage in Spain's International Classification of Diseases (ICD 10)[121]. However, the step of adequately cataloging EHS within diagnoses has not been taken.

The countless studies that have shown the existence of objective pathophysiological changes and health effects that may be associated with extremely low frequency (ELF), radiofrequency (RF), or microwave (MW) electromagnetic fields in the general population do not seem to have mattered.

For a long time[122], exposure to microwave radiation, for example from radars, has been associated with symptoms such as headaches, fatigue, insomnia, loss of appetite, concentration and short-term memory, transient cardiovascular dysfunction, or emotional lability. It has also been found that cell phone users or people living in the vicinity of cell phone towers suffered more frequently from a series of

Electrohypersensitivity (EHS)

A condition caused by exposure to artificial electromagnetic fields, which has emerged following the widespread introduction of new technologies.

Common Sources of Exposure

- Mobile phone antennas, TV, radio, radars
- Wi-Fi routers, smart devices
- Mobile and cordless phones
- High- and medium-voltage power lines, transformers, electrical appliances

Diagnosis of EHS

The diagnosis is based on a complete medical history that takes into account the relationship between health problems and reported symptoms, as well as when and where the symptoms appear or become more apparent, paying special attention to those places where the person spends the most time (and, in particular, the place where they rest).

- Detailed Medical History
- Environmental Measurements
- Biomarkers (Blood and Urine)
- Brain Imaging (TDU, fMRI, UCTS)

Estimated Prevalence in the Population

Sweden: 2.7%

Switzerland: 5%

Finland: 7.2%

Austria: 3.5%

Main symptoms

Symptoms are varied and predominantly neurological. Their intensity and frequency may increase with continued exposure, becoming chronic and incapacitating.

- Headaches
- Fatigue and extreme tiredness
- Sleep disorders
- Memory loss and concentration problems
- Dizziness and balance problems
- Tinnitus and hyperacusis
- Palpitations and arrhythmias
- Muscle and joint pain
- Tingling and burning sensation in the skin
- Anxiety and depressive tendencies
- Digestive disorders
- Emotional lability

symptoms[123] (depending on the distance from cell phone towers, symptoms such as nausea, loss of appetite, visual disturbances, irritability, depressive tendencies, decreased libido, headaches, sleep disturbances, or feelings of discomfort have been reported). Elements such as Wi-Fi devices have also raised concerns[124].

It has been shown that artificial electromagnetic fields can cause alterations in the electroencephalogram during sleep[125] and also at rest[126], as well as changes in alpha, beta, and gamma waves[127]. It has also been proven that the brain response associated not only with sleep quality but also with memory[128], among other effects, is modified. Many provocation studies show the biological effects that this type of radiation can have.

It is well known, and much research has been done on this, that mobile phones and certain forms of wireless communication, for example, may be associated with the appearance of a series of clinical effects, oxidative stress, and damage to genetic material[129].

Multiple studies have addressed the non-thermal effects, with health implications, that this type of radiation can have[130].

Exposure to fields generated by power lines, for example, has been associated with a wide range of health effects[131], ranging from neurodegenerative diseases such as Alzheimer's to reproductive problems, including, among others, increased risk of certain types of cancer[132].

The International Agency for Research on Cancer (IARC), for example, classified extremely low frequency magnetic fields as possibly carcinogenic to humans (Group 2B) in 2002 and radiofrequency radiation in 2011.

The existing evidence linking non-ionizing radiation not only to EHS but also to various other health problems[135] ultimately confirms that we are dealing with something that generates biological effects, reinforcing the idea that EHS is a real somatic pathology caused by factors that have been proven to be objectively harmful.

On the other hand, all this only serves to give even greater importance to EHS itself, as it may be indicative of a broader pathological context, which should lead to the understanding that adopting measures to prevent EHS by reducing electromagnetic pollution may also have positive effects in preventing other diseases.

Symptomatology

The symptoms that people with EHS may experience when exposed to sources of electromagnetic pollution are very varied[136] and are predominantly neurological in nature. Among the symptoms that have been cited in the scientific literature are:

> Headaches, tinnitus, hyperacusis, feelings of pressure in the head and ears, dizziness, nausea, balance disorders, superficial or deep sensitivity abnormalities, fibromyalgia, muscle and joint pain, autonomic nerve dysfunction and reduced cognitive ability, immediate memory loss, attention deficit/concentration deficit, temporal-spatial confusion, sleep disturbance, blood pressure problems, palpitations, increased risk of infections, digestive disorders, flu-like symptoms, fatigue, tiredness, lack of energy, redness, tingling, and burning of the skin, depressive tendencies, anxiety, restlessness, emotional lability, and, occasionally, irritability.

Some symptoms may be exacerbated if, as is often the case, the person with EHS also suffers from other conditions, such as MCS. Specific research can be cited, such as a study[137] conducted in Finland on people with EHS —80% of whom were women— which found that during the acute phase of EHS, the most common symptoms were related to the nervous system, such as stress in more than 60.3% of cases, sleep disorders in 59.3%, and fatigue in 57.2%.

Among the reported triggers, some stood out, such as computers and cell phones.
In another study[138], this time conducted in Japan, the most frequently reported symptoms included fatigue and tiredness (85%), headaches, concentration and memory problems, and difficulty in thinking (81%), as well as others such as sleep disorders and dizziness, neurological problems, and digestive difficulties. These symptoms were associated with factors such as cell phone base stations, household appliances, cell phones, power lines, etc.

In a Swiss study[139], the most frequent complaints among those evaluated were related to sleep disorders in 58% of cases, headaches in 41%, nervousness or anxiety in 19%, fatigue in 18%, and difficulty concentrating in 16%. 74% attributed their symptoms to cell phone base stations, 36% to cell phones, 29% to cordless phones, and 27% to high-voltage power lines.

A study conducted in Madrid[140] showed that, in relation to electromagnetic exposure from mobile phone antennas, "people exposed to higher levels of radiation experienced more intense headaches, dizziness, and nightmares. In addition, they slept fewer hours."

As can be seen, the symptoms can be very diverse, but there are some that tend to dominate. Similar to what we saw with MCS, EHS can evolve from an initial phase in which symptoms may occur only occasionally and are relatively mild, to a situation in which continuous exposure causes them to increase in frequency and intensity, eventually becoming chronic[141] and highly debilitating.

Diagnosis

Various studies have highlighted the importance of taking a **complete medical history** for a correct diagnosis of EHS[142]**.** A medical history that takes into account the relationship between health problems and reported symptoms, as well as when and where the symptoms appear or become more apparent, paying special attention to those places where the person spends the most time (and, in particular, the place where they rest).

Lists of possible symptoms and questions to ask patients about when they first appeared and how they have progressed over time have been drawn up. The aim is also to get the affected person to describe the severity of the symptoms and, for example, whether they have been temporary and mild due to a one-off exposure or, on the contrary, more lasting and severe as a result of more significant exposure.

For example, Japanese scientists developed a detailed questionnaire based on one previously developed by experts in the United Kingdom [143]. The questionnaire first asked questions about the biographical data of the affected individuals [144]. This was followed by questions about 57 specific symptoms and their frequency (none, a little, moderately, quite a lot, and a lot), and then questions about the possible relationship between these symptoms and exposure to different sources of electromagnetic fields.
In addition, three questions were asked about sensitivity to such radiation, the occurrence of static discharges, and adverse health changes on a five-point scale, followed by other questions related to issues such as when the hypersensitivity began and the sequence in which it progressed, as well as other conditions they may have (or have had), such as MCS or others.

Although it is always important for the medical history to ask about any possible causal factors that the patient may report, whether at home, at work, or in other circumstances, it should be noted that the patient may sometimes be unable to identify a specific source of exposure to electromagnetic fields to which their problems can be attributed. This highlights the importance of, in any case, taking measurements in the field to identify possible objective sources of exposure as well as their actual intensity.
When taking measurements, which must be carried out by reliable specialists, the various possible sources of artificial non-ionizing radiation emissions must be taken into account, as these are very diverse. They may include extremely low frequency (ELF) magnetic fields caused by transformers, power lines, etc.; extremely low frequency electric fields from, for example, wiring and household appliances; very low frequency (VLF) magnetic fields, also known as "dirty energy," and/or very low frequency electric fields ("dirty electricity") emitted by various devices or installations; or radio frequencies linked to cordless phones, Wi-Fi, mobile telephony (cell phones and base stations), radio and television antennas, radars, Bluetooth, etc.

The data from these measurements can be very useful for healthcare professionals who are knowledgeable about issues related to the effects of electromagnetic radiation. They can also serve as a basis for subsequent measures to reduce such exposure.

When interpreting these exposures and the influence they may be having on the health of the affected person, aspects such as[145] the intensity of the exposure, whether the person is being exposed to multiple different electromagnetic fields at the same time, the duration of the exposure, whether it occurs during the day and/or at night, what other stress factors on the body may be adding to those of non-ionizing radiation, etc.

It has also been pointed out that all of the above can be supplemented with certain tests that can help to better substantiate the diagnosis. It may be useful to compare certain possible indicators, assessing whether, taken together, they are excessive or deficient, as the case may be, in order to help make a better assessment. Among such parameters, for example, some markers linked to **nitric oxide** production have been cited**.** Others that can reveal abnormalities in **mitochondrial** function (adenosine triphosphate being key to the body's energy) or that indicate the existence of oxidative stress that can cause **lipid peroxidation** (damaging membranes and other cellular structures) have also been cited.
Other parameters that may be useful are also mentioned, such as measuring **melatonin** levels in urine or indicators linked to the existence of **inflammatory processes.**

It is very important to highlight here, as various French researchers have pointed out, the existence of **objective criteria**[146] that can support the diagnosis of EHS. This is because there are good biological markers that can be measured in blood. These include, for example, **histamine** (in cases where there is no associated allergy) or an increase in the **protein S100B**, a relevant marker of damage to the central nervous system.

Also, as these same scientists quoted above, with extensive knowledge of the disease, point out, **"biomarkers related to oxidative/nitrosative stress,** such as **oxidized glutathione (GSSG) and nitro tyrosine (NTT),** can also be taken into account as objective elements that aid diagnosis." However, the researchers point out that "in 30% of cases, no positive biomarkers were detected in the blood," which means that, in addition to the availability of clinical criteria, the diagnosis of EHS could be made using brain imaging techniques "such as **TDU** (Transcranial Doppler Ultrasound), **fMRI** (Functional Magnetic Resonance Imaging), and, if possible, **UCTS** (Ultrasonic Cerebral Tomosphygmography). In these cases, the use of these tests should be carefully evaluated, as they require exposing patients to certain types

radiations that some of them would not even tolerate, and the consequences could lead to a worsening of their condition, sometimes even very severe. Therefore, the physician must assess whether they are really necessary, bearing in mind that the tests themselves may aggravate the symptoms.
The scientists aforementioned stated that, in general, using this approach, they were able to objectively diagnose EHS in approximately 90% of patients who had self-reported suffering from the condition. The study of hundreds of people with EHS and MCS over the years—two out of three of whom were women—led to the conclusion that "EHS and MCS can be objectively characterized and routinely diagnosed by simple available tests”.
Both disorders appear to involve hyperhistaminemia related to inflammation, oxidative stress, autoimmune response, capsulothalamic hypoperfusion and opening of the blood-brain barrier, and a deficit in the metabolic availability of melatonin, suggesting a risk of chronic neurodegenerative disease.
Finally, the common coexistence of EHS and MCS strongly suggests a common pathological mechanism. In relation to this last point, on the other hand, the frequent association with MCS, a disease that is perfectly defined according to a consensus statement, may be another relevant support for the diagnosis of EHS. Scientists such as those mentioned above, based on clinical, biological, and radiological research, consider that EHS can be objectively characterized as a well-defined **neuropathological disorder**. Therefore, patients who report electro sensitivity should be evaluated using a series of currently available tests such as blood and urine tests and some imaging techniques. The scientific literature shows increasing evidence of the existence of different subjective and objective physiological alterations, such as, among others, changes in heart rate or increased mast cells in the skin[149].
Apart from the above, some authors have suggested performing blood tests related to a wide range of parameters which, depending on the case, could be more or less useful for diagnosis and/or treatment, or for assessing the patient's condition[150].

Some basic functional tests may also be useful for the medical history, such as those related to blood pressure and heart rate both at rest and at different times and in different daily situations, as well as stress tests (ergometry).
In some cases, an electroencephalogram during sleep at home may also be useful.

Another type of test that the literature suggests may help in some cases is provocation testing, which involves exposing the patient, in a controlled manner, to radiation from, for example, wireless technology and measuring the possible effects observed (in relation to, for example, heart rhythm disturbances, microcirculation, oxidative stress, estimation of neurological impairment, etc.). In these cases, it is increasingly recognized that such tests should not be performed, as the effects sometimes appear hours or even days after exposure, which can lead to many false negatives that will only confuse the diagnosis. Many of those affected report problems and symptoms even several days later, and the cumulative effect must also be taken into account, which is why studies must be based on long-term effects.

Of course, in order to avoid possible confounding factors when making a diagnosis, it has also been pointed out that it is necessary to investigate the possible existence of other causes other than exposure to electromagnetic fields that could explain the symptoms.

Other factors that should be taken into account in the medical history are a series of possible events that could have directly or indirectly influenced a person's predisposition to EHS. This is the case with various previous traumatic factors (electrical, chemical, physical, infections, immunity, etc.).

Authors such as **Magda Havas** have pointed out the importance of these potential precursor factors, classifying them into five categories:

1. Physical trauma to the central nervous system.
2. Chemical trauma in the form of exposure to environmental toxins.
3. Biological trauma in the form of exposure to various biological agents.
4. Electromagnetic trauma in the form of high levels of acute exposure or low levels of chronic exposure to various forms of electromagnetic frequencies, both ionizing and non-ionizing.
5. Condition of various systems in the body, especially the immune and nervous systems[151].

Detailed knowledge of questionnaires such as those mentioned above can be helpful for healthcare professionals in diagnosing EHS.

Prevalence

Regarding the prevalence of electrohypersensitivity, to varying degrees, different estimates have been made that refer to varying percentages between countries and years, yielding disparate percentages of the affected population.

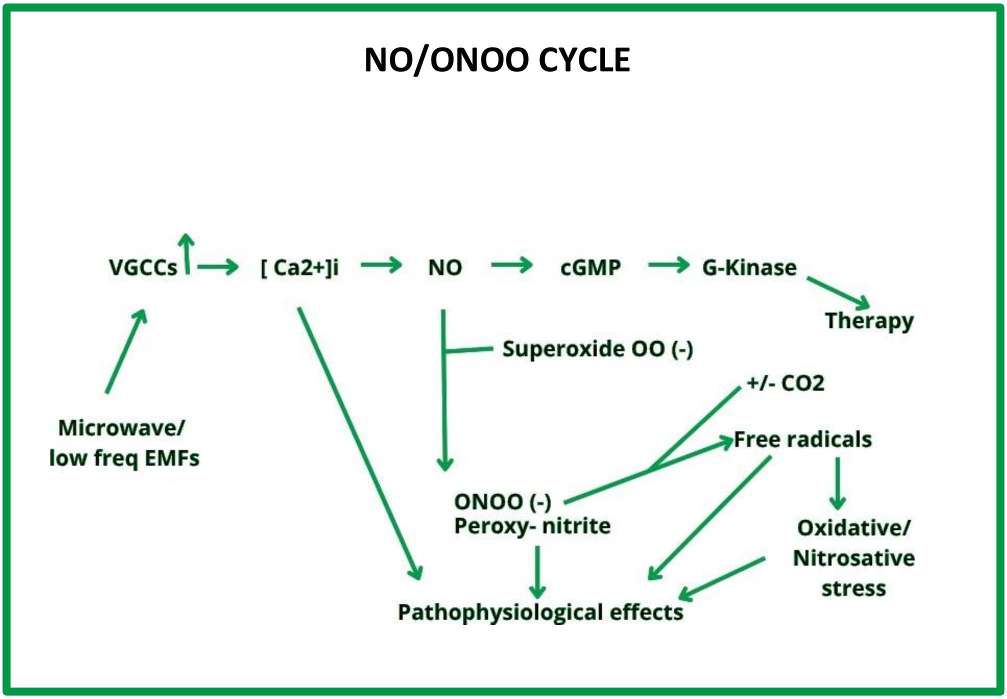
In Sweden, for example, a prevalence of 2.7% has been reported, while the percentage is much higher, at 7.2%, in neighboring Finland. In the case of Switzerland[153], it would be 5% of the population, 3.5% in Austria[154], and 4% in the United Kingdom[155].

A prevalence of 3.2% has been reported in California[156] and between 3.0 and 4.6% in Japan[157] (although only around 1% of the population in that country was aware of the existence of the condition, which may imply that many people could be suffering from it without being aware of its existence[158]).

Regardless of the criteria that may have been used to obtain data in different countries and the lack of estimates in much of the world, it is clear that this is a problem with a significant prevalence that affects many millions of people.

Mechanisms

As various authors point out, EHS is a neurological disorder characterized by inflammation, oxidative stress and blood-brain barrier involvement, as well as neurotransmitter abnormalities.



It manifests as a **reduction in the tolerance threshold in the central nervous system of people who are susceptible to exposure to artificially created electromagnetic fields.** Thus, intolerance to electromagnetic fields in patients with EHS could occur at weak or even very weak electromagnetic field intensities.

Several possible mechanisms have been suggested for the development of EHS, such as those related to the formation of free radicals or **oxidative and nitrosative stress**[160] that could be triggered by exposure to electromagnetic fields.

Scientist **Martin Pall**[161] has specifically demonstrated the role that this type of exposure can play in activating **voltage-gated calcium channels (VGCC**[162]**)**, which can lead to elevated levels of **nitric oxide and peroxynitrite**, a powerful oxidant. This, along with other factors, may be associated with oxidative stress, **inflammation, and mitochondrial damage** that leads to energy loss (which could be linked, among other things, to fatigue[163]).

Metabolic alterations linked to inflammation and oxidation have been found in patients with EHS[164]. Furthermore, it is worth noting the similarities in symptoms between EHS, MCS, and other pathologies such as chronic fatigue syndrome, with similar alterations related to nitric oxide and peroxynitrite having been detected[165].

The activation of voltage-dependent calcium channels, which are widely present throughout the nervous system, may be involved in a wide range of effects[166]. Artificial electromagnetic fields could activate these channels, which are involved in the release of neurotransmitters and neuroendocrine hormones, generating an excessive release of these substances and producing oxidative/nitrosative stress and other possible alterations. All of this can lead to symptoms such as those reported for EHS, including sleep disorders/insomnia, headache, depression/depressive symptoms, fatigue/tiredness, dysesthesia, concentration and memory problems, dizziness, irritability, anxiety, nausea, burning/tingling/dermographism of the skin, and EEG alterations.

Other authors, such as Belpomme[167], comment that the effects of non-ionizing radiation would generate an initial localized

inflammatory response affecting the **immune cells** present in the brain, releasing inflammatory mediators such as histamine. This could be linked to oxidative and nitrosative stress and a decrease in local cerebral blood flow.
In a second phase, inflammation could increase, affecting the blood-brain barrier, followed by the passage of inflammatory cells from the blood to the brain. This would culminate in neuroinflammation that would mainly affect the limbic system and the thalamus.

According to the thesis described, this could explain the main symptoms that may manifest in a person with EHS and/or MCS, such that limbic alteration could explain emotional and cognitive effects like those affecting memory, while thalamic alteration could explain those related to sensitivity.
A possible inflammatory spread to other brain regions—such as the frontal lobes and hypothalamus—would explain other symptoms.
In short, much research remains to be done to outline in greater detail the possible mechanisms involved in the development of EHS, and other aspects may be added to those described, reinforcing or qualifying them.

Treatment

There is general consensus that—although some therapies may be helpful as a complement[168]—the main treatment for EHS is **to prevent or reduce exposure** to the electromagnetic fields that cause it, both at home and at work, and that it would be desirable to do so more broadly in a wide variety of public spaces[169] in order to eliminate the obstacles that limit the accessibility of people suffering from a condition that can be very debilitating in some cases.

A study conducted in Finland[170] showed, for example, that for 76% of people with EHS surveyed, reducing or avoiding electromagnetic fields helped in their total or partial recovery, eliminating or reducing symptoms. Secondarily, other interventions such as dietary changes (69.4%), nutritional supplements (67.8%), or increased physical exercise (61.6%) were also considered beneficial. However, certain official treatment recommendations such as psychotherapy (2.6%) were not considered to be very useful and, in some cases, such as medication, were considered harmful (-4.2%).

Specialists in the field have provided a wide range of advice on how to reduce people's exposure to electromagnetic fields from mobile phones, smartphones, and cordless phones, as well as from Wi-Fi routers, wiring, external sources of radiation, etc.

Proper reduction of exposure to such harmful electromagnetic fields can allow the body to recover. Furthermore, we must always bear in mind that this means acting on the causes—which is always the best approach in medicine—and not just on the symptoms. Because if, for example, treating only the symptoms achieved a certain degree of apparent improvement, this might not mean that the underlying causes were no longer present and causing damage that could even manifest itself later in other diseases, often serious ones, unrelated to EHS.

On the other hand, if, in addition to reducing exposure to non-ionizing radiation, other adverse environmental factors that may be contributing to the damage are addressed, a better result will be achieved.
In environmental medicine, it has been found that a number of treatments can benefit affected individuals, as well as those suffering from other conditions that show similar functional dysfunctions (such as people with Multiple Chemical Sensitivity, Chronic Fatigue Syndrome, or Fibromyalgia).
For example, reducing exposure to chemical pollutants that can occur in everyday life through a wide variety of sources, such as what is ingested, breathed in, or absorbed through the skin.

It is always preferable to choose to reduce exposure rather than use techniques to subsequently eliminate—to the extent that this is actually possible—only some of these toxic substances. Some systems have been proposed that can help with limited organic detoxification, but these should only be applied by reputable professionals.

Improving your diet (for example, by choosing more organic products) can also have positive effects. This, along with other factors, can boost the body's antioxidant capacity and help reduce inflammation. Improving bowel function (especially in cases of dysfunction) is also considered important. It is also important to take measures that can help the mitochondria function properly.

Efforts should also be made to promote the body's internal balance in order to increase its resilience to any harmful effects that stressors may have.
For example, **by taking measures to reduce the adverse effects of peroxynitrite, strengthening the immune system, reducing stress, and detoxification[171].**

Some authors[172] believe that it may also be beneficial, for example, to correct the significant deficiency of vitamins and trace elements (such as vitamin D and zinc) that people with EHS often have[173]. Likewise, trying to counteract excess histamine in the blood, as well as resorting to antioxidants such as glutathione and, if necessary, antinitrosatives. There are even references to natural products that could help improve cerebral blood circulation, such as fermented papaya (which has been attributed with good antioxidant, anti-inflammatory, and immune-modulating properties) or ginkgo biloba.

On another note, attention should also be paid to water consumption, which should be in adequate quantities and of the highest possible chemical quality, as well as ensuring that people get sufficient exposure to sunlight (essential for vitamin D).

In some cases, saunas—under proper supervision—can also help, as can an appropriate level of physical exercise tailored to the individual characteristics of each person affected, stress reduction, and contact with nature, which promotes direct contact with the earth and can help balance the ionic load to which people are exposed.

Comorbidities

Apart from other possible comorbidities[176], perhaps the most notable is Multiple Chemical Sensitivity (MCS), which is very often associated with EHS[177]. Both pathologies appear to share a common pathophysiological mechanism for the onset of symptoms[178] and, as several researchers have stated, could be identified as a single neurological syndrome, regardless of their causal origin[179]. In EHS, some symptoms similar to those of MCS may manifest (such as headaches, fatigue, stress, sleep disturbances, brain fog, short-term memory problems, irritability, etc.).

Various studies conducted in different countries and at different times have estimated varying percentages of comorbidity between this condition and MCS. One study suggests that more than 80% of patients with EHS also had MCS[181]. Another study, published in 2020, stated that:

"EHS is associated with MCS in 30% of cases, and MCS precedes the onset of EHS in 37% of these cases associated with EHS/MCS[182]."

Scientists such as those at the European Cancer and Environment Research Institute (ECERI) in Brussels pointed out that:

"EHS patients not only have symptoms associated with hypersensitivity to low-intensity anthropogenic electromagnetic fields, but also, due to their possible association with MCS, may also be sensitive to low concentrations of multiple chemicals; Therefore, both environmental stressors could trigger clinical symptoms and pathological changes in these patients with weak or even very weak environmental electromagnetic field intensity or chemical concentration."

Sometimes, EHS could also be exacerbated by a series of effects caused by exposure to toxic chemicals. It has even been noted before that, on occasion, MCS may precede the manifestation of EHS, which is why it has been suggested that chemicals may also play a role in the etiology, perhaps in more than 10% of cases[183].

Apart from the above, one author[184] points out, for example, that EHS is often comorbid with different conditions, such as MCS, fibromyalgia (FM), allergies[185] or mast cell activation syndrome[186].

Conclusion

Multiple Chemical Sensitivity and Electromagnetic Hypersensitivity are two conditions that have many points in common. In many cases, they can even occur in the same person and also exhibit possible mechanisms and/or symptoms that may coincide or show similarities in many respects. They also share the fact that the treatment with the best prospects for both is to reduce exposure to the causal factors: chemical contamination and artificial electromagnetic pollution, respectively.

Both MCS and EHS, whose prevalence has only grown in our societies, manifest themselves as a loss of tolerance to exposure to low doses or intensities of these harmful factors. These are adverse environmental factors created by humans which, unfortunately, far from diminishing or remitting, have only grown and grown year after year, with no prospect of general exposure to them being adequately reduced given the inadequacy of the official measures adopted. All this despite the enormous amount of scientific evidence that exists about the damage that such pollution is causing.

The fact that people suffering from these two conditions react visibly to exposure to a series of chemical contaminants and radiation bears some similarity to what happened in the working environment of mines with those birds that warned of the presence of something invisible that neither the organisms nor, of course, the minds of the workers seemed to detect clearly but which, nevertheless, could seriously affect them.

Like the old miners, people with MCS and EHS are a living warning system that should be taken very seriously. They react to invisible harmful elements that may not only be affecting them at low concentrations or intensities, depending on whether they are substances or non-ionizing radiation, but also—as the scientific community has been warning for decades—other people who share the same environments. Consequently, the adoption of measures in favor of people with MCS and/or EHS can have positive repercussions for the health of the rest of the population.
Unfortunately, despite the existing evidence, these diseases have too often not been adequately diagnosed and treated, with the suffering that this may have caused for patients.

Although there are varying degrees of severity, both MCS and EHS can be highly debilitating in the most serious cases. Symptoms may manifest themselves in a very intense way and, unfortunately, the factors that trigger them—toxic chemicals and harmful electromagnetic fields—are practically ubiquitous in today's society.

All of this can represent very real and limiting barriers that make it extremely difficult for those who suffer from them most intensely to lead a reasonably normal life. These barriers can be found everywhere, in public spaces, at work, and even at home, and it would be good to eliminate or reduce them as much as possible, thus enabling these people to carry out their activities as normally as possible, for their own benefit and that of society.

Throughout this chapter, we have presented some of the extensive knowledge that exists about these diseases, drawing on a wide range of scientific literature, with the aim of helping to improve understanding of them and ensuring that those who suffer from them receive the best possible treatment.

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Multiple Chemical Sensitivity and Electrohypersensitivity,

what are we talking about?

Disability perspective: a human rights approach.

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1.2

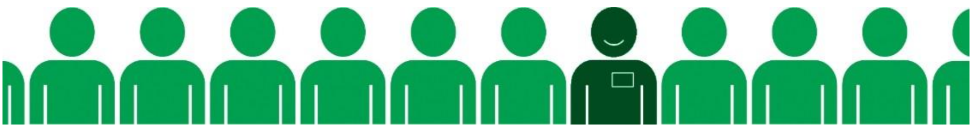
The social model of disability and organic disability

The social model of disability

Before addressing the definition of organic disability (OD), it is essential to frame the analysis within the social model of disability. This model is based on the premise that disability is not a condition inherent to the person, but rather the result of the interaction between a health condition and the barriers imposed by the environment. It contrasts with the medical model, which views disability as exclusively a health problem and therefore focuses on curing or treating the affected person.

The United Nations Convention on the Rights of Persons with Disabilities (CRPD)[187] adopts the social model as its central axis, understanding that disability must be addressed from a human rights perspective. This approach not only identifies persons with disabilities as subjects of rights, but also imposes obligations on States to ensure their access to full and effective participation in society, on an equal basis with others.

Under the CRPD, persons with disabilities are considered to be those who have long-term physical, mental, intellectual, or sensory impairments, provided that these impairments, in interaction with social and environmental barriers, limit their participation in society on an equal basis with others. Consequently, disability is not an individual attribute, but a social construct that results from the combination of a health condition and an environment that does not offer the necessary conditions for inclusion.



Organic disability

The concept of organic disability (OD) must be understood within this same interpretative framework, as set out in the White Paper on Organic Disability, published by COCEMFE in 2022[189]. This document defines OD as a disability resulting from the loss of functionality in one or more bodily systems due to the development of chronic health conditions, combined with social barriers that limit or prevent full participation in society and the exercise of rights and freedoms on an equal basis.

People with OD have conditions caused by the loss of functionality in some of their bodily systems, which may be localized (specific organs) or generalized (systemic failures), and encounter barriers in their daily lives that limit their personal autonomy and create a significant social disadvantage[190].

According to the Spanish Strategy on Disability (2022-2030) and the First National Plan for the Healthy Well-being of People with Disabilities (2022-2026), organic disability covers diseases such as heart disease, kidney and liver disease, cystic fibrosis, Crohn's disease, lymphedema, hemophilia, lupus, migraines, Alzheimer's disease, Parkinson's disease, sleep disorders, fibromyalgia, and chronic fatigue syndrome, among others[191].

The White Paper on Organic Disability emphasizes the importance of differentiating OD from other types of disability, not for purely classificatory purposes, but to highlight the specific needs of those affected and ensure that these are properly understood and addressed.
In this regard, OD has a number of common characteristics that make it difficult to recognize and treat appropriately[192]. In summary, first, it manifests internally, with acute processes that are not easily observable or objectifiable at first glance.

Furthermore, its evolution is uncertain and fluctuating, alternating periods of crisis with phases of relative stability, which complicates both its diagnosis and its medical and social management.
The health status of affected individuals depends on a combination of internal and contextual factors, including symptom variability, access to healthcare, the environment in which they live, environmental factors, and their economic situation. This leads to the need for continuous and specialized social and healthcare, which increases dependence on the health and social assistance system.

One of the main obstacles in addressing OD is late or erroneous diagnosis, which delays access to appropriate treatment and hinders administrative recognition of disability, incapacity, or dependency. This situation limits the affected person's participation in daily and social life, negatively impacting their personal and family life, as well as their relationship with their environment.
Difficulties in accessing and maintaining training and employment are another significant challenge, as the lack of reasonable accommodations and adjustments prevents full inclusion in the workplace and education. For many people with OD, it is essential to maintain a slower pace of life, with adequate time for rest and recovery, which has an impact on their professional and social performance. Likewise, the total or partial reduction in the ability to carry out activities within conventional standards imposes additional limitations, affecting not only personal autonomy, but also self-esteem and the perception of social usefulness. The burden of the disease and its treatment also leads to the postponement of life projects and opportunities, generating a significant emotional and psychological impact.
From an economic and social perspective, the high costs of treatment and special care can lead to a situation of vulnerability that exacerbates pre-existing inequalities. In the most severe cases, OD can result in a situation of high dependency, in which the support of third parties becomes essential.

Finally, the impact of OD is not limited to the affected person, but also extends to their immediate environment, placing a significant physical and psychological burden on their family members and caregivers. Understanding and addressing these factors is essential to ensuring an adequate response to the needs of people with organic disabilities and promoting their full inclusion in society. The structural and social barriers faced by people with organic disabilities profoundly affect their quality of life and prevent their full inclusion in society.

Organic disability associated with Multiple Chemical Sensitivity and Electrohypersensitivity

Within the framework of organic disability, Multiple Chemical Sensitivity (MCS) and Electrohypersensitivity (EHS) are two conditions that can cause serious limitations in the daily lives of those affected. Both pathologies are characterized by the body's inability to tolerate low levels of exposure to certain environmental agents, whether chemicals in the case of MCS or electromagnetic fields in the case of EHS. This exposure produces multisystemic symptoms that significantly impact the health and well-being of those affected. In the case of MCS, exposure to common chemicals in the environment, such as pesticides, cleaning products, perfumes, or industrial pollutants, triggers severe symptoms that affect different body systems. Similarly, EHS manifests when people exposed to electromagnetic fields from electrical transformers or communication networks experience adverse reactions, including acute and chronic inflammatory processes[193].

Unlike other organic disabilities, in which the loss of functionality may pre-exist contact with barriers, in the case of MCS and EHS, symptoms emerge precisely as a result of such contact.

In a hypothetical scenario in which these barriers were eliminated, the symptoms would not manifest. However, the omnipresence of triggers in the environment makes exposure virtually inevitable, which not only aggravates the health status of those affected, but also requires strict environmental control measures to minimize the impact of the disease[194]. As a result, the lives of people with MCS and EHS are profoundly conditioned by the need to avoid exposure, which limits their access to public spaces, health services, employment, education, and adequate housing.

Throughout this chapter, we will analyze in detail the specific barriers faced by people with MCS and EHS, as well as the structural deficiencies in the protection of their fundamental rights. It is imperative that reasonable accommodations and accessibility measures be implemented to ensure equal opportunities and enable full participation in society for people affected by these conditions.

International obligations regarding the rights of persons with disabilities

From the rights-based approach established by the Convention on the Rights of Persons with Disabilities (CRPD), this chapter is based on guaranteeing equal access to fundamental rights for people affected by MCS and EHS, avoiding any form of discrimination.

To understand the barriers faced by these individuals, it is essential to analyze the obligations of States in this area and their application in the context of organic disability.

The obligation to guarantee the full exercise of human rights under conditions of equality

The CRPD establishes equality and non-discrimination as essential principles, present throughout its regulations. The promotion of equality and the fight against discrimination are obligations that must be fulfilled immediately[195], both in the public and private spheres[196], and imply a model of inclusive equality that eradicates indirect and structural discrimination.

The CRPD Committee establishes that States must adopt measures such as modifying or repealing discriminatory regulations and practices[197], implementing affirmative action to guarantee equal access to rights[198], prohibiting all forms of discrimination, and establishing protection mechanisms.

Discrimination can manifest itself directly, indirectly, or through the denial of reasonable accommodations[199]. It can also be intersectional, combining disability with other factors such as gender, ethnicity, or socioeconomic status[200]. These obligations apply across fundamental rights such as health, education, and employment, and compliance with them is key to ensuring full inclusion.

Accessibility and reasonable accommodations as a guarantee of equality and non-discrimination

Inclusive equality requires specific measures that enable persons with disabilities to exercise their rights on an equal basis with others[201]. To this end, two fundamental mechanisms are established: accessibility and reasonable accommodation.
Article 9 of the CRPD establishes accessibility as an essential requirement for the autonomy and social participation of persons with disabilities[202]. Its application must cover the physical environment, transportation, information and communication,

ensuring that all goods and services are accessible[203]. To this end, States must identify and eliminate barriers to access through continuous monitoring[204], apply universal design in the creation of goods and services, avoiding the need for subsequent adaptations[205], train those responsible for accessibility[206], and promote research in this area[207].

Failure to comply with these obligations should be considered discriminatory, unless there is a valid justification[208]. When general accessibility is not sufficient, reasonable accommodations come into play [209].

Reasonable accommodations, on the other hand, are specific modifications or adaptations to ensure access to rights without imposing a disproportionate burden. These are therefore measures that are individual in nature, unlike universal design and accessibility measures, and arise from an ex nunc obligation, i.e., they must be carried out from the moment a person with a disability requires access to inaccessible situations or environments, or wishes to exercise his/her rights[210].

States are obliged to identify and remove barriers in dialogue with the persons concerned, assess the feasibility and effectiveness of the accommodation, ensure that the costs are not borne by the person with a disability, objectively justify any refusal, and ensure that the burden of proof lies with the person refusing the accommodation[211].

Failure to comply with these measures is also considered an act of discrimination. Only through full respect for accessibility and reasonable accommodation can equal opportunities and non-discrimination for people with MCS and EHS be guaranteed.

Environmental control as a necessary measure for access to rights for people affected by MCS and EHS

As previously stated, in the case of people affected by MCS and EHS, the loss of functionality of bodily systems occurs as a result of contact with environmental barriers. In both cases, beyond the

necessary rehabilitation for those cases in which the chronicity of the disease has generated sequelae, the main treatment to reduce or resolve the symptoms is the avoidance of triggering agents, that is, the implementation of strict environmental control.
Environmental control consists of minimizing exposure to risk factors that affect the health of people with MCS and EHS. In the case of MCS, these factors include various types of chemicals and toxic substances, as well as biological and physical pollutants, such as noise pollution or contact with certain electromagnetic emissions[212]. In EHS, environmental control focuses on reducing exposure to electromagnetic fields generated by wireless technologies and electrical networks.

The need to implement effective environmental control forces people with MCS and EHS to make substantial changes to their daily routines, including adapting their environment in terms of air quality, food, drinking water, hygiene, and everyday products. However, many of the triggers are found in spaces beyond the control of those affected, becoming barriers that limit their access to essential environments such as the healthcare system, the labor market, education, housing, and public spaces.

It is precisely these environmental barriers that prevent people with MCS and EHS from participating fully and effectively in society on an equal basis with others, shaping their situation of disability.

Therefore, in order to guarantee the effective exercise of their human rights, it is essential to adopt accessibility measures and reasonable accommodations that allow for the adaptation of environments, goods, and services through the application of rigorous environmental control. These measures must ensure that spaces are accessible and free of triggers that aggravate the condition of people with MCS and EHS, thus enabling their effective social inclusion and the exercise of their rights on an equal basis.

Access to rights for people affected by Multiple Chemical Sensitivity and Electrohypersensitivity: invisibility as the main barrier

Once the relationship between MCS, EHS, and organic disability has been understood, as well as the conceptual framework of disability from a human rights perspective, this section will analyze in detail the main barriers faced by people affected by these conditions. These barriers, which are environmental, social, or informational in nature, have a serious impact on their quality of life and hinder their full inclusion in society on equal terms.

The invisibility of organic disability

The invisibility and limited recognition of organic disability, especially that linked to MCS and EHS, is one of the main obstacles faced by people affected by this condition.

Although the social model of disability, as set out in the Convention on the Rights of Persons with Disabilities (CRPD), takes organic disability into account by focusing on the barriers that hinder full and effective participation in society, this reality remains insufficiently recognized. This invisibility translates into limited attention to organic disability in the field of human rights, which complicates the implementation of measures such as universal accessibility or universal design adapted to the needs of people affected by MCS or EHS[213].

The CRPD Committee, in its decision S.C. v. Brazil, emphasized that the difference between illness and disability is a matter of degree, not of nature. In this sense, a health problem initially considered as an illness, can develop into a disability when it is prolonged in time or becomes chronic, interfering with the person's functionality. The Committee emphasized that a human rights-based model of disability requires taking into account both the diversity of persons with disabilities and the interaction between their impairments and environmental barriers or those derived from social attitudes[214]. This lack of recognition is also reflected in the Spanish legal framework. Until 2022, no regulatory or public policy instrument in Spain explicitly mentioned organic disability. It was the Spanish Strategy on Disability (2022-2030) and the First National Plan for the Healthy Well-being of Persons with Disabilities (2022-2026)[215] that introduced this definition for the first time. However, this progress is insufficient, as the previous gap has for years hindered the legal recognition of disability associated with MCS, as well as access to rights related to incapacity for work or the degree of dependency[216].

Although following the ratification of the CRPD in 2007, Spanish lawmakers have attempted to adapt the national legal framework to international standards[217], in practice, legal recognition of disability continues to depend on an administrative declaration. This is only granted to those who have been recognized as having a degree of disability equal to or greater than 33 percent[218], which in many cases is particularly complex for people with MCS and EHS, given the internal and unpredictable nature of their symptoms.

Legal recognition of organic disability, both in the case of people affected by MCS and by EHS, requires the initiation of an administrative procedure. Historically, this procedure has been based on a scale with a predominantly medical approach[219], which has made it difficult to recognize disabilities whose manifestations are not directly observable or are difficult to objectify. This situation has particularly affected people with MCS and EHS, whose symptoms develop internally and are fluctuating and unpredictable in nature.

In April 2023, a new scale for the recognition, declaration, and classification of the degree of disability[220] came into force, which incorporates greater consideration of social and contextual factors.
During the public consultation process for the new regulations, various civil society organizations submitted contributions aimed at adjusting the scale to the reality of people with organic disabilities. In the case of people affected by MCS, CONFESQ proposed including specific criteria for assessing difficulties in using public transport, as well as complementary social factors related to the family, economic, and work environment, in addition to problems linked to social rejection[221]. Similarly, on behalf of people with EHS, CONFESQ presented proposals aimed at highlighting the environmental barriers resulting from exposure to electromagnetic fields and the need to consider these factors in the assessment of the degree of disability[222]. However, despite these advances, it is still too early to assess the extent to which this new scale facilitates the legal recognition of organic disability resulting from MCS and EHS.
In any case, the new scale maintains the prevalence of medical factors in the assessment of the degree of disability, so medical and scientific knowledge and consensus regarding the underlying medical condition and the resulting impairment will always be particularly relevant[223].

In this regard, the First National Plan for the Healthy Well-being of Persons with Disabilities (2022-2026) includes measures aimed at training assessment teams on the new scale, with special attention to new health situations that cause disability, such as chronic and rare diseases, cancer, organic and degenerative diseases[224]. The plan also provides for the promotion of research aimed at raising awareness of the reality of people with organic and psychosocial disabilities, with a view to effectively integrating them into regulations and public policies[225]. Despite these efforts, the recognition of MCS and EHS continues to face misinformation and stigmatization, factors that continue to hinder the full access of affected individuals to their rights.

The invisibility of MCS

In the case of MCS, both the Parliamentary Assembly of the Council of Europe[226] and the European Parliament[227] have expressed concern about the proliferation of illnesses associated with these factors, including MCS, emphasizing the need for greater recognition and protection for people affected by these conditions. However, MCS does not currently have a specific category in the World Health Organization (WHO) ICD-11 coding system. This condition is currently included under heading T78.4, identified as "Idiopathic Environmental Intolerance"[228].
This partial recognition hinders the standardization of diagnosis and treatment of the disease, as well as the implementation of accessibility measures and reasonable accommodations for affected individuals.

In this context, in July 2023, a group of 56 clinicians and researchers, together with 75 patient associations from six countries, submitted a formal request to the WHO for MCS to be included in the ICD-11 coding system under the heading "Allergic or hypersensitivity conditions"[229]. This recognition would be key to advancing a comprehensive approach to the disease. At the national level, in 2011 the Ministry of Health published the Consensus Document on MCS[230], which was updated in 2015 with the text entitled Update of Scientific Evidence on Multiple Chemical Sensitivity[231]. Both documents are the main references in Spain for the recognition of this health condition. In addition, since 2014, MCS has been classified in the ICD-10 system with the code T78.40, corresponding to "Unspecified allergy". Likewise, the National Institute for Safety and Hygiene at Work (INSHT), under the Ministry of Labor, has developed a guide to good practices (NTP 557) aimed at the prevention and management of MCS and associated phenomena[232].

Despite these advances, MCS is still not recognized as a health condition associated with organic disability in instruments such as the Spanish Disability Strategy (2022-2030) or the First National Plan for the Healthy Well-being of People with Disabilities (2022-2026). This omission is an additional obstacle to people with MCS accessing the rights and resources that guarantee their social inclusion and full participation on equal terms.

The invisibility of EHS

With regard to EHS, its recognition is even more superficial. At the international level, the European Parliament has adopted several resolutions highlighting the need to recognize and address this disease, such as the Resolution of September 4, 2008, on the Mid-term review of the European Environment and Health Action Plan 2004-2010[233], or the Resolution of April 2, 2009, on Health Considerations Related to Electromagnetic Fields[234], which urged Member States to follow the example of Sweden, where electrical hypersensitivity is recognized as a functional impairment, in order to ensure adequate protection and equal opportunities for those affected.

For its part, the Parliamentary Assembly of the Council of Europe has drawn up specific resolutions and recommendations on EHS, notably Recommendation 1863 (2009) entitled Environment and Health: better prevention of environment-related health hazards[235] and Resolution 1815 (2011) on "The potential dangers of electromagnetic fields and their effect on the environment"[236], which urges special attention to be paid to electrosensitive people and recommends the adoption of protective measures, such as the creation of "white zones" free of wireless networks. In this regard, in 2018, the Madrid International Scientific Declaration, signed by international experts in electromagnetic fields and health, requested that public administrations immediately transpose Resolution 1815 of the Council of Europe into their state, regional, autonomous, and municipal regulations.

In Spain, at regional level, some autonomous communities have made progress in implementing these recommendations. The government of Castilla-La Mancha, for example, established stricter

limits on exposure to electromagnetic fields through Law 8/2001 of June 28 on the Regulation of Radio Communication Facilities[237].
Likewise, in 2017, the Aragon Regional Parliament urged the regional government to adopt Resolution 1815 through Non-Legislative Motion No. 76/17, approved by the Health Commission.

Finally, in Navarre, the Association of People Affected by Electromagnetic Fields in Navarre (ASANACEM/EEKNE) filed a complaint in 2017 with the Regional Ministries of Health and Economic Development demanding compliance with Resolution 1815. When they received no response, in 2018 they filed a complaint with the Ombudsman of Navarre, who urged the competent authorities to comply with the resolution. In 2024, the national association Electro and Chemical Sensitive for the Right to Health (EQSDS) asked the Ministry of Health to recognize EHS as a disease of organic origin, but has not received a response to date.
In short, misinformation surrounding MCS and EHS represents one of the main barriers for those affected, as it contributes to their social stigmatization. On numerous occasions, people with these illnesses are mistakenly labeled as obsessive, exaggerated, or victimized, which reduces their illness to mere psychological somatization and questions its organic origin, despite scientific evidence has proven otherwise.

When this stigma is transferred to the institutional sphere, it becomes an even more serious obstacle to the access of affected individuals to their fundamental rights. A clear example of this was the publication of the Updated Guide to the Assessment of Fibromyalgia, Chronic Fatigue Syndrome, Multiple Chemical Sensitivity, Electro sensitivity, and Somatoform Disorders (2nd edition) by the National Social Security Institute (INSS) in 2019. This document, used in assessment procedures for incapacity for work, contained outdated statements and arguments that reinforced the aforementioned stereotypes. In addition, it included therapeutic recommendations that, according to the most recent research, could even be harmful to the health of those affected. This situation was denounced by patient organizations and specialized healthcare professionals who prepared review documents that ultimately led to the withdrawal of the guide[238].

All of the above factors not only result in the legal under-recognition of organic disability resulting from MCS and EHS for the purposes of public policy—and, therefore, access to rights—but also a lack of understanding on the part of society as a whole of the barriers faced by affected individuals, minimizing and ignoring them, seriously affecting social relationships and the creation of support networks.

It is important to note that this first barrier will be decisive in addressing the others. Difficulties in recognizing health conditions will negatively impact the chances of obtaining recognition of disability, which, in turn, will affect access to rights provided for in the legal framework for persons with disabilities. This includes the requirement for accessibility measures, requests for reasonable accommodations, and access to social protection.

Barriers to access to work

International obligations regarding access to work for persons with disabilities

The Committee on the Rights of Persons with Disabilities (CRPD) recognizes the right to work as a fundamental right, essential for the full realization of other human rights and an inseparable and inherent part of human dignity. This right is crucial to ensuring the survival and well-being of both persons with disabilities and their families[239].

Aware that persons with disabilities face barriers that hinder their access to employment on an equal basis with others, Article 27 of the CRPD establishes the obligation of States to take effective measures to ensure the full exercise of this right.

The obligations arising from this provision are broad and closely linked to the principles of accessibility, equality, and non-discrimination[240].

Furthermore, these obligations are not limited to public employment, but must also extend to the private business sector. For the purposes of this chapter, the following fundamental obligations are noteworthy: on the one hand, promoting inclusive equality and eliminating discrimination in all its forms in the workplace, in compliance with Article 5 of the CRPD[241]. In this regard, it is particularly important to address indirect and intersectional discrimination, which occurs when certain rules, policies, or practices, although apparently neutral, disproportionately affect persons with disabilities, or when this is combined with other factors of vulnerability[242].

On the other hand, identify and remove obstacles and barriers that prevent access to the workplace, as well as adopt the necessary measures to ensure accessibility in the workplace. This includes the application of universal design to enable all persons, regardless of their condition, to function fully and equally in their workplaces[243].

Finally, ensure the implementation of reasonable accommodations in the workplace through measures and programs designed to provide technical and financial assistance to employers in both the public and private sectors[244]. The CRPD Committee establishes that employers must have a clear, accessible, and effective procedure for responding to requests for reasonable accommodations.

In this regard, the Committee specifies that when a worker or employer identifies a barrier in the work environment, they must follow these steps to avoid engaging in discriminatory conduct:

First, collaborate with the affected person to explore possible solutions that would eliminate or mitigate the barrier, taking into account the preference of the affected worker.

Second, implement the solution proposed by the affected person, or failing that, any other viable alternative, provided that this does not impose a disproportionate or undue burden on the employer. At this point, it is important to remember all the actions that are necessary to comply with the positive legal obligation to ensure that reasonable accommodations are made. A relevant case in this regard is the Sahlin v. Sweden decision: a university canceled the selection process of a deaf person on the grounds of the disproportionate financial burden that financing sign language interpretation would entail. The CRPD Committee ruled that the university's failure to engage in dialogue with the person to explore alternative reasonable accommodations with the resources available violated their right not to be discriminated against in accessing their right to work, under Articles 27 and 5 of the CRPD[245].

Third, ensure a safe and healthy working environment, which involves designing and implementing a coherent national occupational health policy that takes into account the specific needs of workers with disabilities. This policy should aim to prevent any harm that may arise from work performance or working environment conditions[246].

Failure to comply with these obligations not only violates the right to non-discrimination on the basis of disability, but also infringes on the right to work and the right to fair and favorable working conditions, recognized in Articles 6 and 7 of the International Covenant on Economic, Social and Cultural Rights (ICESCR), as emphasized by the Committee on Economic, Social and Cultural Rights (CESCR)[247]. In this regard, it is important to note that the adoption of accommodation measures in the workplace should be considered the first course of action to ensure people's access to and retention in employment. However, when such measures are unfeasible or insufficient to eliminate existing barriers and job performance is significantly compromised, social protection mechanisms come into play as an alternative to guarantee the rights of these individuals. These mechanisms, mainly linked to the recognition of incapacity for work — whether temporary or permanent—are established based on the severity of the symptoms and the impact they have on the functional capacity of the affected person.

This distinction is particularly relevant, as declaring someone unfit for work without first exploring the possibility of implementing reasonable accommodations in the workplace may constitute a violation of the Convention on the Rights of Persons with Disabilities (CRPD).

This was evidenced by the decisions of the CRPD Committee in the cases of V.F.C. v. Spain (2019) and J.M. v. Spain (2020). In both cases, the individuals involved were police officers who developed a physical disability as a result of a traffic accident, which led to the recognition of a total permanent incapacity for work to perform their usual profession. However, instead of analyzing the feasibility of making reasonable adjustments that would allow them to perform other duties within the police force, they were forced to take compulsory retirement. The CRPD Committee determined that this action violated the right of both men not to be discriminated against in accessing and remaining in their jobs, pursuant to Articles 27, 3, 4, and 5 of the CRPD, thus emphasizing the obligation to always evaluate accommodation alternatives before resorting to a declaration of incapacity for work[248].

Barriers to employment for people affected by Multiple Chemical Sensitivity

People affected by Multiple Chemical Sensitivity (MCS) face significant difficulties in accessing and maintaining employment on an equal footing with the rest of the population, due to barriers arising from exposure to triggers in work environments without adequate environmental control. The magnitude of these obstacles varies depending on the type of professional activity and the degree to which each person is affected.

In office environments, people affected by Multiple Chemical Sensitivity (MCS) face numerous environmental barriers that hinder their professional performance on equal terms. Among the main triggers are the cleaning products used in these spaces, which release large amounts of volatile organic compounds (VOCs), many of which are hazardous[249]. Added to this problem is the emission of VOCs from office equipment such as printers, photocopiers, and fax machines, which are commonly found in these types of environments.

In addition, the use of cleaning and cosmetic products by other workers represents an additional source of exposure for people with MCS, especially in enclosed spaces that lack adequate ventilation. This circumstance is particularly common in buildings known as "smart" or "energy efficient," where limited air circulation to optimize energy consumption exacerbates the concentration of chemical agents in the environment. Other environmental factors that can trigger symptoms in people affected by MCS include the accumulation of dust mites in carpets or upholstery, the use of fumigation and rodent control products, and the presence of organobromine compounds from flame retardants in electrical and electronic equipment[250]. In addition, certain materials used in furniture can emit VOCs that increase the risk of exposure for people with MCS.

In the workplace in shops or establishments open to the public, including educational institutions and the public sector, people affected by MCS face environmental barriers similar to those described in office environments. However, these are exacerbated by additional factors specific to this type of space.

One of the main difficulties lies in the constant flow of people—customers, students, or administered—who carry cosmetic products such as perfumes, deodorants, or creams, whose components can trigger adverse reactions in people with MCS. Likewise, in many of these environments, the use of air fresheners is common, whose chemical composition contributes to increasing the risk of exposure for these individuals.

Significantly, certain businesses such as dry cleaners, cosmetics stores, and hair salons present a considerably higher level of risk. In these establishments, the products commonly used contain high concentrations of chemical compounds, creating a highly contaminated environment that exponentially increases exposure to triggering agents. The industrial sector presents significant difficulties in terms of access to and retention of employment for people affected by MCS, due to constant exposure to toxic gases generated during production processes.

The nature of these gases varies depending on the sector, activity, and specific phases of the industrial process. They may be released directly into the atmosphere through chimneys or generated as intermediate by-products during the chemical reactions that form part of these processes. In this context, operators responsible for supervising and maintaining industrial processes face a high risk of exposure, even when using the appropriate personal protective equipment (PPE). The continuous presence of triggering agents in this type of industrial environment, coupled with the limitations of PPE in providing total protection against certain chemical compounds in low concentrations, makes these jobs particularly inaccessible to people affected by MCS.

The agricultural and forestry sectors present significant barriers for people affected by MCS due to constant exposure to pesticides, herbicides, and synthetic fertilizers used in these activities.

These chemicals, widely used for pest control and crop maintenance, pose a significant risk to people with MCS, as even low concentrations can trigger severe symptoms.
Finally, the healthcare sector also poses significant obstacles for people with MCS, mainly due to the intensive use of chemicals for cleaning, disinfecting, and sterilizing healthcare facilities and instruments. These barriers are particularly relevant in areas such as laboratories, where various types of chemical agents are handled, or in laundry services, where the use of industrial detergents and disinfectants significantly increases the risk of exposure to triggering substances.

As explained above, there are certain work environments whose very nature is inherently incompatible with the condition of people affected by MCS, as the degree of exposure to triggering agents is so high that it prevents the adoption of measures to ensure safe conditions for these individuals. In these cases, access to or continued employment is unfeasible, and alternative social protection mechanisms would therefore come into play.
However, in other work environments where it is possible to adopt adaptation measures, identifying and removing environmental barriers, implementing accessibility measures, and applying reasonable accomodations are essential to ensure that people with MCS can access employment and perform on an equal footing with the rest of the working population.

These measures not only enable the working inclusion of affected persons, but also contribute to respect their right to decent working conditions, in accordance with the provisions of the CRPD. In this context, Law 31/1995 on Occupational Risk Prevention[251] establishes a regulatory framework whose main objective is to guarantee the protection of workers' health, requiring companies to adopt a series of preventive measures. These measures include the development and implementation of occupational risk prevention plans, the creation of monitoring programs for health, the assessment and

periodic updating of occupational risks, the planning of preventive actions, and specific training for personnel, among other actions.
Although the National Institute for Occupational Safety and Health (INSST) has addressed the difficulties faced by people affected by MCS in the workplace—both in the Practical Encyclopedia of Occupational Medicine[252] and in its NTP 557 good practice guide[253]—the practical application of these regulations is insufficient to adequately protect this group. The main obstacle lies in the widespread lack of knowledge about MCS, misinformation about its characteristics, and the persistence of stigmas that minimize the severity of the disease.

The recognition of a person affected by MCS as a "particularly sensitive worker," in accordance with Article 25 of Law 31/1995 on Occupational Risk Prevention, represents a key mechanism for ensuring their protection in the workplace. This article establishes that the employer has an obligation to adapt the workplace to the specific needs of these workers, which, in practice, translates into the implementation of reasonable accommodations. Article 25 defines a "particularly sensitive worker" as a person who, "due to his/her own personal characteristics or known biological condition, including those with a recognized physical, mental, or sensory disability, is particularly sensitive to the risks arising from work" [254].

In this regard, the Practical Encyclopedia of Occupational Medicine highlights the following aspects concerning individuals affected by MCS[255]: first, it emphasizes that individuals with MCS should be considered particularly sensitive workers, which implies reinforcing the principles of preventive action, avoiding exposure to triggering agents in the workplace as much as possible.

In the context of occupational risk assessment, it emphasizes the need to consider that affected individuals may develop symptoms even when exposed to chemical levels well below the values established as Occupational Exposure Limits for Chemical Agents. Therefore, it is essential that this type of assessment also considers the presence of factors that, although not classified as occupational risks, can trigger symptoms in people with MCS. These factors include elements such as perfumes and fragrances, cleaning products, printed paper, construction work or new furniture in the workplace.

In addition, emphasis is placed on the importance of assessing the worker's clinical condition and analyzing the specific risks to which they are exposed, in order to determine their fitness for work and define the necessary preventive measures. This assessment must be individualized, respectful, and inclusive, taking into account the particularities of each case. As for the recommended adaptation measures, various actions are proposed that can help ensure the safety and well-being of people with MCS in their work environment, including: measures to improve air quality in the workplace, such **as implementing fragrance-free company policies**, **replacing cleaning products** with less aggressive alternatives, **improving ventilation, or relocating** the worker's office to an area less exposed to chemical agents; **changing the worker's job** if the adaptations prove insufficient or unfeasible; or **assessing the need for temporary incapacity for work** during phases of exacerbation of symptoms or even permanent incapacity for work, depending on the severity of the condition and the characteristics of the job.

Finally, it is indicated that it is the responsibility of the health services of the Occupational Risk Prevention and Occupational Medicine Services to assess the suitability of these adaptations, ensuring that the measures implemented respond to the specific needs of each person and contribute to the effective protection of their health in the workplace.
Although the current regulatory framework offers, in theory, sufficient guarantees to protect the labor rights of people affected by MCS, in

practice these individuals face numerous difficulties in being recognized as particularly sensitive workers. These difficulties stem mainly from social and informational barriers that hinder the proper application of the measures provided for in labor legislation: first, the lack of specific training for occupational health professionals in relation to MCS represents a significant barrier. Lack of knowledge about the causes, development, and characteristics of this condition hinders or delays the recognition of people with MCS as particularly sensitive workers.

On the other hand, the insufficient training of occupational risk prevention technicians further aggravates the situation. In many cases, these professionals only identify as a risk the presence of environmental chemical levels that exceed occupational exposure limits, without considering that people with MCS may experience symptoms even at very low levels of exposure. This misinterpretation of risk leads to the effects of low doses of chemical agents or the accumulation of substances in the workplace being dismissed. As a result, the specific recommendations made by the INSST on this matter are ignored.

Finally, the lack of awareness and understanding of MCS, both on the part of employers and other workers, is an additional obstacle. This situation is exacerbated by the absence of specific programs designed to provide technical and financial assistance to employers to implement the necessary adaptations. In addition, stereotypes surrounding this illness—often linked to misperceptions about exaggeration or somatization of symptoms—contribute to employers' reluctance to make the necessary modifications to the work environment.

In conclusion, although occupational risk prevention regulations constitute, in theory, a valuable framework for ensuring both the adoption of accessibility measures and the implementation of reasonable accommodations in the workplace, their practical application in the case of people affected by MCS is insufficient. This deficiency in the implementation of the measures provided for directly violates the obligations that States must comply with under the principles of accessibility and equal conditions established in the CRPD. As a result, the right of this group not to be discriminated against in the workplace is compromised, limiting their opportunities to access and remain in employment on equal terms.

In this context, patient associations have played a key role, acting as mediators between affected individuals and their employers, in both the public and private sectors, to facilitate the implementation of reasonable accommodations that allow them to remain in employment on an equal basis.

Among the adaptation measures most frequently requested by people with MCS are the following:

Establishment of a fragrance-free policy, either throughout the entire workplace or in specific areas, in order to minimize exposure to volatile chemicals present in perfumes, colognes, or air fresheners.

Replacing cleaning products with alternatives that have a lower chemical load and are not harmful to those affected.

Relocating the workplace to areas with less exposure to sources of volatile organic compounds (VOCs), such as printers, photocopiers, or fax machines, which can generate harmful emissions.

Using appropriate materials in the event of construction or remodeling, selecting those that do not release chemicals that could aggravate the symptoms of people with MCS.

Control of fumigation, limiting it to what is strictly necessary, using less toxic pesticides or ensuring that the affected person can telework until the chemicals used have completely disappeared.

Implementation of ventilation and clean air policies, resorting, if necessary, to forced ventilation by mechanical means or the installation of air filtration systems.

Teleworking, as a temporary or permanent alternative, in cases where it is not possible to adapt the work environment safely for the affected person.

A prime example that highlighted the need to strengthen occupational adaptation measures for people with MCS was the health crisis caused by COVID-19. During this period, many companies implemented indiscriminate disinfection policies that included the use of highly toxic products, posing an added risk to people with MCS. Faced with this situation, patient associations actively intervened, engaging in dialogue with employers in both the public and private sectors to request the adoption of reasonable accommodations to ensure the safety of those affected. Among the most requested measures was teleworking, which was presented as an effective alternative to prevent exposure to triggers in the workplace.

The responses to these requests varied greatly. While greater progress was observed in the private sector in adopting these measures, the response from the public administration was generally more limited, making it difficult for affected individuals to access the necessary accommodations to guarantee their right to work in conditions of equality.

However, there are situations in which the implementation of these measures is unfeasible or does not occur. This can happen when the diagnosis of MCS or the associated disability is not officially certified, when the degree of impairment is particularly severe, or when the very nature of the job prevents the adoption of adequate measures to guarantee the safety of the person affected. In these cases, remaining in employment becomes impossible and the right to social protection comes into play.

People with MCS who find themselves in this situation are often forced to apply for sick leave or recognition of temporary or permanent incapacity for work, depending on the degree of impairment. However, these procedures are often complex and bureaucratic, which creates significant difficulties for those affected. These processes are often marked by misinformation and a lack of knowledge on the part of the professionals responsible for assessing the medical condition, which leads to the diagnosis and the associated disability being continually questioned. This context generates significant emotional distress for those affected, whose psychosocial well-being is severely affected when faced with these prolonged and uncertain procedures, which in many cases limit their effective access to the labor and social rights to which they are entitled.

Barriers to employment for people affected by electrohypersensitivity

The regulatory framework for occupational risk prevention is insufficient to effectively protect people affected by EHS. This deficiency is mainly due to ignorance, misinformation, and the stigma surrounding this condition. As a result, the risks arising from exposure to electromagnetic fields (EMFs) are not adequately assessed, either in cases of low-intensity exposure or in those of high-intensity or prolonged and continuous exposure.
As in the case of people affected by MCS, the recognition of a person affected by EHS as a "particularly sensitive worker," in accordance with Article 25 of Law 31/1995 on Occupational Risk Prevention[256], is a fundamental mechanism for ensuring the adoption of protective and adaptive measures in the workplace.

However, if this system is often ineffective for people affected by MCS, which, as we have seen, is recognized to a certain extent in the Practical Encyclopedia of Occupational Medicine and in the NTP 557 good practice guide, it is even more complicated to recognize a person affected by EHS as a "particularly sensitive worker."

Protection against electromagnetic fields is regulated by Council Directive 89/391/EEC of June 12, 1989, on the introduction of measures to encourage improvements in the safety and health of workers at work[257], Directive 2013/35/EU of the European Parliament and of the Council of June 26, 2013, on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields), and Royal Decree 299/2016 of July 22 on the protection of the health and safety of workers from the risks arising from exposure to electromagnetic fields. The latter, in its Article 3, establishes that EMFs constitute a physical element regulated as an occupational risk.

However, this regulation does not sufficiently address two fundamental aspects for the effective protection of people with EHS: the type of exposure and the scope of application. In addition to acute short-term exposures, EHS can also be triggered by non-acute, prolonged exposures over time[258].
Similarly, exposure to EMFs can result from both the work activity itself and the environment in which the work is carried out, given the widespread presence of wireless devices and telecommunications technologies in today's work environments.

In this regard, the INSST report on indoor air quality at work[259] points out that Multiple Chemical Sensitivity is one of the pathologies associated with environmental factors, along with exposure to electric and magnetic waves. This report highlights the need to consider these factors in occupational risk assessment to ensure the protection of people with EHS.
Article 4.1 of RD 299/2016 establishes that the risks arising from exposure to EMFs must be eliminated at source or reduced to the lowest possible level, taking into account technical progress and the availability of measures to control the risk at source.
However, the regulations do not explicitly provide for the adoption of measures to protect people who are exposed to these fields in a non-specific manner, which represents a significant shortcoming in the protection of this group.

It is worth noting that ruling 203/2018 of the Social Court No. 1 of Zaragoza represents a significant milestone in the recognition of EHS as a disease with an occupational origin. In this ruling, the court determined that the plaintiff's EHS was a direct and exclusive consequence of his professional activity. The case in question involved a senior telecommunications technician who was diagnosed with EHS in February 2014. Although the INSS incapacity assessment team reported that EHS was not recognized in Royal Decree 1299/2006 as an occupational disease and, consequently, could not be classified under Article 156.2 e) nor 157 of the General Social Security Law[260], the court reached a different decision. The court concluded that the plaintiff's condition was caused exclusively by exposure to particularly powerful electromagnetic fields in his work environment, which was significantly higher than that found in non-work environments. Based on this finding, the court determined that the episodes of temporary incapacity for work that the worker had suffered in previous years should be classified as a work-related accident, directly resulting from the working conditions to which he was exposed[261].

With regard to the environmental barriers that hinder access to and permanence in the workplace for people affected by EHS, various factors can be identified that have a negative impact on their well-being. Among these barriers, EMFs generated by personal wireless devices used by employees, such as cell phones, smart watches, or other portable devices, stand out.

Added to this is the EMF emissions from the building's own wireless transmission systems, such as Wi-Fi networks, Bluetooth, electronic work equipment and, in some cases, the presence of femtocells and repeaters within the premises. Other elements of the working environment, such as the lighting system and certain electrical appliances commonly used in offices, shops, or industries, are also considered to be significant sources of EMF. Finally, it should be mentioned that EMF emissions from outside can have an impact on the working environment, especially in those buildings with nearby mobile phone antennas, or even those installed on their roofs or facades, as well as high- or medium- voltage towers, transformers, etc.

In terms of social barriers, people with EHS often encounter significant difficulties due to a lack of awareness of their condition among company staff. This lack of information creates a hostile environment in which the severity of their symptoms is questioned or their impact is minimized. The absence of administrative and social recognition of EHS contributes to requests for workplace adaptations not being handled with due diligence. Likewise, the lack of protocols for action in the workplace to protect people with EHS exacerbates the situation of this group, as there are no clear guidelines regulating the adoption of preventive measures or workplace adaptations. Added to these difficulties is the lack of specially equipped spaces for people with EHS, which prevents them from having a safe environment during their working day.

Another factor that hinders access to employment is the frequent lack of credibility faced by people with EHS when they disclose their condition to their employers or coworkers. This attitude often manifests itself in the form of direct questioning, disdain, or rejection of their situation and specific needs in the workplace. The lack of attention paid to research and recognition of the syndrome also represents a significant barrier, as it limits the implementation of adequate measures to protect this group. In this context, the lack of awareness about the impact of certain elements of the work environment, such as EMFs, contributes to the adoption of measures that, far from promoting the inclusion of people with EHS in the workplace, aggravate their symptoms and deteriorate their health.

In this context, people affected by EHS require the implementation of reasonable accommodations that allow them to carry out their professional activities without compromising their health. Normally, these requests are made to their companies' occupational health services, accompanied by medical reports and supporting letters from patient associations. Among the most common measures are a change of job to an area with less exposure to EMFs or the assessment of temporary incapacity for during periods of exacerbation of symptoms.

In practice, people affected by EHS encounter numerous difficulties in implementing these reasonable accommodations, especially when adapting the work environment requires significant changes. This lack of adaptation often results in those affected being forced to leave their jobs or, in cases where it is not possible to find another job, being left unprotected because they are not granted extended sick leave or recognized with a permanent incapacity for work by the INSS. Teleworking has emerged as an effective alternative for many people with EHS, as it allows them to adapt their home environment to minimize exposure to EMFs. These adaptations often include the wiring of electronic devices, proper grounding of these, the use of computers protected by shielding systems and the exclusive use of corded and hands-free telephones. Although these measures constitute reasonable accommodations under the CRPD, in practice, people affected by EHS are often forced to bear the costs of these adaptations themselves.

Although teleworking is an effective solution for many people with EHS, it is not always sufficient. In cases where the degree of impairment is particularly severe, even adapting the home environment does not reduce symptoms enough to allow the person to work. As a result, people with EHS face numerous obstacles to accessing their labor rights on equal terms. The absence of effective preventive measures, the lack of recognition of the illness, and the insufficient implementation of reasonable accommodations significantly limit their opportunities for accessing and remaining in employment. Given this situation, it is necessary to ensure that appropriate measures are taken to enable the inclusion of this group in the workplace and, in cases where the severity of the condition so requires, to recognize the right to incapacity for work.

Conclusion

The analysis developed in this chapter shows that organic disability, especially that derived from MCS and EHS, faces a scenario marked by invisibility, lack of institutional recognition, and the persistence of social, environmental, and informational barriers that seriously hinder the effective exercise of their rights, especially in the workplace.

The difficulties faced by people with MCS and EHS in accessing and remaining in the labor market stem mainly from the lack of measures to ensure the removal of environmental barriers and the implementation of reasonable accommodations.

Factors such as the presence of chemical agents in the workplace, the proliferation of electronic devices that emit electromagnetic fields, and the absence of programs to raise awareness among employers exacerbate these barriers, reducing opportunities for access to and retention in employment.

The effective application of the principle of equal opportunities in the workplace requires the adoption of concrete measures that respond to the specific needs of people with MCS and EHS. The establishment of fragrance-free environments, the control of electromagnetic emissions, relocation to safe areas, and the implementation of teleworking are fundamental tools for ensuring that these individuals can carry out their professional activities without putting their health at risk.

It is also a priority to promote technical and financial assistance programs that make it easier for employers to adopt these measures. In this regard, patient associations have played a key role in promoting these actions, facilitating mediation between affected individuals and their work environments.
On the other hand, in cases where the adoption of adaptation measures is not feasible due to the nature of the job or the severity of the condition, it is essential to guarantee access to social protection mechanisms such as temporary or permanent incapacity for work. This recognition must be agile and in line with the reality of people with MCS and EHS, avoiding administrative uncertainty that could aggravate their vulnerable situation.

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CHAPTER

2

The treatment of both sensitivities in labor legislation and in risk prevention and public health legislation

Spanish legislative context

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2.1

This chapter analyzes the legal treatment in our country of Multiple Chemical Sensitivity (MCS) and Electrohypersensitivity (EHS), diseases that are still invisible in our legal system. We examine their recognition in Social Security legislation, especially in relation to healthcare, temporary incapacity for work, permanent incapacity for work, the declaration of a person with a disability, and access to other benefits such as early retirement due to disability. The aim is to highlight the need for legislative reform to better protect those affected, taking into account gender perspectives and the frequent underestimation of disability. We will also address the issue of termination of the working relation and the special protection afforded by the legal system to dismissal on grounds of supervening incapacity. Finally, we include a relevant bibliography.

Recognition of Multiple Chemical Sensitivity and Electrohypersensitivity in the Spanish Legal Context

The necessary legal recognition

It is clear that both Multiple Chemical Sensitivity (hereinafter MCS) and Electrohypersensitivity (hereinafter EHS) do not have the legal recognition they should have, or at least what we professionals who regularly work with people affected by these conditions believe should be enshrined in our legal system, when other health conditions are explicitly reflected, such as for example, in Royal Decree 1851/2009, of December 4, which allows early retirement due to disability with a degree of 45%, or Royal Decree 888/2022, of October 18, which establishes the procedure for the recognition, declaration, and classification of the degree of disability.

In this regard, there are already requests for the inclusion of fibromyalgia in RD 1851/2009 and in RD 888/2022, and it was about time, Chapter 6, within the Global Disability Scale for Individuals (hereinafter BDGP), addresses chronic pain when it is the main symptom, and does so in association with fatigue, in clear reference to Chronic Fatigue Syndrome and, although it avoids mentioning it by name, Fibromyalgia. However, neither MCS nor EHS are covered by these regulations, nor, as far as I have been able to investigate, by any other legal regulation. But this "silence" does not prevent access to the protective umbrella of Social Security, as we will discuss, because the powers of the State have taken these pathologies into account at various times.

One of the most important moments in the context of the recognition of the disease is the parliamentary procedure in the Congress of Deputies regarding the inclusion of Multiple Chemical Sensitivity in the international classification of diseases. The proposal (file number 161/002126)[262] stated that there was already sufficient scientific evidence to include the term Multiple Chemical Sensitivity in the alphabetical index of diseases in the International Classification of Diseases (hereinafter, ICD) and it was expressly stated that it was "a request that we believe is the only and best solution at this time so that multiple chemical sensitivity can be recognized as a disease in Spain and so that people who suffer from it can escape from the defenseless situation in which they find themselves at present". Finally, inclusion in the ICD was achieved, but this has not been the only occasion on which our Parliament has dealt with these diseases, as more recently, associations of affected individuals were able to recount the difficulties faced by people diagnosed with fibromyalgia, multiple chemical sensitivity syndrome, and other central sensitization syndromes, requesting that the General State Budget include budget items for social awareness, scientific research, and training of healthcare professionals[263].

Undoubtedly, as a result of the above, Law 22/2021, of December 28, on the General State Budget for 2022 included a budget item, under the heading "226.11 Institutional campaign aimed at the normalization of Fibromyalgia, Chronic Fatigue Syndrome, and Multiple Chemical Sensitivity," and an amount of 50,000 euros.

In short, both MCS and EHS, although the latter to a lesser extent, and in general all pathologies linked to Central Sensitization Syndromes, are present in political life and also, as we shall now see, directly or indirectly in our legislation, which must grant them the appropriate level of protection.

Multiple Chemical Sensitivity and Electrohypersensitivity in the field of social security

Healthcare

Without a doubt, the main demand of people affected by MCS and EHS is to receive adequate protection in terms of comprehensive healthcare. The main regulation is found in Royal Decree 1030/2006, of September 15, which establishes the portfolio of common services of the National Health System and the procedure for updating it, including primary care, specialized care, therapeutic treatments, rehabilitation, and pharmaceutical benefits, provided by the respective services of the Autonomous Communities, which, as we know, have been transferred and assumed responsibility for this area. At the time, the action taken by the Autonomous Community of Catalonia was paradigmatic, in an ambitious rollout of care for Central Sensitization Syndromes (CSS), which aimed to implement an Operational Plan for the care of affected individuals by, among other diseases,

Multiple Chemical Sensitivity[264], which addresses not only treatment in primary care, but also the creation of Expert Units to monitor the most complex cases. More recently, the Catalan Agency for Health Quality and Assessment (AQuAS), a public law entity attached to the Department of Health of the Government of Catalonia, published an interesting document in 2023 dealing with the international approach and experiences of CSS in general, and MCS in particular[265]. However, we must not forget that the treatment and monitoring of both MCS and EHS must be carried out according to the needs and specific circumstances of the people who require healthcare. Therefore, documents such as the "Protocol for the care of people with Multiple Chemical Sensitivity" from SER-GAS[266] or in Catalonia on "Recommendations for good clinical practice in emergency services for people affected by MCS"[267] are essential guidelines for doctors who have to treat this group of affected people.
The fact is that, time and again, places and exposures that are harmless to users of healthcare centers and hospitals are not harmless to people diagnosed with these conditions; on the contrary, they cause their symptoms to worsen.
In short, there is a right to healthcare in the field of MCS and EHS, both at the primary and specialized levels, given the legal recognition of their existence by the scientific community and public administrations.

Temporary incapacity for work

However, the issue becomes more complicated when access to benefits is purely financial. At the first level, temporary incapacity for work, as regulated in Articles 169 et seq. of Royal Legislative Decree 8/2015 of October 30, approving the revised text of the General Social Security Law (hereinafter TRLGSS), offers beneficiaries protection through the corresponding allowance, provided they meet the constitutive requirements, that is, they receive healthcare from Social Security and are unable to work, they must also be registered with the social security system and, in the case of a common illness, they must have made a minimum contribution of 180 days in the 5 years prior to the start date of their sick leave. Its duration is limited in time to a maximum of 545 days, although there is the possibility of an extension of 180 more days[268]. And yes, people diagnosed with MCS and/or EHS are entitled to the protection afforded by this benefit, whether the person is in the early stages of the disease, or whether it is already chronic, and even if it evolves through flare-ups or the symptoms are more stable.

As we have seen in the previous section, there is a clear right to receive healthcare—which may even take the form of rest or avoiding exposure for a certain period of time to certain work or public environments, agents, or conditions that may exacerbate the symptoms of MCS and EHS—, which obviously have a temporary impact on the worker's work activity. It may be worth reflecting, but that is addressed in other chapters of this book, on the impact of teleworking, as regulated by Law 10/2021 of July 9 on remote working, or on the necessary reasonable accommodations that employers must make in accordance with Royal Legislative Decree 1/2013 of November 29, which approves the Consolidated Text of the General Law on the Rights of Persons with Disabilities and their Social Inclusion. Nor can we ignore the special protection granted, even without proving an "officially" recognized disability, in accordance with the provisions of Articles 25 of Law 31/1995, of November 8, on the Prevention of Occupational Risks, and Articles 4 and 6 of Law 15/2022, of July 12, on equal treatment and non-discrimination, as a clear projection of the prohibition of discrimination in the International Convention on the Rights of Persons with Disabilities and Council Directive 2000/78/EC of November 27, 2000, establishing a general framework for equal treatment in employment and occupation.

In short, MCS and EHS are protected by this specific and temporary benefit, even in the current management framework involving various agents, in which the primary care physician issues the initial sick leave certificate and subsequent confirmation certificates, but it is the Medical Inspectorate and the collaborating mutual insurance companies that exercise parallel, sometimes suffocating, control. Temporary incapacity for work is the support for coping, I insist, even if the illness is already chronic, with temporary situations of worsening or aggravation of the specific symptoms of MCS and/or EHS, which prevent the worker from performing his/her daily work activities.

Permanent incapacity for work

Although access to a life pension—in principle, because it is subject to possible revisions due to improvement until the normal retirement age is reached—is usually preceded by a situation of temporary incapacity for work, direct access to it is possible without such a situation when the injuries are already permanent. In this regard, Article 193 of the TRLGSS (Consolidated Text of the General Social Security Law) has recently been amended, and although the definition of the concept of permanent incapacity for work remains the same as always, i.e., the situation of a worker who, after having undergone the prescribed treatment, has serious anatomical or functional impairments that are objectively determinable and foreseeably permanent, which reduce or nullify their working capacity, recently, Law 3/2024 of October 30 on Amyotrophic Lateral Sclerosis has partially amended that article to indicate that it will not always be necessary to have previously been in a situation of temporary incapacity for work or to have exhausted all therapeutic possibilities. As for MCS and EHS, in the context of central sensitization syndromes (CSS), it does not seem unreasonable to understand that they should be subsumed under this exception[269].

That said, the main objective of the benefit for permanent incapacity for work, which is calculated at different levels depending on the degree of reduced working capacity, is clearly to replace earned income. And, also depending on the degree and the contingency from which it derives, the regulatory base, as an average of the worker's contributions, will be subject to special protection, which will be more intense and favorable the greater the degree of incapacity and taking occupational contingencies into account. Regarding the difficulty of accessing pensions and their recognition, we must refer to the article by Fernando Lousada[270] in which he exhaustively analyzes the judgments handed down, particularly in the area of permanent incapacity for work, highlighting that these are highly feminized illnesses, and that the legal treatment of MCS and EHS is not entirely satisfactory in our legal system, which, as it mainly affects women, constitutes gender inequality, a statement with which we fully agree.

Even so, there is absolutely no legal limitation on the recognition of MCS and EHS as pathologies that give rise to a declaration of permanent incapacity for work. On the contrary, if the disease is diagnosed by the Public Health Services, medical follow-up is also provided by the public and specialized health system, and the severity of the sequelae is accredited in the patient's medical history, there is no reason to deny access to a permanent incapacity pension, provided that the legal requirements for access are met in terms of registration or equivalent status in the Social Security system and, in the case of a common illness, the required contributions or waiting period.

With regard to the incapacitating effect, and given that this is a matter that is in practice prohibited from being heard by the Supreme Court, the doctrine of the Social Chambers of the High Courts of Justice takes on special importance. In this regard, the most recent ruling, STSJ CAT 7902/2024, recognizes the absolute permanent incapacity for work of a worker with chronic fatigue syndrome and stage III fibromyalgia, as well as chronic and severe idiopathic multiple chemical sensitivity syndrome, which prevent her from performing any work activity with minimum performance. The declaration of the "severity" or "gravity" of the pathologies, often classified as grade III or IV, implies that the functional limitations constitute a declaration of permanent incapacity for work, particularly in the absolute degree that prevents the performance of any activity or profession.

One of the issues that provokes the most judicial rulings in the area of social security benefits is the definition of so-called "occupational diseases," that is, those that originate in the workplace and do not qualify as professional diseases because they do not meet the requirements of Article 157 TRLGSS and of Royal Decree 1299/2006, of November 10, which approves the list of professional diseases in the Social Security system and establishes criteria for their notification and registration, i.e., the disease and/or activity and/or agents that may cause it do not appear in the current list[271]. However, "occupational diseases," and therefore the workers who suffer from them, deserve the protection of the social courts, as they must be considered as genuine accidents at work.

The issue becomes more complicated when the illness contracted at work is MCS. However, legal doctrine allows for the recognition and protection of such illnesses under the concept of accident at work when they originate in the workplace, under the protection of Article 156.2 e) TRLGSS, if it is proven that the illness is exclusively caused by the work performed for somebody else. However, we must not forget that section f) of the same article also allows for the recognition of occupational contingencies, even if the injury or illness pre-existed the accident at work, if it was aggravated as a result of or during the accident.

In short, there is no express legal provision for the protection of MCS and EHS in the area of permanent incapacity for work, but as with other pathologies, it is the objective determination, chronicity, and functional impact that leads to its protection, without there being any reason to exclude both pathologies from this special protective action for workers, even if the causal link is proven, as a professional contingency. And we agree with Raquel Poquet when she points out that "It is therefore necessary to try to protect the affected person and offer them social and Social Security benefits that, at a minimum, compensate them for the loss of wages resulting from their inability to work like any other person"[272].

Disability. Special reference to the Scale of Limitations in Mobility Activities.

The recent reform of Article 49 of the Spanish Constitution, expressly stating that persons with disabilities exercise the rights provided for therein in conditions of real and effective freedom and equality, deserving of special protection and guarantees that allow for their full personal autonomy and social inclusion, has its main projection in Royal Legislative Decree 1/2013, of November 29, which approves the Consolidated Text of the General Law on the Rights of Persons with Disabilities and their Social Inclusion. However, as we indicated in previous sections, the official declaration of a person with a disability is made in accordance with the provisions of Royal Decree 888/2022, of October 18, which establishes the procedure for the recognition, declaration, and classification of the degree of disability. However, neither MCS nor EHS are expressly covered by this regulation, which in practice makes it extremely difficult to obtain official recognition as a person with a disability[273]. Nevertheless, Article 4 of Royal Legislative Decree 1/2013 of November 29 allows for the certification of a disability of at least 33% through a resolution by the INSS declaring a degree of total permanent incapacity for work, absolute permanent incapacity for work or great incapacity for work, thereby simplifying access to the declaration of disability in the event of obtaining a pension. But of course, once a pension has been obtained as a substitute for salary, obtaining the degree of disability loses importance, although it is decisive for accessing other benefits. Among these, we will highlight some of the most important ones, which in practice are very difficult for people with MCS and/or EHS to access, in the following sections, such as retirement due to disability or non-contributory incapacity.

Also, in the area of official recognition of persons with disabilities, RD 888/2022 establishes a new Scale of Limitations in Mobility Activities (hereinafter, BLAM), which is configured as an assessment tool designed to measure the difficulties that a person may experience when performing activities related with mobility. This scale is part of the

Capacities/Limitations in the Activity Assessment Scale (hereinafter referred to as BLA), which in turn is one of the four main blocks in the assessment of disability, along with impairment, participation restrictions, and contextual factors. The BLAM focuses specifically on limitations in the domain of mobility, which in the previous scale was referred to as "reduced mobility" or "inability to use public transport". Thus, it is configured as an independent scale, which draws on information collected during the assessment of abilities and limitations in daily activities, on a range from 0 to 100%. This score reflects the degree of difficulty the person experiences when performing mobility activities. If the final score for limitation in the mobility domain is equal to or greater than 25%, the person is determined to have reduced mobility and mobility difficulties in using public transport.
The activities assessed are the person's ability to perform activities such as changing basic body positions, maintaining body position, lifting and carrying objects, fine hand use, walking, moving around inside and outside the home, using public transportation, and driving vehicles.

At this point, why do people with MCS or EHS need this scale? Because it is clear that they often experience very significant limitations in their mobility, which may be invisible to the assessor, as they are not related to physical mobility itself, but nevertheless they experience a serious loss of autonomy in moving or traveling in their daily lives, since, as we know, they do have indirect limitations on their mobility. With MCS, they experience symptoms such as fatigue, dizziness, muscle weakness, and cognitive difficulties, induced by exposure to chemicals present in the environment and also in means of transportation. EHS, for its part, causes similar symptoms, such as dizziness, disorientation, or pain, in response to exposure to electromagnetic fields. We understand that these are mobility problems in themselves, because these symptoms greatly hinder the performance of daily activities that require movement or travel, such as leaving home, shopping, walking along roads and in community spaces, or using public transport. Furthermore, the use of public transport, especially in urban environments, is problematic for people with MCS and EHS due to exposure to chemicals and radiation, and therefore their ability to move around is restricted. When assessing the ability to use public transport, we understand that the BLAM must evaluate these limitations. At this point, we can affirm that the mobility limitations derived from MCS and EHS significantly affect a person's ability to participate in social, work, and leisure activities. When combined with the BRP (Participation Restrictions Scale), the BLAM can show the relationship between mobility limitations and restrictions on social participation. As with other conditions, it is essential to bear in mind that pain and fatigue can significantly influence a person's mobility. People with MCS and EHS often suffer from headaches, muscle or joint pain, which can be caused or aggravated by exposure to chemicals or electromagnetic fields, which are present in public transportation, but also through other users of those means of transportation, as they use cologne, deodorants, cell phones, wireless devices, etc.

The BLAM is a valuable tool for assessing mobility limitations in people with MCS and EHS, as it highlights both physical difficulties and indirect limitations caused by the symptoms of the disease and by environmental restrictions.

Its application, taking into account the characteristics of people with MCS and/or EHS, would allow them to access the support and resources necessary to improve their quality of life, enabling them to travel independently, for example, in vehicles adapted to their health condition, and allowing them to park in designated areas.

Early retirement due to disability

There is no legal impediment to accessing retirement on grounds of disability as regulated in Article 206 bis of the TRLGSS, which allows the normal retirement age to be reduced in the case of people with a disability equal to or greater than 65%. It implements Royal Decree 1539/2003, of December 5, its terms and involves the application of coefficients of 0.25% on the effective contribution period, certifying 65% disability—note, only during periods of coincidence of work activity and that percentage of disability—, or 0.50% if the need for a third person for basic activities of daily living is also certified. This is undoubtedly a positive measure for people with disabilities, but given the difficulty of recognizing people with MCS and/or EHS as disabled, it is even more difficult for them to reach such high percentages. Needless to say, reality shows that it is impossible to access this type of retirement.

Furthermore, for those with a degree of disability equal to or greater than 45%, Article 206 bis TRLGSS allows access to early retirement from the age of 56, provided that, in the latter case, the disability is one that is determined by regulation and for which there is proven evidence that it generally leads to a significant reduction in life expectancy. However, in the short list of diseases in Royal Decree 1851/2009, of December 4, MCS and EHS, pardon the expression, "are neither included nor expected to be included", so this option is also off-limits for them.

Partial retirement

Article 215 TRLGSS establishes that partial retirement is possible, allowing part-time work to be combined with a retirement pension up to three years in advance of the normal retirement age, provided they can prove, among other requirements, 33 years of effective contributions. However, if a degree of disability equal to or greater than 33% is accredited, the effective contribution period required is reduced to 25 years. This is undoubtedly a new positive step which, given the lack of protection for people with MCS and/or EHS, does not provide adequate protection either. However, the recent publication of Order ISM/444/2025, of April 30, regulating the procedure for including new disability-causing pathologies in the annex to Royal Decree 1851/2009, of December 4, establishes the procedure whereby, exclusively at the request of associations, foundations, or other organizations representing groups affected by pathologies whose inclusion is requested, the procedure may be initiated. We hope that this will allow, perhaps in the near future, MCS and EHS to be included in the list.

Non-contributory incapacity

Among the requirements of Article 363 TRLGSS, which allows access to the non-contributory incapacity pension—fortunately, the term "invalidity," which was clearly pejorative for this benefit, is no longer used following the reform of the Single Additional Provision of Law 2/2025 of April 29—, not only must the applicant have been a legal resident of the country for five years, be between 18 and 65 years of age, and lack sufficient income, but they must also prove a degree of disability equal to or greater than 65%. This being the case, and given the need to protect people who are unable to work as a result of their illnesses, and who have not contributed, or at least not enough to be eligible for a contributory pension, we see in our daily advisory practice that in situations of MCS and/or EHS it is practically impossible to access this welfare pension, and we have to redirect the person to areas of protection such as the Minimum Living Income, which means providing coverage not because of their reduced capacity for work, but because of their immersion in poverty. And this is greatly exacerbated when, as in most cases, the person is a woman.

Minimum Living Income

This benefit, created in the context of the COVID pandemic and currently regulated by Law 19/2021 of December 20, which establishes the minimum living income, is intended and designed to address situations of extreme poverty and attempt to reintegrate beneficiaries into the labor market. Consequently, access to this type of benefit for people with MCS and/or EHS, when they are not eligible for any other benefit[274], becomes a kind of "vicious circle", in which they are not eligible for other benefits due to the severe functional limitations caused by the disease, but cannot take advantage of the employment pathway proposed by the MLI for the same reason. However, the regulation itself states that it will pay special attention to the participation of people with disabilities, which takes the form of an increase in the benefit if a 65% disability is certified, and the obligation to remain registered as a job seeker is removed. It is clear that this is not an adequate benefit for the deserved protection of people with disabilities in general, and even less so for those with MCS and/or EHS in particular.

Dependency

Law 39/2006, of December 14, on the Promotion of Personal Autonomy and Care for Persons in a situation of Dependency, does not contain any express regulation, nor do its implementing regulations, that refers to MCS and/or EHS. However, unlike the scale in RD 888/2022, it does allow, in some way, for the impact of these pathologies on the person's autonomy and their basic and instrumental activities of daily living to be taken into account. However, it is neither a pension nor a benefit that allows the person to live with dignity, but rather it is presented as a complementary benefit to basic pensions, whether retirement or permanent incapacity for work, or even, in most cases, non-contributory pensions.
However, if there is no access to the former, dependency benefits are completely insufficient.

MCS and EHS in labor legislation

Termination of the employment relationship due to dismissal

Special protection for people with MCS and/or EHS

The termination of the employment relationship, when carried out through the dismissal of the worker as a unilateral decision by the employer, can be classified, if a legal claim is filed against that decision, as void, unfair, or for objective reasons, each with different legal implications and consequences. Below, I detail each type of dismissal, including possible nullity in cases of temporary incapacity for work (TIW) and for health reasons, with special reference to people with Multiple Chemical Sensitivity (MCS) and Electrohypersensitivity (EHS).

The classification of dismissal. Types, requirements, and consequences

Void dismissal

Nullity is considered when it occurs for discriminatory reasons, violation of fundamental rights, or in specific situations of protection. There are multiple causes for nullity, including:

- Discrimination on the basis of sex, origin, race, religion, beliefs, political ideas, sexual orientation, gender identity, gender expression, sexual characteristics, trade union membership, disability, or age. This discrimination contravenes Article 14 of the Spanish Constitution and Article 2 of Law 15/2022.

- Violation of the fundamental rights and public freedoms of the worker. Article 9.2 of the Spanish Constitution and Article 1 of Law 15/2022 establish the obligation to guarantee equality and non-discrimination.
- During periods of contract suspension due to birth, adoption, guardianship for adoption purposes, foster care, risk during pregnancy, risk during breastfeeding, enjoyment of parental leave, or due to illnesses caused by pregnancy, childbirth, or breastfeeding. Article 45.1 of the Workers' Statute establishes the causes for contract suspension.
- Dismissal of pregnant workers, from the beginning of pregnancy until the start of maternity leave. Article 55.5 of the Workers' Statute protects pregnant workers.
- Dismissal of workers who have requested or are enjoying leave for birth, adoption, guardianship for the purposes of adoption or foster care, or for exercising their right to effective judicial protection or the rights recognized by law to enforce their protection or their right to comprehensive social assistance. Articles 37 and 48 of the Workers' Statute regulate these types of leave.
- Dismissal of workers after they have returned to work at the end of the periods of suspension of the contract due to birth, adoption, guardianship for the purposes of adoption or foster care, provided that no more than twelve months have elapsed since the date of birth, adoption, guardianship for the purposes of adoption or foster care. Article Section 53.4 of the Workers' Statute establishes this protection.

The consequences of declaring the dismissal void involve the immediate reinstatement of the worker and the payment of wages not received, and may also include compensation for moral damages suffered as a result of the violation of a fundamental right, with the aim of repairing that damage.

Unfair dismissal

In general, dismissal is classified as unfair or unjustified when the employer fails to prove the employee's breach of contract in disciplinary dismissals alleged by the employer or when the form of dismissal does not comply with the requirements established in Article 55.1 of the Workers' Statute.
This is what we call dismissal "without real cause".

> **Consequences**. The employer can choose between reinstating the worker or paying compensation of 33 days' salary per year of service, up to a maximum of 24 months' salary. If reinstatement is chosen, the worker is entitled to back pay and unemployment benefits, if applicable.
> However, it is important to note that, in the case of a union representative, the choice between compensation or reinstatement is up to the worker.

Dismissal for objective reasons

Normally, this type of termination, which may be collective or individual, is based on economic, technical, organizational, or production reasons, employee’s incapacity, or a lack of budgetary allocation for permanent contracts in non-profit entities for the execution of public plans and programs.

> **Requirements**. For a dismissal for objective reasons to be valid, written notification must be given to the worker, specifying the cause; compensation of 20 days per year of service must be made available to the worker, with a maximum of 12 monthly payments; and 15 days' notice must be given. Article 53.1 of the Workers' Statute establishes these requirements.
>
> **Consequences.** If the dismissal is declared fair, the worker will be entitled to compensation and will be considered unemployed for reasons not attributable to him or her. If it is unfair, the consequences of unfair dismissal will apply.

There is currently intense debate among legal practitioners, not yet resolved by the Supreme Court or the Constitutional Court, on the classification of dismissals of workers on temporary incapacity for work leave (hereinafter, TIW). Traditionally, the Supreme Court has understood that the termination of the employment relationship during such a situation deserved to be classified as unfair, but the publication of Law 15/2022 of July 12, on equal treatment and non-discrimination, has highlighted that, in certain cases, if the dismissal takes place during a situation of TIW, it can be argued that discrimination on the grounds of health or illness has occurred, and the dismissal should therefore be considered void. Article 2 of Law 15/2022 expressly prohibits any discrimination on the grounds of illness or health condition.

In the case of people with MCS and/or EHS, whose conditions may cause work limitations and absences from work, their dismissal may be due to clear discrimination on the grounds of health. The dismissal of these individuals due to their health condition or absences from work associated with TIW processes or medical visits, etc., could be considered void for violating the right to non-discrimination, according to Articles 1 and 2 of Law 15/2022, and for violating fundamental rights according to Article 4 of Law 15/2022.
I insist that the Spanish Constitution, the Workers' Statute, and now Law 15/2022 prohibit discrimination on the grounds of health and illness. Dismissal based on a worker's health condition, especially if this condition involves a disability, can be considered void. We cannot turn a blind eye, and it is clear that daily practice shows us that people with MCS and/or EHS are affected by work environments that are not adapted to their health conditions, which can lead to frequent absences due to the impossibility to perform their work effectively, usually in the form of TIW processes, as we have explained in the corresponding section. If the dismissal is based on these absences or on the condition of MCS/EHS itself, the termination of the employment relationship is discriminatory and, therefore, void.

Let us not forget, moreover, that the denial of reasonable accommodations for people with disabilities (including conditions such as MCS and EHS) is considered direct discrimination. If an employer fails to make the necessary adaptations for a person with MCS or EHS to work and decides to dismiss them for not being able to perform their duties, the dismissal must be considered void on the grounds of denial of reasonable accommodations and discrimination on the basis of disability, according to Article 6.1 of Law 15/2022.

In summary, a dismissal can be declared void if it is based on discriminatory grounds, violation of fundamental rights, or specific situations of protection such as pregnancy, childbirth, breastfeeding, and related leave. Dismissals during TIW related to these grounds are also void, as are those that discriminate on health grounds, including conditions such as MCS and EHS. An unfair dismissal is one where non-compliance is not proven or formal requirements are not followed, while a dismissal for objective reasons is based on justified causes but must follow legal requirements to be valid. The key to determining the nullity of a dismissal lies in the existence of discrimination or the violation of fundamental rights, especially when it comes to health situations affecting people with MCS and/or EHS, for whom protection against discrimination is their shield against business decisions of a dismissive nature without justified cause. As I mentioned earlier, Law 15/2022 reinforces protection against discrimination, including that based on health reasons, and especially for people with MCS and EHS.

Special reference to dismissal for objective reasons on the grounds of supervening incapacity in persons with MCS and/or EHS.

All workers, and of course people with MCS and/or EHS, have the right to effective protection in terms of occupational safety and health, as enshrined in Article 19.1 of Royal Legislative Decree 2/2015, of October 23, which approves the consolidated text of the

Workers' Statute Law (hereinafter ET), and which is repeated and developed in Article 14 of Law 31/1995, of November 8, on Occupational Risk Prevention (hereinafter LPRL). Its content includes monitoring their state of health. The ET also reiterates that, in the employment relationship, workers have the right, among other things, to physical integrity and an adequate occupational risk prevention policy (art. 4.2d).

In turn, health surveillance—although not exclusively, but mainly a medical examination adapted to the requirements of the specific job and the risks arising from it— is developed in Article 22 of the LPRL, establishing the right for it to be periodic, "conditional" voluntary, guaranteed by the employer and, for the purposes of what we are now addressing, it is expressly stated that "it shall always be carried out with respect for the right to privacy and dignity of the worker and the confidentiality of all information related to their state of health" and, more importantly, "data relating to health surveillance may not be used for discriminatory purposes or to the detriment of the worker". Royal Decree 39/1997, of January 17, approving the Regulation on Prevention Services, regulates various aspects of health surveillance, which are further developed in Technical Prevention Note No. 959[275] of the National Institute for Safety and Health at Work. In line with what is set out therein, it is important to note that company actions in the field of health surveillance form part of the worker's medical history.

From the above regulations and their technical implementation, but especially from Article 22.4 of the LPRL, which states that "...the employer and the persons or bodies with responsibilities in the field of prevention shall be informed of the conclusions drawn from the examinations carried out in relation to the worker's fitness for the job...", it follows that, once the medical examination has been carried out, the company's medical service, which is part of the Prevention Service (whether internal, external, or joint), must inform only the workers of their health status, but also the employer regarding the impact of their health conditions, issuing a certificate on their fitness for work, in which it can be determined that they are a) fit, b) unfit, or c) fit with restrictions, and also the temporary or "permanent" nature of the condition, with permanent being understood as meaning that, although the nature of the condition may change, it is expected to be permanent over time.

This is where problems arise for the employer and the employee in all cases where the report is not "fit without limitations", specifically "fit with limitations" and "unfit" of a permanent nature—in the case of a temporary nature, the solution is clear: temporary incapacity. Thus, in principle, **and taking into account the employer's obligation to make "reasonable accommodations" according to the doctrine of the CJEU and the obligation under Article 25 of the LPRL to adapt the workplace to the health situation of the "particularly sensitive worker", in certain cases, and especially in large companies, the aforementioned adaptation, or even a change of job, should be sufficient.** However, this is not always possible, and this is where the problems arise. We will come back to this later, but I can already say that it concerns indefinite "unfitness" and the impossibility of making - or the company's refusal to make - the adaptation and/or change of job. There is significant friction between the declaration of fitness in health surveillance and other related concepts. It may happen that a worker who is "unfit" or "fit with restrictions" is not considered—or does not have official recognition—to be a person with a disability (Article 25 of the LPRL does not require disability status to adapt the job, although if it's available it does reinforce the company's obligation). Conversely, a person with a disability may not be considered a "particularly sensitive worker" in his/her company. Unfortunately, this occurs very frequently in the field of MCS and/or EHS.

Worse still, a worker who is declared "unfit" is not automatically declared permanently incapacitated in its degree “total” and thus unable to perform the usual job—not even partially, for that matter.

The Supreme Court doctrine tells us that "the worker's lack of aptitude to perform the specific tasks of their job, which were entrusted to them in accordance with the employer's managerial authority (Article 20 in relation to Article 5.a and c ET), should not be confused with the permanent contributory incapacity for work defined in Article 193.1 LGSS 8/2015". I would add that the legal syllogism is true, but how do we explain to a person with MCS and/or EHS who is dismissed from their job for being considered "unfit", and whose permanent incapacity pension for their usual profession, which they cannot perform, is denied by the INSS? I, at least, still do not know how to explain it. And, for the purposes that we will analyze later—discrimination based on disability in the context of the consequences of health surveillance—we cannot continue without first taking into account that the doctrine of the CJEU, in the Nobel Plastics case, equates long-term illness with a true situation of disability. And in the field of MCS and EHS, this is the situation we often find ourselves in, without official recognition of the degree of disability, but with chronic illnesses that have a wide-ranging impact on the daily life, not to mention the working life, of the person affected.

Prior to the publication of Royal Decree-Law 5/2023 of June 28, it was reasonable to understand that lack of aptitude, declared "officially" by the Prevention Service as "unfit" after the appropriate health surveillance assessment, was subsumed under the termination of employment provided for in Article 52 a) ET, i.e., "due to the worker's known or supervening incapacity after their effective placement in the company."

However, with important nuances, such as in STS 1015/2022 - ECLI:ES:TS:2022:1015, such dismissal has been considered inadmissible, since, it states, "... compliance with this safety obligation by the employer does not mean that the employer can automatically terminate the employee's employment contract on the grounds of the employee's supervening incapacity based solely on the conclusions of the external prevention service's report, the purpose of which, as we have emphasized, is purely informative, limited to conveying

conclusions which cannot be based on the worker's injuries, since information relating to the worker's state of health is protected by their right to privacy and their right to data protection, in accordance with the provisions of Article 22.3 and 4 of the LPRL."
However, Royal Decree-Law 5/2023 of June 28 changes the previous situation, and perhaps not enough attention has been paid to what I am about to explain, since this new regulation has an impact on the termination of the employment relationship due to supervening incapacity if it occurs as a result of being declared "unfit" by the prevention service.

Firstly, it should be noted, as pointed out in a highly qualified legal opinion by Fernando Salinas, Emeritus Judge of the Supreme Court[276], and I quote verbatim, "Articles 108.2 (classification of dismissal as void) and 122.2 (classification of termination of contract for objective reasons as void) of the LRJS are amended to ensure consistency with the amendments made, respectively, to Articles 53.4 and 55.5 ET". It is true that the wording adapts the grounds for nullity to the new rights of work-life balance, but it does not remove what was already established in the previous wording: "Dismissal shall be void if it is based on any of the grounds of discrimination prohibited by the Spanish Constitution or by law, or if it violates the fundamental rights and public freedoms of the worker". However, Royal Decree Law 5/2023 has also amended Article 4.2 c) ET, concerning workers' rights in their employment relationship, now including the concept of disability in its wording. Whereas previously the article stated:

"Not to be discriminated against directly or indirectly for employment, or once employed, on grounds of sex, marital status, age within the limits set by this law, racial or ethnic origin, social status, religion or beliefs, political opinions, sexual orientation and identity, gender expression, sexual characteristics, union membership or non-membership, or language, within the Spanish State."

And the new wording reads:

"Not to be discriminated against directly or indirectly for employment or, once employed, on grounds of marital status, age within the limits set by this law, racial or ethnic origin, social status, religion or beliefs, political opinions, sexual orientation, gender identity, gender expression, sexual characteristics, union membership or non-membership, language within the Spanish State, disability, or sex, including unfavorable treatment of women or men for exercising their rights to work-life balance or shared responsibility for family and work life."

In short, new concepts are added, such as unfavorable treatment for exercising reconciliation rights, to which the legislator expressly links objective nullity if it is a cause for dismissal, but also disability.

Equally important is that the legislator has removed from Article 4.2.c) ET what was previously its second paragraph, which has been expunged from the legal system, which stated: "Nor may they be discriminated against on the grounds of disability, provided that they are fit to perform the work or job in question." And this is no "oversight" on the part of the emergency legislator, as Article 127 of Royal Decree Law 5/2023 expressly states that "Letter c) of Article 4.2 is amended to read as follows...", with the aforementioned paragraph disappearing.

Therefore, it should be noted that:

1. Remains cause for the nullity of a dismissal, those based on any cause of discrimination also prohibited by law, and consequently those described in Article 4.2.c) ET.
2. The legislator reinforces as a labor right the right not to be discriminated against, among other reasons, on the basis of disability in the new wording of Article 4.2 c) ET, on the same level as other causes for the nullity of a dismissal. And

without the need to resort to Law 15/2022—or, if preferred, reinforcing the grounds for prohibiting discrimination if we do resort to it.

3. And, more importantly, if the exception relating to "they may not be discriminated against on the grounds of disability, provided that they are fit to perform the work or job in question" no longer applies, the conclusion, for me, is clear: the termination of the employment relationship on the objective grounds of Article 52 a) ET, i.e., due to supervening incapacity, cannot justify the dismissal of the worker declared "unfit," since the company's action in this regard constitutes discrimination against the worker on the grounds of disability. Thus, I insist, although the cause of nullity of discrimination on the grounds of disability already existed, when we were in the area of health surveillance and declaration of "incapacity," the former Article 4.2.c) ET allowed termination, even in the presence of disability, if the worker did not retain their working capacity, or, put another way, understood that there was discrimination in the termination if the worker with a disability "provided that they were fit to perform the work or job in question."

This interpretation does not render Article 52(a) of the Workers' Statute meaningless or inapplicable, which is now limited to, for example, situations involving the loss of legal authorization to practice a particular profession.

As mentioned above, a worker who, due to their health conditions and/or disability, and especially in the case of MCS and EHS with the significant impact this has on their ability to work, has the right to be recognized as a "particularly sensitive worker" due to their health conditions, etc., and for the employer to take the necessary preventive and protective measures, which includes not employing them in jobs that may pose a risk to their health.

Or, in the words of the CJEU, that reasonable accommodations be made (which is reflected in Articles 4 and 6 of Law 15/2022, with unjustified refusal being grounds for direct discrimination).
And I understand, from now on, that dismissal for supervening incapacity is not a solution, as it is linked to the nullity of the termination decision. Or at least, that is what I believe. Nevertheless, it becomes a real protective shield for workers with disabilities in general, and with MCS and/or EHS in particular. And it was about time.

Conclusions:

We have emphasized that it would be advisable to review the legislation and scales of disability and dependency in order to better protect people with MCS and EHS, allowing them access to social security benefits, especially in cases of temporary and permanent incapacity for work, without so many administrative obstacles, which are forcing people with these illnesses to resort to excessive legal action in order to obtain the protection they are entitled to. As a preliminary step, and although their right to healthcare is recognized, it would be useful to clearly identify the Specialized Units that provide care for them, which may be accompanied by other conditions such as Fibromyalgia or Chronic Fatigue Syndrome, but which, currently recognized by the scientific community as a distinct and individualized entity, must be diagnosed and treated by specific and recognized specialists in the field. We believe that extending the effects of the ELA Law would be very positive.

There is no doubt that the disability scale of RD 888/2022 must recognize, and, in this regard, we request the express inclusion of MCS and EHS, which would undoubtedly allow access to Social Security benefits, both in the contributory sphere—we refer to early retirement due to disability—and in the welfare sphere—in clear reference to the non-contributory incapacity pension. In particular, with reference to RD 1851/2009, both diseases should be included in the list that allows retirement with 45% disability.

As a matter related to the recognition of disability, assessment teams must be trained to take into account the specific characteristics of MCS and EHS in order to correctly assess the Mobility Activity Limitation Scale, which would allow for the performance of activities independently, given the real impossibility of using public transport.

As an indirect reflection of the reform of unemployment allowances, the elimination of the Active Integration Income, which specifically protected the situation of people with at least 33% disability, and its transition to the minimum living income, now creates a gap in protection for people with MCS and/or EHS.

The current regulations in the Workers' Statute and Law 15/2022 of July 12 comprehensive for equal treatment and non-discrimination with respect to persons with disabilities in the workplace, offer significant protection against dismissal on health grounds for people with MCS and/or EHS.

However, although we believe it is advisable to incorporate both diseases more intensively into our Social Security and Labor regulations, the incorporation of the gender perspective, and also disability, in the legal approach to MCS and EHS, especially with the recent Law 15/2022, must be key elements in the deserved protection that must be provided to this group, which is mainly composed of women.

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In this regard: Occupational disease and gender issues Does Royal Decree 1299/2006 comply with the principle of equal treatment between men and women? In line with the Supreme Court's doctrine on occupational diseases caused by women Miguel Arenas Gómez Labor and Social Security Journal. CEF, ISSN-e 2792-8322, ISSN 2792- 8314, No. 449-450, 2020, pp. 115-124

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In this regard, the Judge of the High Court of Justice of the Canary Islands states in her dissenting opinion in the High Court of Justice ruling of December 19, 2024 (rec. 1198/2023), "This regulatory gap, which unfortunately is consistent with the historical legislative and scientific neglect of women's health, makes it difficult, first, for administrative bodies and, second, for the courts, to assess it for the purposes of determining a percentage of disability that would allow access to a range of economic, social, and employment benefits, and constitutes indirect institutional discrimination on the basis of sex, as it is mostly women who suffer from the three diseases, in some cases overwhelmingly so."

274
The situation has been further aggravated by the fact that the Active Integration Income, which provided more favorable protection for people with a disability equal to or greater than 33%,
has been repealed by Royal Decree-Law 2/2024 of May 21, which adopts urgent measures to simplify and improve the level of unemployment protection.

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The treatment of both sensitivities in labor legislation and in risk prevention and health legislation

Context of occupational risk prevention

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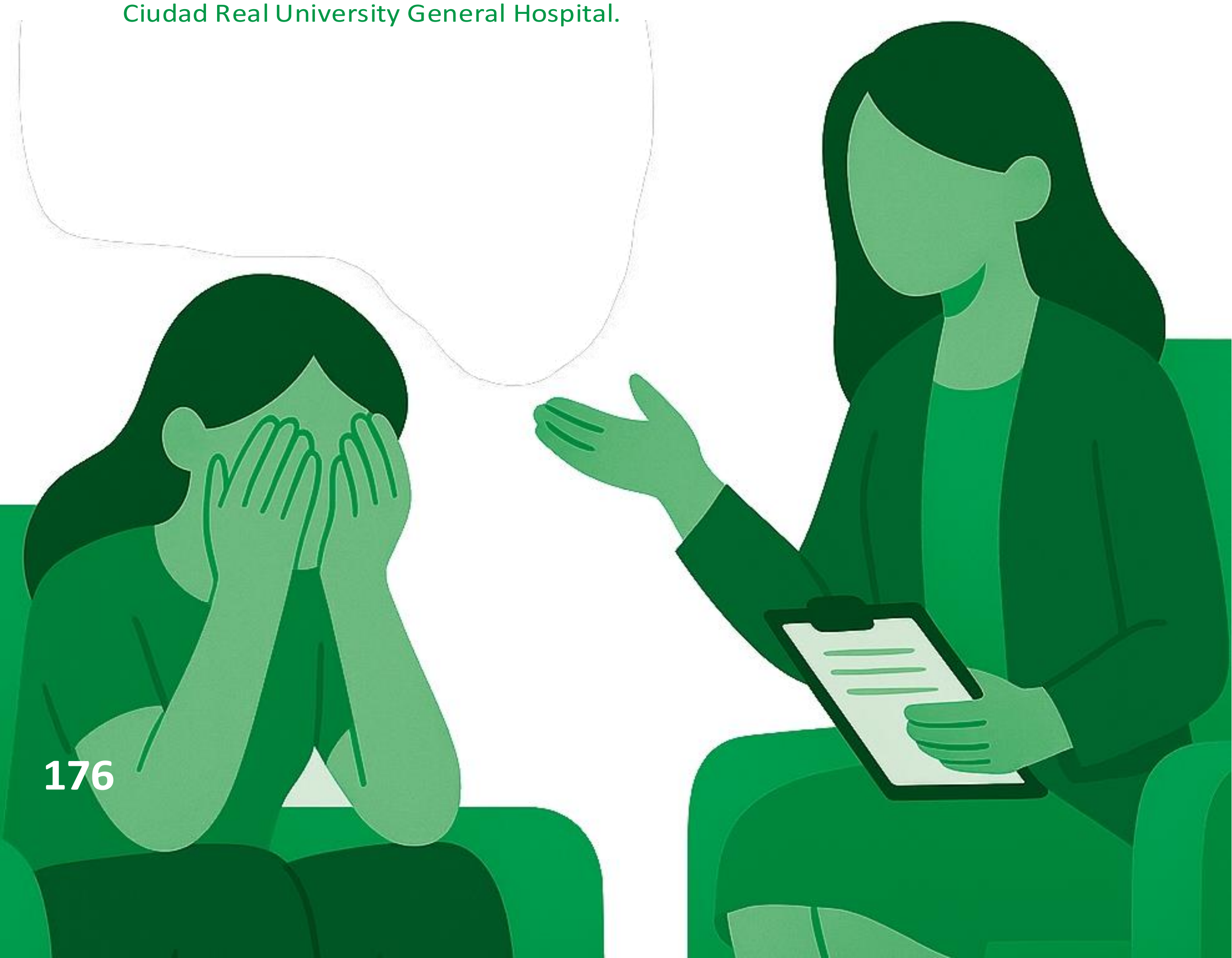

2.2

Context of occupational risk prevention:

Multiple Chemical Sensitivity

Multiple Chemical Sensitivity (MCS) is the most commonly used term to describe a complex syndrome that presents as a set of symptoms linked to a wide variety of agents and components found in the environment, with these reactions occurring at levels commonly tolerated by most people. **(Practical Encyclopedia of Occupational Medicine, 2018).**

In the field of occupational medicine, workers affected by MCS should be considered particularly sensitive and, in compliance with Article 25 of the Occupational Risk Prevention Act (LPRL), the application of preventive measures in the workplace should be reinforced, avoiding exposure to triggering agents as far as possible.

This will improve symptoms, reduce the number of attacks, and prevent the onset of new intolerances. These types of measures are difficult to implement in most cases given the widespread use of chemicals in any environment, and multiplying in the workplace, which can lead to avoidance behaviors in the affected person (taken from the Practical Encyclopedia of Occupational Medicine, 2018, where references appear in the sections on occupational allergology, endocrinology, and occupational pulmonology).

The LPRL determines the basic body of guarantees and responsibilities necessary to establish an adequate level of protection for workers' health against the risks arising from working conditions. The regulatory implementing rules establish the minimum measures that must be adopted for the protection of workers, including those aimed at ensuring safety against risks related to chemical agents in the workplace. (BOE No. 104).

Council Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work lays down minimum specific requirements, and Directive 2000/39/EC provides an initial list of occupational exposure limit values.

In our environment, Royal Decree 374/2001 of April 6 aims to establish provisions for the protection of workers against risks arising or likely to arise from the presence of chemical agents in the workplace or from any activity involving chemical agents. This legal text defines:

> **Chemical agent:** an element or compound, alone or in a mixture, as it occurs naturally or is produced, used, or released, including release as waste, in a work activity, whether or not it is intentionally manufactured or marketed.
>
> **Exposure to a chemical agent:** presence of a chemical agent in the workplace, involving contact between the agent and the worker, normally through inhalation or skin contact.
>
> **Hazard:** the intrinsic capacity of a chemical agent to cause harm.
>
> **Risk:** the possibility of a worker suffering a specific harm as a result of exposure to chemical agents.

Due to these risks, the employer must determine:

1. Whether there are hazardous chemical agents in the workplace and, if so, proceed to assess the risks to the health and safety of workers caused by these agents.
2. Risk assessment, including all activities that may lead to exposure.
3. Specific prevention and protection measures.

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Once the risks have been assessed and evaluated, these chemical products will be eliminated or reduced to a minimum through various measures, including:

- Design and organization of work systems.
- Selection and installation of work equipment.
- Establishment of appropriate procedures for the use and maintenance of equipment used to work with chemical agents.
- Adoption of appropriate hygiene measures.
- Reduction of the quantities of hazardous chemical agents.
- Minimization of exposed workers.
- Minimizing the duration and intensity of exposure.

In the field of occupational risks, addressing this condition requires an integrated approach that combines preventive and individual management measures. The following is recommended:

Identification of risks in the workplace:

- Risk assessment: conducting a detailed analysis of the workplace to identify potentially harmful chemicals, such as cleaning products, paints, solvents, fragrances, pesticides, or industrial emissions.
- Exposure analysis: determine the levels of exposure to the chemical agents present and establish whether they exceed the acceptable thresholds for people with MCS.

Preventive and control measures:

Substitution of chemicals:

- Replace volatile chemicals with less toxic alternatives or natural products.

- Promote the use of materials certified as "low emission" or free of harsh chemicals.

Ventilation control and air purification:

- Implement efficient ventilation systems that renew the air and minimize the accumulation of pollutants.
- Use air purifiers with HEPA and activated carbon filters.

Ergonomic design of the workspace:

- Create specific chemical-free areas, especially for workers with MCS.
- Establish a "no fragrance" policy that prohibits the use of perfumes, air fresheners, or aromatic products in the workplace.

Action protocols:

- Training and awareness: educate employees about MCS and the risks associated with chemicals to foster a culture of mutual care.
- Emergency procedures: Develop a plan for accidental exposure, including evacuation to a safe area and medical assistance.
- Reasonable accommodations: Adapt working conditions for employees diagnosed with MCS, such as allowing teleworking or modifying tasks to avoid contaminated areas.

Compliance and standardization policies:

- Ensure that work practices comply with national regulations on occupational health and chemical management (such as OSHA, the European REACH Directive, or equivalents in each country).

- Establish regular audits to ensure that the controls implemented are effective and sustainable.

Active worker participation:

- Involve workers in identifying risks and solutions.
- Create communication channels to record incidents or complaints related to environmental exposure.

Health surveillance: this is an aspect that we will look at in more detail later, but as an introduction we would point out the following:

- Regular medical check-ups: monitor the health of workers exposed to chemical environments and detect possible cases of MCS in the early stages.
- Individualized treatment: the Occupational Health Service designs specific strategies for each affected worker, including psychological support and medical guidance.

Primary prevention:

Learning about MCS can have the collateral effect of improving environmental conditions in the general population. By reducing exposure to environmental pollutants, it will be possible to reduce the incidence of MCS and, therefore, the burden of disease that can be attributed to environmental exposures.

To this end, the employer shall ensure that the risk posed by the chemical product is eliminated or reduced to a minimum by applying, among other measures, ventilation measures as collective protection. Likewise, the occupational risk assessment shall take into account that persons affected by MCS may develop symptoms when exposed to levels at which the chemical is well below the ranges established as Occupational Exposure Limits for Chemical Agents. In addition, exposures that are not considered occupational risks can trigger symptoms, such as perfumes, fragrances, cleaning products, printed paper, construction work, new furniture in the workplace, among others.

Secondary prevention:

The most effective treatment for MCS is to avoid exposure to situations previously known to trigger clinical symptoms, bearing in mind that symptoms may appear after a single high dose or repeated exposure to one or more products. This contact can occur in a wide variety of settings, not only at work, but also at home, in food, etc.
To avoid re-exposure to these triggers, it is recommended to:

- Modify daily habits, improving ventilation and air circulation in your home.
- Avoid humid environments (ensure there is no mold due to the dangers of mycotoxins).
- No exposure to irritating environments (gases, fumes, etc.).
- Follow an organic diet.

Therefore, measures to avoid exposure in daily life and adapting the home and work environment are considered to be more effective than any symptomatic treatment.

General measures:

To promote health among workers with MCS, a series of recommendations in three areas should be taken into account:

Health promotion:

- Promote social campaigns (advertising, media, conferences, seminars, etc.) to raise awareness and improve knowledge of MCS.

Training of healthcare professionals:

- Improve knowledge of MCS among professionals who may be involved in dealing with it, promoting training in Environmental Medicine to ensure a valid response to the needs of people who suffer from it.
- Train healthcare personnel in early detection and improving care.

Health information systems:

- Ensure that the diagnosis of MCS is included in medical records.
- Develop protocols for this type of patient.

Health monitoring:

The medical staff of the company's Occupational Risk Prevention Service must assess the worker's clinical condition and, taking into account the confidentiality of their health data, study the risks to which they are exposed in coordination with their team (health and technical staff) in order to determine their fitness for work and recommend the preventive measures that should be taken in that particular case.
On occasions, this Health Surveillance may reveal that, following anamnesis and examination, the worker is suspected of having symptoms of MCS, in which case they will be referred to the appropriate

unit for confirmation of the diagnosis through its study. In other cases, it will be the worker himself/herself who informs us that he/she has been diagnosed with this condition.
In order to carry out specific health surveillance, it is necessary to start with knowledge of the workplace, which must be recorded in detail in the clinical-occupational history. This means that it must be noted what the person does, where and how they do it, what substances they use, when they do it, for how long, and what protective measures they use.
The occupational risk prevention service must have a risk assessment, having identified the substances to which the person may be exposed, which must be recorded in the clinical-occupational history.

This health monitoring shall be carried out through the scheduled practice of initial, periodic, post-long-term absence due to health reasons, and post-occupational health examinations. In order to carry out these examinations, Article 37.3.c of Royal Decree 39/1997 of January 17, which approves the Regulation on Prevention Services, must be taken into account. This article states that the clinical-occupational history of each worker must include the following:

Specific medical history:

- Work history: information will be collected on chemical agents to which the patient may have been exposed in the past and currently, activities or tasks, preventive measures adopted, and their use. To this end, it is recommended to use records that collect information on:
    - Company (business name and activity).
    - Profession.
    - Occupation and/or job position.
    - Working hours.
    - Chemical agents.
    - Activities carried out with chemical agents or with risk of exposure to them.
    - Prevention and protection systems used.

- Clinical history: covering the following aspects:
  - Family history.
  - Personal history:
    - Pathological history related to exposure.
    - Other pathological antecedents of occupational cause.
    - Pathological history of common causes.
    - Toxic habits.
    - Lifestyle and leisure habits.
    - Reproductive history (including fertility problems, miscarriages, and malformations).
  - Current history: symptoms and signs related to exposure. Identify manifestations of possible chemical exposure. If so, use standardized questionnaires (QEESI and SANOXA).

Specific physical examination: this should be comprehensive and, depending on the possible effects of the chemicals, special emphasis should be placed on the organs and systems that may be affected.

Specific complementary tests and biological monitoring: those that indicate possible effects of the chemicals will be chosen.

Adequate health monitoring of workers with MCS depends on a combination of ongoing medical evaluations, accommodations to the work environment, and awareness among all staff. It is essential to ensure a preventive and reactive approach to protect workers' health and maintain their ability to work in the best possible conditions.

Health monitoring for people with MCS requires a comprehensive, multidisciplinary, and highly personalized approach. These workers experience adverse reactions to very low levels of common chemicals, so their care must focus on minimizing exposure and managing symptoms appropriately.

Here are the key strategies for their monitoring and management:

1. **Identification and Initial Assessment:**
    - Clinical diagnosis: Confirm the diagnosis through a detailed medical history and rule out other medical conditions.
    - Medical history: Collect comprehensive information on symptoms, chemical triggers, exposure patterns, and their temporal evolution.
    - Identification of triggers: Determine the specific substances that cause reactions in the worker in order to establish avoidance strategies.
    - Complementary tests: Although there are no specific biomarkers for MCS, tests can be performed to rule out allergies or poisoning, and diagnostic tests should be performed to evaluate the function of organs that may be affected by exposure.
2. **Safe environment:**
    - Exposure control: Implement measures to minimize or eliminate the presence of chemical agents in the work environment.
    - Personal Protective Equipment (PPE): Provide appropriate PPE and ensure its correct use to reduce exposure to possible triggers (although this PPE may be made of materials that are toxic to people with MCS).
    - Modification of the environment: Create spaces free of contaminants (perfumes, cleaning products, volatile materials).
    - Adapting the home and workplace: Ensure adequate ventilation, avoid fresh paint, pesticides, and other potentially harmful chemicals.
    - Educating family members and colleagues: Raise awareness of the importance of avoiding chemical products near the affected person.

3. **Periodic assessment:**
    - Clinical follow-up: Regular visits to assess the evolution of symptoms and adjust treatments.
    - Functional assessment: Estimate how symptoms affect quality of life and daily activities.
    - Symptom tracking: Keeping a diary to identify patterns and new triggers.
4. **Medical management:**
    - Symptomatic treatment: Very cautious use of medications to treat symptoms (e.g., antihistamines, anxiolytics), as drugs are often poorly tolerated, even at the usual dose.
    - Complementary therapies: Some people find relief in approaches such as physical therapy, acupuncture, or mindfulness.
    - Avoid drug overload: Since these individuals may also be sensitive to medications, it is crucial to use low doses and monitor the effects.
5. **Prevention and education:**
    - Patient information: Explain preventive measures to avoid exposure to chemical triggers.
    - Training of professionals: Ensure that doctors, nurses, and other healthcare professionals are familiar with MCS and its management.
    - Hospital protocols: Establish protocols for patients with MCS, such as perfume-free waiting areas.
6. **Psychosocial support should be recommended:**
    - Psychological assistance: Many people with MCS develop anxiety or depression due to the impact on their quality of life. It is important for psychologists to be familiar with these conditions in order to adequately support workers.

- Support groups: Participate in communities or groups of patients with MCS to share experiences and strategies.

This health monitoring will only be possible with the worker's consent. The only exceptions to this voluntary nature, subject to a report from the workers' representatives, are cases in which medical examinations are essential to assess the effects of working conditions on workers' health or to verify whether the worker's state of health may constitute a danger to themselves, to other workers or to other persons related to the company, or when so established in a legal provision relating to the protection of specific risks and particularly dangerous activities (Article 22.1 of the LPRL).

Particularly sensitive worker:

People affected by MCS assessed by the Occupational Health Service or those identified as such during health surveillance will be labeled as particularly sensitive workers (PSWs). This concept can be defined on the basis of Article 25.1 of the LPRL, which states that it is "those who, due to their personal characteristics or known biological condition, including those with a recognized physical, mental, or sensory disability, are particularly sensitive to the risks arising from work...". Furthermore, Article 37.3 c) of the Prevention Services Regulation establishes that "health surveillance shall be subject to specific protocols or other existing means with regard to the risk factors to which the worker is exposed...".

By legal mandate, employers must guarantee the protection of workers, taking into account the aspects mentioned in the risk assessments and, based on these, adopting the necessary preventive and protective measures.

As a general rule, workers shall not be employed in situations where (Article 25.1 of the LPRL):

- They, other workers, or other persons related to the company may be placed in danger due to their personal characteristics, biological condition, or duly recognized physical, mental, or sensory disability.
- They are clearly in a temporary state or situation that does not meet the physical and mental requirements of their job.

Three mechanisms will be used to detect situations of special sensitivity:

- By communication from the interested party to the internal or external bodies responsible for prevention.
- By the Occupational Health Service during medical examinations.
- By prevention technicians based on the risk assessments carried out.

Criteria for assessing fitness for work:

In addition to informing the person concerned of the results of their health surveillance, the occupational physician will also inform the employer and the persons or bodies responsible for prevention by means of a fitness report. In the case of people with MCS, they may be deemed FIT with adaptation or restriction measures due to being particularly sensitive. These measures may be:

- Adaptive: these involve adapting all or part of the work environment to the worker so that they can fully perform the tasks associated with their job.

- Restrictive: these involve the total or partial non-performance of very specific tasks related to their job.

However, it may also be the case that performing the tasks could lead to serious health problems or that the person's symptoms make it impossible for them to carry out the tasks of their job, in which case they would be UNFIT. In this scenario, two situations could arise:

- Change of job.
- If there is no compatible position available in the company, the person may be guided, with justification, towards the start of the Permanent Incapacity procedure.

Electrohypersensitivity

Electromagnetic fields in the workplace are understood to be low-frequency electric and magnetic fields, as well as electromagnetic waves with frequencies between 30 kHz and 300 GHz; it should be noted that these fields are also present in public and domestic environments.
Electrohypersensitivity (EHS) is a debilitating and little-known neurological disorder. It affects people who are sensitive to electromagnetic fields (Wi-Fi networks, mobile phones, and other sources of non-ionizing radiation) and is characterized by a decrease in tolerance thresholds. It is a condition that affects patients' quality of life and sometimes even prevents them from working.
Dr. Fernando Solá[277] indicates that it is a disorder caused essentially by a brain dysfunction, developing symptoms such as skin irritation, redness, dry mucous membranes, nasal irritation, dyspnea, nausea, headache, irritability, impaired concentration, fatigue, etc.. However, none of these symptoms are specific to this condition. Diagnosis is always clinical and will be made when there are no other pathologies that justify it.

It has not yet been defined as a disease by the WHO, although after the scientific consensus meeting sponsored by the WHO in 2004 in Prague, this condition of morbidity was called "idiopathic environmental intolerance" (IEI) attributed to electromagnetic fields.

In 2011, **Resolution 1815 of the Parliamentary Assembly of the Council of Europe** (PACE)[278] recognized that the biological effects of exposure to electromagnetic fields (EMFs) on living beings, as reported in the extensive scientific literature, can potentially manifest themselves below the legal thresholds based on the criteria of the International Commission on Non-Ionizing Radiation Protection (ICNIRP), which only considers short-term thermal effects. The Council of Europe calls on its member states to reduce exposure to EMFs at levels as low as reasonably achievable (ALARA principle), especially to radio frequencies (RF) and in children and young people, protecting electrosensitive individuals with special measures such as "white zones" without wireless exposure.

Various scientific societies and appeals, government agencies, and reports from European institutions, such as the review on RF by the European Parliamentary Research Service (EPR-S)[279] of 2021, describe biological effects reflected in the extensive scientific literature (ranging from reproductive and developmental effects, increased cancer risk, cellular effects, crossing the blood-brain barrier, neurological effects, immune effects, electrosensitivity, etc.) and call for **the application of the PRECAUTIONARY PRINCIPLE in line with the ALARA PRINCIPLE,** especially for the population they classify as most vulnerable (children and young people, pregnant women, immunocompromised individuals, people with chronic diseases, electrosensitive individuals, etc.).

The WHO's International Agency for Research on Cancer (IARC) classified EMFs as 'possible human carcinogens' (group 2B): in 2001 for extremely low frequency (ELF) EMFs[280] and in 2011 for radiofrequency (RF) EMFs[281]. The 2021 EPRS systematic review on RF considers RF to be a 'probable human carcinogen' (group 2A), concluding that there is sufficient evidence of RF carcinogenesis in animals, in line with the 'high certainty' causal finding in the 2025 systematic review of laboratory animals [282], partially funded by the WHO, with the same types of tumors observed in humans.

Law 31/1995 of November 8 on Occupational Risk Prevention establishes the specific guarantees and responsibilities for establishing an adequate level of protection for workers' health against risks arising from working conditions. According to Article 6 of this Law, the regulatory standards must specify the technical aspects of preventive measures, establishing the minimum measures that must be adopted for the adequate protection of workers. Among these measures are those aimed at ensure protection against the risks arising from exposure to EMF. Royal Decree 299/2016 of July 22 regulates the provisions aimed at preventing or reducing the risks related to exposure to EMF and includes the obligation for companies to develop and implement an action plan that must include technical and/or organizational measures aimed at:

- Preventing exposure from exceeding certain limit values.
- Determine exposure limit values and action levels.
- It establishes the obligation for employers to carry out an assessment and, where necessary, measurements or calculations of the levels of electromagnetic fields to which workers are exposed.
- It includes a list of aspects to which employers must pay special attention when assessing risks.
- It specifies that workers must not be exposed in any case to values exceeding the exposure limit values.
- It sets out two basic rights in the field of prevention, namely the need to train and inform workers, and how workers can exercise their right to be consulted and to participate in matters relating to prevention.
- It also establishes provisions relating to health surveillance in relation to the risks of exposure to electromagnetic fields.

These provisions contained in the Royal Decree shall apply to activities in which workers are or may be exposed to risks arising from EMFs as a result of their work, referring primarily to the health risk due to the known direct biophysical effects and indirect effects caused by these fields. However, it does not address the possible long-term effects or the risks arising from contact with voltage conductors.

It addresses actions aimed at preventing or reducing exposure, stating that risks arising from exposure to EMFs should be eliminated at source or reduced to the lowest possible level, and sets out an action plan that pays particular attention to:

- The adoption of working methods that involve less exposure.
- Choosing equipment that generates less intense electromagnetic fields, taking into account the work for which it is intended.
- Applying technical measures to reduce emissions and exposure, including, where necessary, the use of blocking systems, shielding, or similar health protection mechanisms.
- Appropriate delimitation and access measures, such as signs, labels, floor markings, or barriers to limit or control access.
- In the event of exposure to EMF, measures and procedures to control contact currents and spark discharges, using technical methods and worker training.
- Appropriate maintenance programs for work equipment, workplaces, and workstations.
- Design and layout of workplaces and workstations.
- Limitation of the duration and intensity of exposure.
- Availability of appropriate personal protective equipment.

It also states that, based on the risk assessment carried out, the employer shall draw up and implement an action plan that includes technical and/or organizational measures aimed at preventing risks to particularly sensitive workers and any other risks due to the indirect effects of electromagnetic fields.

EMFs can have two types of effects on the human body: direct biophysical effects and indirect effects:

Direct biophysical effects:

- Thermal effects: heating of tissues due to the absorption of energy from EMFs.
- Non-thermal effects: stimulation of muscles, nerves, or sensory organs.
- Currents in the extremities.

Indirect effects: caused by the presence of an object in the EMF that may pose a risk to health or safety, such as:

- Interference with electronic medical equipment and devices.
- Risk of projection of ferromagnetic objects in static magnetic fields.
- Activation of electro-explosive devices (detonators).
- Fires and explosions resulting from the ignition of flammable materials.

Risk assessment:

When assessing risks due to exposure to electromagnetic fields, the following aspects must be taken into account:

- Exposure limit values (ELVs) related to health effects and ELVs related to sensory effects.
- The frequency, level, duration, and type of exposure, including the distribution of the electromagnetic field throughout the workplace and on the worker's body.
- Direct biophysical effects.

- Any effect on the health and safety of particularly sensitive workers, especially pregnant workers or workers who wear implanted medical devices, such as pacemakers, or who wear other types of devices such as insulin pumps.
- Any indirect effects.
- The existence of replacement equipment designed to reduce levels of exposure to EMF.
- Information obtained from health surveillance.
- Information provided by the equipment manufacturer.
- Multiple sources of exposure.

Information and training for workers:

The employer must ensure that workers who may be exposed to EMF risks in the workplace receive the necessary information and training on the occupational risk assessment prepared by the Prevention Service, covering the following aspects:

- Measures adopted.
- Meaning of the ELVs, possible associated risks, and preventive measures adopted.
- Possible indirect effects of exposure.
- How to detect possible adverse health effects resulting from exposure.
- Possibility of transient symptoms and disorders related to effects on the nervous system.
- The right to health surveillance.
- Safe working practices to minimize exposure risks.
- Particularly sensitive workers.

Unfortunately, the reference limit values in Royal Decree 299/2016 cannot be considered valid or protective, as they refer to a healthy adult, far from the standard of a person affected by EHS, as noted in the legal doctrine study[283] on MCS and EHS of 2024 by J. F. Lousada and R. P. Ron.

Protectionist consensus in the international scientific community, such as that of 2020[284], recommend exposure levels that address biological effects, such as those set out in the **"Guidelines and strategies of the European Academy of Environmental Medicine (EUROPAEM) of 2016 for the prevention, diagnosis, and treatment of health problems and diseases related to EMFs"[285].** In this regard, these limit values are recommended for sensitive and more vulnerable individuals.

Therefore, employers must ensure that working conditions respect the needs of particularly sensitive individuals, including those who are hypersensitive to electromagnetic fields, and do not pose a risk to their health.

Primary prevention:

Awareness of EHS may have the collateral effect of improving environmental conditions for the general population. Reducing exposure to environmental pollutants may reduce the incidence of EHS and, therefore, the burden of disease that can be attributed to environmental exposures.
The following strategies can be considered to address the primary prevention of electrohypersensitivity:

- **Health promotion and education:** Information campaigns can be carried out on the risks of exposure to electromagnetic fields in workers in general and especially in particularly sensitive individuals. This information should be based on proven scientific evidence from independent scientists.
- Provide workers with **documentation** containing information on best practices regarding the use of wireless technologies and other possible exposures to electromagnetic fields at work.
- **Regulations and guidelines:** Current exposure levels follow the criteria of the ICNIRP, a non-governmental organization that is widely questioned (conflicts of interest, denial of biological effects), in the European institutional sphere (e.g., European Environment Agency[286] , EPRS[287] , European Parliament 2009[288] , PACE[289] , TEN Section TEN of the European Economic and Social Committee[290] , parliamentary reports[291], etc.), and in numerous scientific positions and appeals[292] and those of experts (see analysis by CIPRACEM in 2021[293] and by the International Commission on the Biological Effects of Electromagnetic Fields -ICBE-EMF in 2022[294]). While the 2020 International Consensus Statement[295] represents more than 3,500 medical professionals, the 2015 International EMF Scientist Appeal[296] represents scientists who have published more than 2,000 articles on EMF, biology, and health, and they request that the

PRECAUTIONARY PRINCIPLE be applied, in line with the ALARA PRINCIPLE.

- **Assessment and control in work environments:** Implement procedures to assess EMF exposure in the workplace and apply preventive measures when necessary. To this end, the employer shall ensure the elimination or minimization of the risk posed by the source of electromagnetic fields as collective protection measures (e.g., giving priority to landline telephones and wired Internet connections and, in the case of Wi-Fi routers[297], move it away from places where people spend time and turn it off when not in use), among other measures. Likewise, the assessment of occupational risks shall take into account that people affected by EHS may develop symptoms when exposed to radiation levels well below the established limits.

Secondary prevention:

Secondary prevention of EHS focuses on early detection and proper management of symptoms to prevent their progression and improve the quality of life of those affected.
The main strategies are detailed below:

- **Reducing exposure to EMFs:** Minimizing or eliminating exposure to sources of EMFs is the main action to prevent the onset of symptoms, as well as to alleviate them. In general, it is considered that measures to avoid exposure in daily life and adapting the home and work environment are more effective than any symptomatic treatment. This includes practices such as replacing wireless devices with wired ones, replacing Wi-Fi connections with wired ones, avoiding the use of mobile phones, and grounding connections. In addition, creating EMF-free zones at home, especially in rest areas such as the bedroom, is very important.

Sometimes it will be necessary to carry out shielding in homes or workplaces when the sources of emission are external and cannot be avoided.

- **Comprehensive medical evaluation:** It is essential that people with symptoms attributed to EHS undergo a complete medical evaluation to rule out other medical conditions that may be causing the symptoms. The WHO recommends a thorough evaluation to identify possible underlying causes and provide appropriate treatment. We must not forget that the effects of radiation are cumulative over time, so a complete medical history is very important.
- **Medical care and psychological support:** symptomatic treatment, complementary therapies (some people find relief in approaches such as physical therapy, acupuncture, or mindfulness). It is advisable to avoid exposure to toxic chemicals, strengthen the immune system, eat more organic products, reduce stress, spend time in nature, etc.
- **Education and support:** Providing accurate information based on independent scientific evidence about EHS and EMFs can help reduce associated anxiety and stress, as it would provide tools to avoid exposure and carry out appropriate treatments. However, we must not forget that each person has a specific degree of sensitivity that allows for greater or lesser tolerance to different frequencies and intensities, so it is important to always treat each case with an individual approach.
- **Support from groups and communities** can provide a space for sharing experiences and coping strategies.

General measures:

To promote health among workers with EHS, a series of recommendations in three areas should be taken into account:

Health promotion:

- Promote social campaigns (advertising, media, conferences, seminars, etc.) to raise awareness and improve understanding of EHS.

Training of healthcare professionals:

- Improve knowledge of EHS among professionals who may be involved in dealing with it, promoting training in Environmental Medicine to ensure a valid response to the needs of people who suffer from it.
- Train healthcare personnel in early detection and improving care.

Health information systems:

- Ensure that the diagnosis of EHS is included in the medical record.
- Develop protocols for this type of patient.

Health surveillance:

Employers must ensure health surveillance of workers based on the risks arising from exposure to EMFs at work, in order to prevent and diagnose as early as possible any adverse effects on workers' health resulting from such exposure.
According to the LPRL, this must be specific, proportional to the risk, voluntary, confidential, and documented. If the risk assessment identifies a potential risk from exposure to EMF in one or more workplaces, specific health surveillance will be provided to workers assigned to those positions. However, there is currently no specific protocol for assessment of the health of workers exposed to EMFs,

only in RD 299/2016, of July 22, on the protection and safety of workers against risks related to exposure to EMFs (which, as we have indicated above, establishes exposure limit values that cannot be applied to people with electrohypersensitivity). It states that:

- The employer shall ensure adequate monitoring of the health of workers in accordance with the risks inherent in work involving exposure to EMFs, as provided for in Article 22 of Law 31/1995, of November 8, in order to prevent and diagnose as early as possible any adverse effects on the health of workers resulting from exposure to EMFs.
- Health surveillance shall be carried out through the preventive organization adopted by the company and in accordance with Article 37.3 of Royal Decree 39/1997, of January 17.
- Health surveillance shall include the preparation and updating of the clinical and occupational history of the workers subject to it.
- Access to, confidentiality, and content of these records shall comply with the provisions laid down in Article 22, sections 2, 3, and 4, of Law 31/1995, of November 8, in Article 37.3.c) of Royal Decree 39/1997, of January 17, and in the Organic Law 15/1999, of December 13, on the Protection of Personal Data. Workers shall have access, upon request, to the history that personally affects them.
- If a worker reports an undesirable or unexpected effect on their health, or in any case where exposure above the exposure limit values is detected (we know that the limit values to be taken into account for electrosensitive persons are those set by the EUROPAEM EMF Guideline 2016), the employer shall ensure that the affected worker can benefit from appropriate health examinations. These examinations must be available during the hours chosen by the worker.

Monitoring the health of workers with EHS is essential to ensure their well-being and adapt the work environment to their specific needs. The main strategies to consider are detailed below:

Individualized medical evaluation: It is essential to conduct thorough medical examinations to identify and document symptoms associated with EHS, ruling out other possible conditions. This evaluation should be carried out by health professionals with experience in occupational medicine and disorders related to EMF exposure.

Workplace adaptation: Implement technical and organizational measures to reduce or eliminate EMF exposure in the workplace. This may include relocating EMF-emitting equipment, using devices with lower emissions, and reorganizing spaces to maintain a safe distance between emission sources and the affected worker.

Training and awareness: Educate both affected personnel and the rest of the workforce about EHS and the possible effects of EMFs. Training should address safe practices and the proper use of equipment to minimize exposure.

Regulatory compliance: As the only regulation we have in Spain on EMF exposure is Royal Decree 299/2016, which sets exposure limits that are not valid for people with EHS, compliance with the guidelines set out in the EUROPAEM EMF Guideline 2016 must be ensured.

Regular health monitoring: Establish regular medical check-ups to monitor the evolution of symptoms and the effectiveness of the measures implemented. This monitoring allows prevention and adaptation strategies to be adjusted according to the changing needs of the worker.

Psychological support: Offer psychological support resources to help workers manage the stress and anxiety that may arise due to the impact of the illness on their daily quality of life, taking into account the significant limitations, social rejection, etc.

This health monitoring will be carried out through scheduled initial, periodic, post-long-term sick leave, and post-employment health examinations. In order to carry out these examinations, Article 37.3.c of Royal Decree 39/1997 of January 17, which approves the Regulation on Prevention Services, must be taken into account. This article states that the clinical and occupational history of each worker must include:

Specific medical history:

- Occupational history: this will include information on possible past and present exposure to EMFs, activities or tasks, prevention measures adopted, and their use. To this end, it is proposed that records be used to collect information on:
    - Company (business name and activity).
    - Profession.
    - Occupation and/or job position.
    - Working hours.
    - EMFs exposure assessment.
    - Activities performed with exposure to EMFs.
- Clinical history: covering the following aspects:
    - Family history.
    - Personal history.
    - Pathological history related to exposure.
    - Other pathological antecedents of occupational cause.
    - Pathological history of common cause.
    - Toxic habits.
    - Lifestyle and leisure habits.
    - Reproductive history (including fertility problems, miscarriages, and malformations).
- Current history: symptoms and signs related to EMF exposure. Identify the manifestations of this possible exposure.

Specific physical examination: this should be comprehensive and, depending on the possible effects of EMFs, special emphasis should be placed on the organs and systems that may be affected and the symptoms described by the worker.

Specific complementary tests and biological monitoring: those that indicate possible effects of EMF will be chosen, such as markers of oxidative stress, inflammation, and the presence of autoantibodies against O-myelin.

Adequate health monitoring of workers with EHS depends on a combination of ongoing medical evaluations and accommodations to the work environment. It is essential to ensure a preventive and reactive approach to protect workers' health and maintain their ability to work in the best possible conditions.
Health monitoring for people with EHS requires an integrated, multidisciplinary, and highly personalized approach. These workers experience adverse reactions to EMFs that do not bother other workers, so their care should focus on minimizing exposure and managing symptoms appropriately.

Particularly sensitive worker:

As with MCS, people affected by EHS who have been assessed by the Occupational Health Service or those identified as such during health surveillance will be labeled as particularly sensitive workers (PSWs). This concept can be defined on the basis of Article 25.1 of the LPRL, which states that it is "anyone who, due to their personal characteristics or known biological condition, including those with a recognized physical, mental, or sensory disability, is particularly sensitive to the risks arising from work...". Furthermore, Article 37.3 c) of the Prevention Services Regulations establishes that "health surveillance shall be subject to specific protocols or other existing means with regard to the risk factors

to which the worker is exposed...". The legal requirement stipulates that the employer must guarantee the protection of PSWs, taking into account the aspects mentioned in the risk assessments and, based on these, adopting the necessary preventive and protective measures.
As a general rule, workers shall not be employed in situations where (Article 25.1 of the LPRL):

- They, other workers, or other persons related to the company may be placed in danger due to their personal characteristics, biological condition, or duly recognized physical, mental, or sensory disability.
- Are clearly in a temporary state or situation that does not meet the physical and mental requirements of their job.

Three mechanisms will be used to detect a situation of special sensitivity in a worker:

- By notification from the worker suffering from EHS to the internal or external bodies responsible for prevention.
- By the Occupational Health Service during medical examinations, when the pathology is detected or when informed of the diagnosis by the worker.
- By prevention technicians based on the risk assessments carried out.

It is essential in companies where there are workers with EHS to pay special attention to these people due to their intolerance to EMFs, introducing special protection measures and providing spaces that are free of waves and not covered by the wireless network.

Criteria for assessing fitness for work:

The assessment of work fitness in people diagnosed with EHS must be approached on an individual basis, considering both the symptoms manifested and the specific demands of the job.
The key criteria for this assessment are detailed below:

Comprehensive medical evaluation:

It is essential to perform a complete medical examination to identify and document the symptoms associated with EHS, ruling out other possible conditions that may be causing the clinical manifestations. Given that EHS does not have clear diagnostic criteria, the evaluation should focus on the reported symptoms and their functional impact.

Workplace analysis:

Examine working conditions in detail, identifying potential sources of EMF and assessing exposure levels in comparison with the limits established by the EUROPAEM EMF Guideline 2016. Although the WHO indicates that exposures below the recommended limits should not cause adverse health effects, it is important to consider the perception and well-being of particularly sensitive workers.

Reasonable adaptations:

Based on the findings, consider implementing measures such as relocating the worker to areas with lower EMF exposure, modifying equipment, or changing the organization of work to minimize or eliminate exposure. These accommodations should balance technical and economic feasibility with effectiveness in reducing reported symptoms.

Functional assessment:

Evaluate how the symptoms affect the worker's ability to perform the essential tasks of their job. In cases where EHS is associated with other medical conditions, such as fibromyalgia or chronic fatigue syndrome, the possibility of recognizing permanent incapacity for work has been considered. Each case must be analyzed individually, considering the severity of the symptoms and their impact on work performance.

To establish the criteria for work fitness in workers with EHS, the following sections must be taken into account:

Individualized Medical Evaluation:

- Diagnosis and medical certification of hypersensitivity.
- Assessment of symptoms and their relationship to EMF exposure.
- Report from an occupational health specialist.

Workplace Assessment:

- Identification of sources of electromagnetic radiation in the work environment.
- Measurement of EMF levels in the work area.
- Determination of the possibility of adapting or relocating the worker.

Work Environment Adaptation Measures:

- Reduced exposure to electronic devices and Wi-Fi.
- Implementation of work areas with low or no electromagnetic radiation.
- Use of equipment with lower EMF emissions.
- Possibility of teleworking if feasible.

Occupational Risk Assessment:

- Application of the precautionary principle in health protection.
- Training and raising awareness among staff about EHS.
- Periodic review of working conditions.

These points will lead us to make a decision on Work Fitness, which may be:

- If the position allows for adaptation and the worker can perform their duties with reasonable adjustments, they are considered Fit with restrictions.
- If it is not possible to guarantee adequate conditions, relocation may be considered.
- In extreme cases where exposure is unavoidable and harmful, the individual may be considered Unfit for that specific job.

Conclusions:

Both MCS and EHS are emerging health problems that are derived from environmental changes. Direct involvement of Occupational Health Services is necessary to propose measures that are capable of controlling the risks that exist in the working environment.

The assessment of occupational risks by Prevention Technicians can highlight environmental factors in the workplace that may be harmful and affect the health of workers or aggravate the symptoms of people suffering from MCS or EHS. Health surveillance carried out by Occupational Physicians can contribute to the diagnosis of these pathologies or to their proper assessment, in order to improve the working conditions of those affected by them.

Workplace adaptations or changes should be made in cases of MCS and EHS where necessary, in order to reintegrate workers into working life.

Those diagnosed with or suspected of having MCS or EHS should be considered particularly sensitive workers. It is necessary to be aware of and consider MCS and EHS in order to diagnose them and thus improve the quality of life of those who suffer from them. Early detection and avoidance of exposure (in the home, public spaces, and the workplace) are two fundamental pillars for the treatment of these conditions.

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CHAPTER

3

Adaptation of work environments and workstations

For Multiple Chemical Sensitivity

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3.1

Context

Occupational Epidemiology

Epidemiology emerged to study epidemics triggered by infectious diseases. It was crucial to understand the process in order to combat them, analyzing infectious agents, how they spread, and how they could be controlled. In the 20th century, the scope of epidemiology evolved, extending to other fields and entering the world of work.

Currently, the World Health Organization (hereinafter WHO) defines epidemiology as:

"The study of the distribution and determinants of health-related states or events (particularly diseases) and the application of these studies to the control of disease and other health problems."

The International Labor Organization[298] (hereinafter ILO) has defined occupational epidemiology as:

"the study of the effects of workplace exposures on the frequency and distribution of diseases and injuries in the population. It is therefore an exposure-oriented discipline, which has links with epidemiology and industrial hygiene. As such, it uses methods similar to those employed by epidemiology in general."

Occupational risk prevention (hereinafter ORP) is one of the objectives of occupational epidemiology. It is responsible for identifying the health consequences of performing a work activity. In this way, the hazards to which a worker is exposed can be eliminated or reduced.

There are several levels at which occupational epidemiology can be applied:

- Preventing the onset of diseases through health surveillance.
- Analysis and verification of the harmful effect on health of certain exposures, quantifying that effect.
- Interventions to implement measures that eliminate or reduce the danger of certain exposures, as well as their long-term effects.

Although it is true that occupational epidemiology usually focuses on a population group within a work environment, we can extrapolate the technique if what is needed is to adapt a specific job position. This is because epidemiology allows the study to be varied according to the hypothesis proposed and the objectives sought.

An occupational epidemiological study analyzes in detail the risks or hazards caused by performing a professional activity, so that solutions can be found to eliminate or minimize the effects on health. The process can be approached as follows:

1. Search and identification of causes.
2. Search and identification of the effects.
3. Control or elimination of occupational risks.
4. Determination of acceptable exposure levels.
5. Determination of priorities.
6. Determination of interventions.

Work activity

There are many activities that are considered work, and these can be carried out in a wide variety of physical spaces. The vast majority of work activities are regulated under Law 31/95[299] on occupational risk prevention.

This Law on ORP applies "both in the field of labor relations regulated by the revised text of the Workers' Statute Law, and in the field of administrative or statutory relations of personnel in the service of public administrations [...] It shall also apply to cooperative societies" (L 31/95, art.3). Therefore, the physical spaces where work is carried out, or workplaces, must meet minimum health and safety requirements.

In general terms, a worker is understood to be a person "who voluntarily provides paid services for somebody else and within the scope of the organization and management of another person, natural or legal"[300] (RDL 2/15, art.1). Although this is a definition from the private sector, the concept can be extrapolated to the public administration in general.

It is essential to identify the purpose of the ORP Act, which is "to promote the safety and health of workers through the application of measures and the development of activities necessary for the prevention of occupational risks" (L 31/95, art. 2.1). The measures determined by current regulations focus on minimums (L 31/95, art. 2.2), which is why it is a basic objective that can be improved upon.

This makes it clear that every worker has the right to safety and health in their job, regardless of the activity they perform or the workplace where they perform it. When measures are implemented, a proactive rather than reactive approach should be taken, eliminating or reducing risks to workers before damage to health occurs.

An "occupational risk" arises when there is a possibility that a worker may suffer a specific injury as a result of his/her work activity (L 31/95, art. 4.2). It should be noted that this harm occurs because the work activity is carried out; if it were not carried out, the risk and therefore the harm would not arise.
Any characteristic of the work that may have a significant influence on the generation of risks to the safety and health of the worker is a "working condition"[301] (L 31/95, art. 4.7). This specifically includes the characteristics of the premises, equipments, products, etc. existing in the workplace, as well as any physical or chemical agent present.
As mentioned above, workers have the right to effective protection in terms of occupational safety and health, which correlates with the duty of the "employer"[302] to ensure the protection of the workers in his/her service and in all aspects related to work. Furthermore, this duty of protection also constitutes a duty of public administrations with regard to their employees (L 31/95, art. 14.1 and 14.2).

Some of the general principles of preventive action are as follows (L 31/95, Art. 15.1), and their order is as follows in the following points:

- **a.** Avoid risks.
- **b.** Evaluate risks that cannot be avoided.
- **c.** Combat risks at source.
- **d.** Adapt work to the individual.

In order to protect the health of workers, the "employer" must draw up a risk prevention plan based on the assessment of occupational risks and the planning of preventive measures (L 31/95, art. 16).

The "employer" has the obligation to "carry out an initial assessment of the risks to the safety and health of workers, taking into account, in general, the nature of the activity, the characteristics of the existing workstations and of the workers who must perform them. The same assessment must be carried out when selecting work equipments, chemical substances or preparations, and when fitting out workplaces" (L 31/95, art. 16.2.a). These assessments must be kept up to date to ensure that there have been no changes in working conditions, in the measures adopted, in the personal characteristics of the worker (RD 39/97, art. 4.2.c)[303], or due to technological advances that allow for better solutions to be adopted in terms of adapting the workstation.

In addition, the Law specifically guarantees the protection of workers who, "due to their personal characteristics or known biological condition, including those with a recognized physical, mental, or sensory disability, are particularly sensitive to the risks associated with work. To this end, it shall take these aspects into account in risk assessments and, based on these, shall adopt the necessary preventive and protective measures" (L 31/95, art. 25).

In conclusion, the assessment of the workstation and the measures to be taken to protect health in the workplaces must always take into account the specific conditions of the worker, such as those who are particularly sensitive to any element found in their workstations, whether or not they have a recognized disability.

Multiple Chemical Sensitivity

This point has been extensively defined in previous chapters. Here, we will only discuss the determining factors that influence the workplace when a worker suffers from Multiple Chemical Sensitivity (hereinafter MCS).

In order to adequately adapt the workstation, it is essential to understand how the disease works and where the working conditions and the work environment can affect. To this end, we refer to the definition provided by the Canadian Human Rights Commission in 2007, which identifies MCS as "a complex syndrome that presents as a set of symptoms linked to a wide variety of agents and components found in the environment, with these reactions occurring at levels commonly tolerated by most people".

This definition is key because it narrows down the lines of action if we want to adapt a job to a worker diagnosed with MCS, as it identifies, on the one hand, the need to analyze the affecting elements located in the "environment" within the working conditions, and, on the other hand, that it is an effect that exclusively affects certain people, which means that the environmental values pre-established as optimal in the workplace are not valid for use as a reference when evaluating the workstation of a worker diagnosed with MCS.

Delimitation of the workspace

In order to analyze the space and workstation, it is exclusively taken into account the space or work area where the worker with MCS will carry out his/her professional activity within the framework of a working day.

The scope of the workspace is understood to be any area of the workplace where workers must remain or to which they have access due to their employment status as workers of the organization that employs them. Therefore, the workspace includes the place where the workers spend most of their working time, as well as other common areas to which they have access, such as corridors, stairways, bathrooms, etc.

This definition is necessary because it is where the scope of action of organizations that have workers with MCS lies, but the parameters identified and the individual measures proposed could be taken as a reference for the analysis of other spaces.
The parameters determined here have not taken into account the industrial environment, which requires a specific study and specific regulations.

Ways in which toxins enter the body of a worker with MCS

Toxic elements or compounds that can affect a person, including workers with MCS, can enter the body through different routes:

> **Inhalation:** the toxin is found in the air breathed by the person with MCS.
>
> **Absorption through the eyes, mucous membranes, or skin.** The toxin is found in the air and/or can also be found on items in close proximity to these parts of the body, e.g., on the eyes and mucous membranes, such as glasses, masks, lenses, clothing, etc., or on the skin, also on clothing, furniture, tools, equipment, or items used in the work activity.
>
> **Ingested:** these would be products that workers would have to ingest due to their work activity, such as restaurant workers.

Once the route of entry of the toxin into the body has been identified, it is crucial to analyze where it is located in order to reduce it and, better still, eliminate it. The toxins that affect the health of a worker with MCS are found in:

- Air in the workplace.
- Materials in contact with the worker.

- Elements and/or food ingested during work: not taken into account in this study due to its specific nature. It is recommended to consult the literature on the type of diet required by a person affected by MCS.

Indoor air quality in buildings

As has been determined, the agents that can influence the safety and health of a worker with MCS are found in the environment of the space where they work, and the element where these compounds are located is in the air. Therefore, it is essential to understand and analyze indoor air quality and the form in which these compounds are found in order to control them.

Indoor air quality regulations

The state regulations that set the objectives and parameters that determine indoor air quality are:

- Technical Building Code (hereinafter **CTE**) in its DB SH 3, on indoor air health and quality.
- Regulation on Thermal Installations in Buildings (hereinafter **RITE**).

This regulation lists certain parameters and quantifies them to determine whether air quality is sufficient for the general population. These data are minimum parameters:

- CO2 below 900 PPM. This data is fundamental because, even if there are no means to analyze other air compounds, it can help to assess air quality. This was done at a time when there were specific measures to combat the spread of COVID, when it was not possible to determine the amount of virus present in work environments, it was determined that the amount of CO_2 could be related to the probability of the virus being present.

- Maximum air flow of 1.5 L/s even without human presence.
- Adequate filtration of outside air to remove dust and other suspended particles (PM10 and PM2.5)[304]. Illustration 1 shows the size of the particles, demonstrating that certain compounds are extremely small.

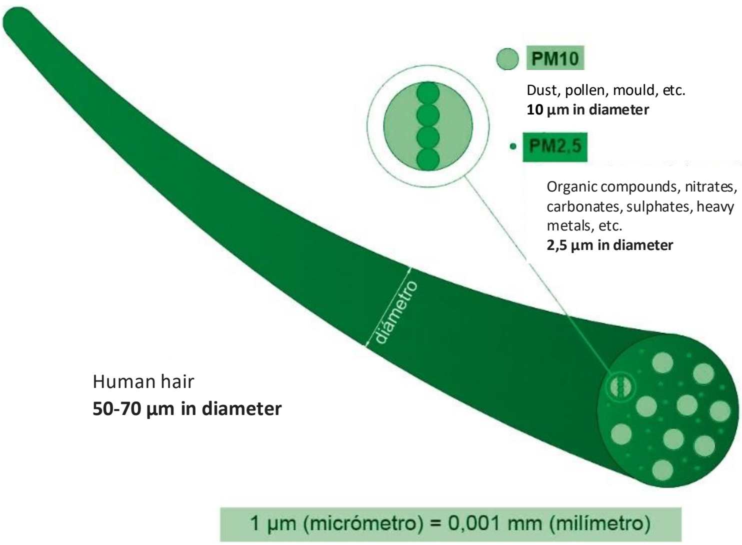

Figure 1:

- Ensure proper air renewal.
- Maintain a relative humidity level between 40% and 60%[305].

Relationship between poor air quality and human health

According to the WHO, 3.2 million people worldwide die prematurely from diseases attributable to poor indoor air quality caused by the inappropriate use of fossil fuels.

In addition, poor air quality caused the loss of some 86 million years of healthy life in 2019, and a link has been demonstrated between indoor air pollution and low birth weight, tuberculosis, cataracts, and cancers of the larynx and nasopharynx[306]. According to the National Institute for Safety and Health at Work (hereinafter INSST), poor indoor air quality in the workstations, we may experience the following symptoms:

> **Eye area:** itching, stinging, dryness, watering, or redness, among others.
>
> **Upper respiratory tract (nose and throat):** itching, stinging, dryness, congestion and runny nose, epistaxis (nosebleeds), sneezing, dry cough, sore throat, etc.
>
> **Lungs:** feeling of suffocation, bronchitis, chest tightness, wheezing, dry cough, etc.
>
> **Skin:** localized and/or generalized itching, redness, dryness, etc.
>
> **Others:** difficulty concentrating, headaches, drowsiness, weakness, anxiety, irritability, nausea, dizziness, etc.

Diseases related to poor indoor air quality include:

> **Ischemic heart disease:** according to the WHO, there are more than one million premature deaths each year.
>
> **Strokes.**

Asthma: this is a chronic inflammatory disease of the airways that causes episodes of narrowing of the airways and obstruction of airflow.

Allergies or rhinitis. These are especially related to the accumulation of dust mites, allergens in general, and humidity.

Lower respiratory tract infections: according to the WHO, these cause 45% of deaths from this disease in children under 5 years of age and can be attributed to 28% of deaths from pneumonia in adults.

Chronic obstructive pulmonary disease (COPD): this disease causes obstruction of the bronchi, leading to emphysema in the lungs.

Lung cancer: The WHO indicates that approximately 17% of deaths from this cause in adults are attributable to exposure to carcinogenic materials.

Main factors responsible for poor air quality

There are various factors related to poor indoor air quality, but in order to adequately address air quality, in addition to determining the elements that affect the environment, it is essential to differentiate between their form and size.

In general, the following elements are related to poor air quality, the most common being chemical pollutants, volatile organic compounds (hereinafter VOCs), carbon dioxide, carbon monoxide, and various biological particles such as bacteria, fungi, spores, etc., in addition to volatile solid particles of any kind.

Solid agents in indoor air

Solid elements in indoor air are volatile agents found in suspended particles of different sizes and behaviors. When inhaled, volatile solid pollutants can cause serious health problems if they enter the lungs.

The smaller the particle size, the more damage it causes because it cannot be retained by the airways leading to the lungs.
Larger particles can be stopped at the body's defenses in the nose, trachea, or bronchi.
There are biological compounds that are also treated as solid particles for the purposes of this study, such as molds, viruses, and bacteria.

Examples of these agents include **fossil fuels, organic waste, dust of various compositions, ash, soot, etc.**
At the building control level, these particles are removed by filters, with the exception of viruses.

Gaseous agents in indoor air

Gaseous agents harmful to health found in indoor air include carbon dioxide, produced by the respiration of people and animals, the aforementioned VOCs from bodily emissions, cleaning equipments or products, perfumes, aerosols, formaldehydes, etc.

They are removed from inside a building by extracting the air and replacing it with new air from outside, always treating it beforehand.
This process is called air renewal.

Materials in direct contact with the worker

Materials inside a workspace can volatilize their compounds, in which case the toxic substances would be released into the air in the form of volatile compounds. To avoid exposure to this type of toxic substance, it is necessary to address the specific issue of air quality and its treatment.

It may also be the case that materials present within a workspace may come into contact with the skin, eyes, or mucous membranes of a person with MCS and affect them. This is so because all materials degrade; what differentiates them is their speed and form of degradation.

The degradation of materials refers to the deterioration that all matter undergoes due to various factors such as environmental, mechanical, and even biological factors, releasing in this process particles of different sizes or emitting compounds into the environment, materials which may end up affecting people with MCS. This process affects both organic and inorganic materials and is caused by various mechanisms such as corrosion, wearing away, microbial action, ultraviolet rays, etc.

To determine the measures to be taken, the INSST proposes answering the following questionnaire:

> Are there materials in the work environment that affect workers with MCS? There are materials that directly affect people with MCS, some of which are explained in the section *on identifying hazards for workers with MCS.*
>
> Is the substance reliable? For example, if the degradation is of a natural element such as organic cotton, the impact on workers with MCS will be practically non-existent.

Is it possible to modify the work activity to avoid handling agents that are aggressive to the sick worker?

Are there different areas that can be classified as clean and dirty, and is it possible to place a barrier between them? This occurs when there are elements that degrade, producing compounds. Sectorization will help prevent the spread of the contaminant to the person affected with MCS.

Is it possible to use smooth, impermeable surfaces that are easy to clean? When cleaning degraded materials, it will be necessary to take into account the compound and how it is removed, as products that could harm the health of people with MCS could be used.

Once these questions have been answered and the appropriate modifications have been made, monitoring should be considered to ensure that conditions do not change over time.

As the degradation of materials is inevitable, it will be necessary to use materials that are as natural as possible, as these are the most suitable for people with MCS. If this is not possible, the creation of a barrier between these materials and people who are highly sensitive to them should be considered.

Occupational risk assessment in the context of MCS

According to Law 31/95, which transposes Framework Directive 89/391/EEC, risk assessment is the basis for active management of occupational health and safety and, therefore, identifies the following as necessary:

- Planning preventive action through adequate risk assessment.

- Assessing the risks of existing and new elements in the workspaces.

Current regulations define occupational risk assessment as "the process of estimating the magnitude of those risks that have been unavoidable, obtaining the necessary information so that the employer is in a position to make an appropriate decision on the need to adopt preventive measures and, if so, on the type of measures to be adopted." (RD 39/97, art. 3).

Therefore, in order to take measures, it is necessary to analyze what risks arise in the specific case of people with MCS.

The initial assessment of risks to the safety and health of workers, and its subsequent monitoring, is the basis for preventive action by any entity that has workers. To this end, the organization must[307]:

- Identify the hazards.
- Estimate and evaluate risks, assessing both the probability and consequences of the hazard materializing.
- Control risks. Using the risk value obtained and comparing it with the tolerable risk value, a judgment is made about the tolerability of the risk in question.
- Maintain the control measures implemented.

The occupational risk assessment proposed here does not replace the conventional risk assessment. The assessment proposed in this study complements the traditional assessment corresponding to the job being performed. Specifically, a detailed analysis will need to be carried out in the case of an employee with MCS within an organization. Therefore, the other conditions analyzed in the traditional assessment must be taken into account, where the job is specifically studied independently of the person performing it.

In the specific case of people affected by MCS, it is necessary to focus on and expand the usual environmental analysis and identify which elements or chemical compounds affect them.

General environmental conditions in a workplace and specific conditions for workers with MCS

The environmental conditions that a conventional workplace must meet are set out in RD 486/97[308], which establishes, among other things, the minimum environmental conditions. The RITE also has something to say on this matter.

It is determined that **"exposure to environmental conditions in the workplaces shall not pose a risk to the safety and health of workers" (RD 486/97, art. 7.1).**

The standard identifies specific agents to be taken into consideration within the environmental setting, and outlines the need to develop specific regulations on exposure to physical, chemical, and biological agents (RD 486/97, art. 7.2). This opens the door to controlling other compounds not specifically identified to date, to which workers are exposed, as is the case of those affected by MCS.

The RD stipulates that workplaces should not be a source of discomfort or nuisance for workers. Therefore, extreme temperatures and humidity, sudden changes in temperature, uncomfortable drafts, or unpleasant odors, among other agents, should be avoided (RD 486/97, Annex III.2).

In the case of enclosed workplaces, the parameters that must be met at the environmental level are quantified (RD 486/97, Annex III.3):

> **Temperature:**
>
> a. The temperature of premises where sedentary office or similar work is carried out shall be between 17 and 27 °C.

b. The temperature of premises where light work is carried out shall be between 14 and 25 ºC.

Relative humidity: shall be between 30 and 70 percent, except in premises where there are risks due to static electricity, in which case the lower limit shall be 50 percent. It should be noted that the CTE and RITE recommend maintaining relative humidity between 40% and 60%. Therefore, it is recommended that the humidity in a work environment where a person with MCS carries out their activity be maintained between 30% and 50%.

Air speed: frequent drafts should be avoided and should be limited depending on the activity carried out and on the ambient temperature, reaching a maximum of 0.75 m/s. The standard is more restrictive if the movement of air is intended to combat the ambient temperature.

The existing ventilation system must ensure effective air renewal in the workplaces.

There are other parameters to be taken into consideration, identified in the UNE-EN-ISO-7730 standard on the ergonomics of the thermal environment:

a. Discomfort due to air currents.

b. Vertical difference in air temperature.
Stratification.

c. Hot and cold floors.

d. Asymmetry of radiant temperature.

It is recommended that CO2 levels be below 500 PPM in places where a person with MCS is working.

It is very important to comply with the above parameters because they promote environmental balance, as the parameters described directly affect other agents in the environment, such as the proliferation and distribution of certain pathogens (mold, Legionella, etc.), the accumulation of mites, and electromagnetic fields.

RITE proposes an air supply system with a specific volume and quality depending on the use of the building. Depending on the use of the building or premises, the indoor air quality (IDA in its acronym in Spanish-Castilian) category to be achieved shall be at least the following[309]:

a. IDA 1 (optimal air quality): hospitals, clinics, laboratories, and nurseries.

b. IDA 2 (good air quality): offices, residences (common areas in hotels and similar establishments, nursing homes, and student residences), reading rooms, museums, courtrooms, classrooms and similar areas, and swimming pools.

c. IDA 3 (medium air quality): commercial buildings, cinemas, theaters, auditoriums, hotel rooms and similar, restaurants, cafes, bars, nightclubs, gyms, sports facilities (except swimming pools), and computer rooms.

d. IDA 4 (low air quality)

It is proposed to increase an IDA if the space is occupied by a worker with MCS.

The outdoor air flow rate set by RITE to achieve indoor air quality categories can be calculated using five methods to be selected based on metabolic activity and human occupancy, so it will be necessary to use the appropriate methodology depending on the worker's activity and his/her workplace.

A. Indirect method of outdoor air flow per person. This methodology is used when the people inside the building have a metabolic activity of around 1.2 met (metabolic equivalent of task) and/or when the production of substances with pollutants from sources other than humans are low.

CATEGORY	dm^3/s per person.
IDA 1	20
IDA 2	12.5
IDA 3	8
IDA 4	5

Table 1: Outdoor airflow rates in dm^3/s per person. Source: RITE

B. Direct method based on perceived air quality. In this method, based on report CR 1752 (olfactory method), the values to be used are those in Table 2. A decipol (pollutio in Latin or pollution in English) is the unit of measurement for perceived air quality, identified as the pollution caused by a standard adult (being 1 olf) with a ventilation rate of 10 L/s of unpolluted air, where 1 decipol = (0.1 olf) / (1 L/s).

CATEGORY	DP
IDA 1	0.8
IDA 2	1.2
IDA 3	2
IDA 4	3.0

Table 2: Perceived air quality, in decipols. Source: RITE

C. This technique is based on the sensory load produced by pollutants generated by individuals and elements of the building to determine ventilation rates. This technique is proposed for calculating spaces used by workers with MCS.

CATEGORY	PPM(*)
IDA 1	350
IDA 2	500
IDA 3	800
IDA 4	1200

Table 3: CO^2 concentration (in parts per million by volume = ppm) above the concentration in outside air. Source: RITE.

D. Direct method by CO^2 concentration. Used in locations with high metabolic activity (party rooms, premises for sports and physical activities, etc.) where the CO^2 concentration method can be used, as it is a good indicator of human bioeffluent emissions. The values are identified in Table 3. For premises with high pollutant production (swimming pools, restaurants, cafes, bars, some types of shops, etc.), the data in Table 3 can be used, although if the composition and flow rate of the pollutants are known, the dilution method in section F (dilution method) is recommended.

E. Indirect method of air flow per unit of surface area. This is used in spaces not intended for permanent human occupation, so there is no need to explain it.

F. Dilution method. When there are known emissions of specific pollutants in a building, the dilution method shall be used for specific control of these pollutants. This methodology is proposed as a complement in the case of a worker with MCS.

Depending on the use of the building or of its sectorized area, the extracted air (AE) is classified according to the following determinations and must comply with the following parameters[310]. For this analysis, it is taken into account that smoking is not permitted in any space:

AE 1, low pollution level: The predominant environmental sources of pollution are interior materials, construction and decoration, and the people who use the space.

AE 2, moderate pollution level: buildings and premises where the air contains more pollutants than in the previous category.

AE 3, high pollution level: buildings or premises where chemicals, humidity, etc. are produced. This classification includes saunas, industrial kitchens, printing presses, etc.

AE 4, very high pollution level: this classification includes parts of the building that contain odorous substances and pollutants that are harmful to health, as is the case for workers with MCS. This air cannot be used as recirculation or transfer air.

Once the agents involved in air quality for the working population in general have been identified and how the methodology can be used for workspaces used by people with MCS, it is necessary to identify those agents that have a specific impact on workers with MCS.
In the case of work carried out outside buildings, the parameters proposed here must also be complied with for workers affected by MCS.

Identification of hazards for a worker with MCS

The elements that can affect the health of a worker with MCS are found in the environment or in elements that may come into contact with the skin, hair, nails, etc. Contact with the agent through ingestion is not taken into account for the purposes of this study.
The European Chemicals Agency [311] (hereinafter ECHA) [312] defines a chemical substance as a chemical element and its compounds in their natural state or obtained by any manufacturing process. This manufacturing process is shown in Figure 2, where it can be seen that the compound is a newly created element, completely different from the initial elements that make it up.

Figure 2

Some examples of these substances are metals, solvents such as acetone, dyes, pigments, or fuels such as diesel. These types of substances can affect the health of people with MCS if they come into contact with him or her.
On the other hand, ECHA considers that a mixture or combination of two or more substances is not a substance, because according to European Union legislation on chemicals, mixtures are not considered chemicals. These mixtures are shown in Figure 3.

Figure 3

These products include some shampoos, soaps, other cosmetics, detergents, and paints. Although these products are not legally considered chemicals, their chemical composition does not exist in nature, so they are products that can affect people with MCS if they come into contact with her/him. It will all depend on their composition. If a mixture of chemicals has been produced, it will have an effect; and if the mixture is made up of natural, chemically unmodified basic products, the MCS patient will probably not be affected as long as they are not transformed into another compound or chemical element.
It is important to highlight the complexity of the chemical interactions that occur when different chemicals are mixed, which can trigger different reactions in MCS patients, as there are many factors involved in the process, such as exposure time, the temperature of each element and the ambient temperature, the different concentration percentages of each element, relative humidity, atmospheric pressure, etc.
For a person affected by MCS, due to her/his high hypersensitivity, minimal exposure and concentration of the agent is sufficient to have an impact on his/her health. Therefore, for the purposes of this analysis,

the appearance of any chemical substance and its mixtures, many of which are listed below, is considered to affect the health of a worker with MCS, regardless of the duration of exposure and the concentration of these substances. In order to avoid damage to health, it is necessary to identify these compounds. The list below is general in nature, as it is not feasible to list all the chemicals that may affect all people with MCS, due to the complexity of the disease and the wide variety of these products and their mixtures.

List of chemical agents that affect people with MCS

Below is a non-exhaustive list of elements that, when found in the environment or that may come into contact with the patient, trigger the symptoms of the disease in workers affected by MCS[313]:

- Cleaning products such as: disinfectants, ammonia, salt fumigants, zotal, glass cleaners, floor polishers, fabric softeners, and others.
- Cosmetics and personal hygiene products such as: colognes, body creams of any kind, sunscreens, hand creams, etc., soaps, shower gels, cosmetics, hair products such as shampoos, hairsprays, hair curlers, conditioners, etc., deodorants, nail polish, makeup, among others.
- Products used inside buildings such as: air fresheners, smoke of any kind such as candles or incense, sprays, formaldehyde emitted from building materials, chemical paints such as varnishes, temples, contact adhesives, etc.
- Other items that can be found in a workplace: inks and printing products for newspapers, magazines, or advertising, toner, chemical solvents such as acetone, glues, etc.

- Of biological origin, this can manifest itself in a multitude of ways, such as viruses, bacteria, molds, etc. For example, we can look at our recent history of the significant impact of COVID in the work environment, or today, the great struggle promoted by governments to try to reduce the spread of Legionnaires' disease, but it is necessary to broaden the spectrum of action.
- Depending on the job, there may be elements that are not so common but which do affect workers, such as pesticides, fungicides, protective waxes, packaging materials, fuels such as gasoline, propane, gas oil, etc., asphalt, tar, engine smoke, and smoke from other sources such as tobacco, barbecues, food preparation, fires, etc., metals, dyes, pigments, etc.
- Factors that directly impact the health of the general population but have a greater impact on people affected by MCS: Solid particles of biological origin, ozone, nitrogen dioxide, sulfur dioxide, carbon monoxide, heavy metals, and benzene, among others.
- Chemicals that affect the general population, but with more concentration restrictions for people affected by MCS, such as chlorine, bleaches, nitrogen dioxide, sulfur dioxide, carbon monoxide, or similar. Table 4 shows an example.

EC No.	CAS No.	CHEMICAL AGENT (year of incorporation or update)	LIMIT VALUES				NOTES	HAZARD INDICATIONS (H)
			ELV-DE®		ELV-STE®			
			ppm	mg/m³	ppm	mg/m³		
		Refined mineral oil, mists		5		10	am	
00-836-8	75-07-0	Acetaldehyde			25	46	**C1B**	**224-350-341-335-319**
11-047-3	628-63-7	n-Amyl acetate	50	270	100	540	VLI	**226-EUH066**
210-946-8	626-38-0	Sec-amyl acetate	50	270	100	540	VLI	**226-EUH066**
	625-16-1	Tertiary amyl acetate	50	270	100	540	VLI	
205-399-7	140-11-4	Benzyl acetate	10	62				
204-658-1	123-86-4	n-Butyl acetate (2021)	50	241	150	723	VLI	**226-336-EUH066**
203-300-1	105-46-4	Sec-butyl acetate (2021)	50	241	150	723	VLI	**225-EUH066**
208-760-7	540-88-5	Tertiary-butyl acetate (2021)	50	241	150	723		**225-EUH066**
203-933-3	112-07-2	2-Butoxyethyl acetate	20	133	50	333	dermal route, VLI	**332-312**
		Ethylene glycol monobutyl ether acetate	see 2-Butoxyethyl acetate					
		Ethylene glycol monoethyl ether acetate	see 2-ethoxyethyl acetate					

Table 4: Occupational exposure environmental limit values (ELV); daily exposure (DE); short-term exposure (STE) in 2024. Partial data.

This is a partial representation of the report published annually by the INSST on the limit exposure to environmental chemical agents to which any worker may be exposed[314].

It is important to note that each person with MCS may have a different reactivity to the same compound and/or mixture of compounds, probably in part due to their ease or difficulty of absorption, which may be conditioned by general environmental conditions such as temperature, pressure, humidity, etc., or her/his own physical condition.

Sources of chemical agents that affect people with MCS

In order to determine the main sources, present in the air of the working environment of a person with MCS, it is essential to clarify that industrial spaces are excluded, since, due to their specific characteristics, they require a differentiated analysis.

The national building stock is very diverse in terms of location. Some of the buildings are located in areas with inadequate outdoor air quality, but many others are located outside urban areas, which means that the toxins that affect workers with MCS come mainly from inside the building, although also from outside. Some of these sources are[315]:

- Outdoor air.
- People and animals inside the work environment produce carbon dioxide, particles, water vapor, aerosols, and may be carriers of viruses, such as COVID, which is transmitted through the air.
- Cleaning and maintenance of buildings, with the products used.
- Materials inside buildings, including construction materials, furniture, and/or decorations.

- Any source of smoke emission.
- Any equipment that uses fuel, due to improper maintenance or operation, and even due to inadequate ventilation. Cookers, dryers, refrigerators, washing machines, heaters, stoves, etc.
- Poorly maintained air conditioning and ventilation systems.
- Inadequate maintenance throughout the building. Materials, equipment, and systems can deteriorate to such an extent that they can break down or create leaks that are harmful to health.
- Lack of ventilation in basements. Due to gases emanating from the ground, such as radon gas.

Risk assessment for a worker with MCS

The World Health Organization defines health as "a state of complete physical, mental, and social well-being, and not merely the absence of disease or illnesses." This means that it is essential to analyze what affects workers with MCS so that they can achieve a state of well-being during their work, without suffering immediate harm from exposure.
It is considered appropriate to clarify certain concepts that are widely used in the world of occupational risk prevention:

Damage: pathologies or injuries suffered as a result of work activity due to exposure to risks in the work environment. To avoid this circumstance, the employer has an obligation to take preventive action in all phases of business activity.

Hazard: a source or circumstance with the potential to cause harm.

Risk: the combination of frequency and probability both of which can lead to the materialization of a hazard causing damage resulting from work activity. Due to the hyperreactivity and hypersensitivity of people with MCS, it is not possible to take into account the probability of a chemical agent affecting the health of this person; the mere presence of chemical compounds is enough for it to materialize. Therefore, for a worker with MCS exposed to a substance that is harmful to their health, risk and hazard are the same and can cause them damage.

The assessment of occupational risks and the adaptation of workstations involve two courses of action: a proactive one, improving the environment so that no damage occurs, and a reactive one, analyzing the damage to health that has occurred and changing whatever has contributed to the risk materializing.

Reactive action: an illness resulting from work activity is damage caused by the slow and gradual deterioration of the health of a worker who has been exposed to counterproductive situations in the work environment or in the course of the work. Therefore, if the worker with MCS is not exposed to chemical elements outside of work, this course of action could be considered to determine exposure as a work accident[316] or occupational disease[317].

Proactive action: this action plan, which eliminates the risks and hazards to which workers are exposed, is the duty of every organization that has workers under its responsibility. It requires technical measures and organizational adjustments to be taken. It should be the course of action if it is known that there is a person within the organization affected by MCS.

Adapting the workplace for a worker with MCS

In addition to eliminating the specific risks that arise from being a person with MCS, the workplace must comply with all other applicable health and safety regulations.
Specifically, when a risk arises in the workstation, such as the existence of environmental agents that affect the health of a person with MCS, it is necessary to devise and provide the means, measures, and resources necessary to eliminate these environmental agents. According to the law, the means of action may be:

- Collective protection, which is any means or device that can protect more than one worker and is not applied to the body. This solution should be prioritized because the worker is not disturbed by the direct action of an element on their body.
- Personal protective equipment (hereinafter PPE), which is "any equipment intended to be worn or held by the worker to protect them from one or more risks that may threaten their safety or health" (RD 773/97, art.2)[318]. It is used when the risk cannot be eliminated by appropriate technical means. The use of PPE is an exceptional measure. Its ultimate goal is to be replaced by collective protection (L 31/95, art.15).

It could be argued that if there is only one worker with MCS in an organization, the direct solution would be to choose PPE, such as a mask, but according to current regulations, the solution must be as non-invasive as possible for the worker, which is why collective protection solutions will always be prioritized over individual ones.
Furthermore, it must be borne in mind that PPE, such as the use of a mask, does not eliminate the risk, as the aggressor agent remains in the environment. PPE only serves to minimize the consequences.

This, together with the fact that the effectiveness of preventive measures must take into account the distractions that the worker may commit (L 31/95, art.15.4), reaffirms the prioritization of collective measures over individual ones such as masks.
The environmental agents that influence the health of people with MCS have been identified previously and are present in two states: components dissolved in the air and/or particles suspended in it. Therefore, there are also two ways of eliminating the toxin through air treatment:

Air filtration: to remove suspended particles. This can be done by:

a. Air conditioning and/or ventilation equipment in the building. Its impact is generalized.

b. Autonomous equipment installed specifically for this purpose, commonly known as air purifiers. These do not affect the entire workplace, but rather a specific area, so their environmental impact is limited.

c. Personal protective equipment: such as masks or protective goggles; goggles are more a barrier than a filter.

Air renewal: to extract air laden with harmful agents and provide higher quality air. This is mainly done with air handling units (hereinafter AHU) or fans.

This classification is basic, as building installations can be more complex depending on their size. The aim is to explain how they work and their general composition in order to identify areas for improvement or definitive solutions in each specific case of the buildings and achieve an optimal working environment.

Sometimes the same equipment can filter and renew the air, as is the case with AHUs or certain air conditioning equipment, but for a simpler understanding, they are analyzed as if they only performed one action.

In order for these air treatment units to function correctly, they are integrated into systems or installations that allow them to move air throughout the building. It is therefore important to bear in mind all the parts that make up an air treatment installation, which will consist of at least the following elements:

Main equipment: The equipment or equipments must be selected and sized appropriately for the purpose for which it will be used, the way it will be used, and the system into which it will be integrated. It seems obvious, but on many occasions we find that buildings have changed use or modified their interior layout, and the main machines remain the same, or rooms have been enlarged or reduced, so the equipment may not be suitable for its new reality or may not be configured according to the needs demanded by the changes.

Distribution network: this is carried out using ducts, pipes, probes, grilles, filters, etc. These are as important as the equipment itself; incorrect sizing, inadequate distribution or location, incorrect choice of materials, poor maintenance, poor installation, etc., will prevent the system from functioning correctly.

Secondary equipment: this is used when installations are of a certain size or are integrated with other installations. It must be given the same consideration as the two previous points.

A very simple diagram of the layout of an indoor air treatment system can be seen in Figure 4. The image shows some of the elements that make up the system: the indoor controlled mechanical ventilation unit (VMC) or main equipment in blue, and in yellow the air distribution network, which in large buildings can be very complex installations with secondary equipment, and finally, the air inlets and outlets, in gray, which must be of the correct size and location.

All filtration and ventilation systems work in a similar way, as shown in Figure 4. The fans in the main unit extract the air, treat it (temperature, humidity, particles, etc.) and sometimes the main unit also supplies air from outside that has been treated mechanically, which is how it is built today. However, this is not always the case, especially in older buildings or of small size. There are situations in which the main equipment only extracts air from inside the building, so in order to maintain the hydrostatic balance of the building and due to the pressure gradient, untreated outside air will be introduced through the gaps or spaces in the building and/or when doors and windows are opened.

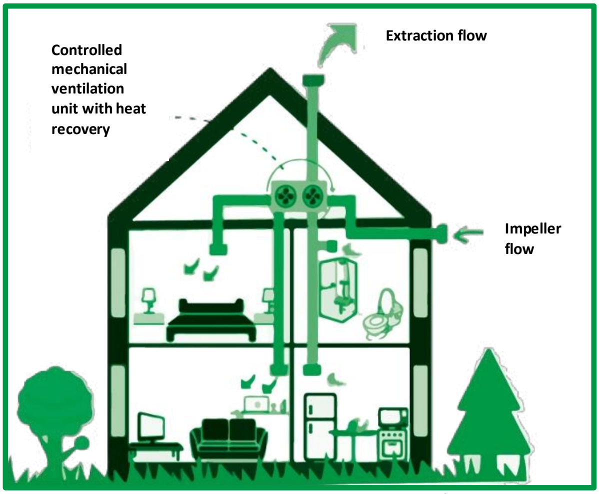

Figure 4

One element deserves special mention as it has a significant impact on the air quality in the room where the person with MCS is located, as it conditions the movement of the indoor environment, as shown in Figure 5.

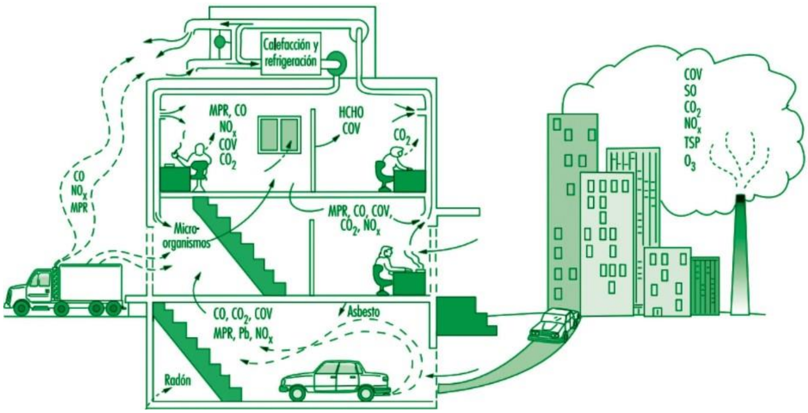

Figure 5

This element is the ventilation grille, or openings specifically created to allow air to enter or exit the installation mechanically.

Size and dimensions: They must be of the appropriate size and dimensions, in line with the rest of the installation, in order to carry out the necessary air renewal without causing large air movements that could stir up particles that are normally settled on surfaces in the room or causing pressure gradients that draw in air from other areas with lower air quality.

Yes to extraction and no to impeller: if the room has an air extraction grille but no impeller grille, this will mean that air that may be contaminated for a person with MCS will enter the room due to the pressure gradient, as can be seen in Figure 5.

Yes to impeller and no to extraction: if the room has an air impeller grille but no extraction grille, this means that the treated air enters the room directly and exits through the permeability and gaps in the building. This is the most beneficial situation for a person with MCS because there would always be the possibility of supplying good quality air and the room would be in overpressure, which means that the entry of particles and pollutants from outside would be significantly reduced.

Both impeller and extraction: The room has extraction and impeller grilles. The fluid mechanics of this situation are shown in Figure 6.

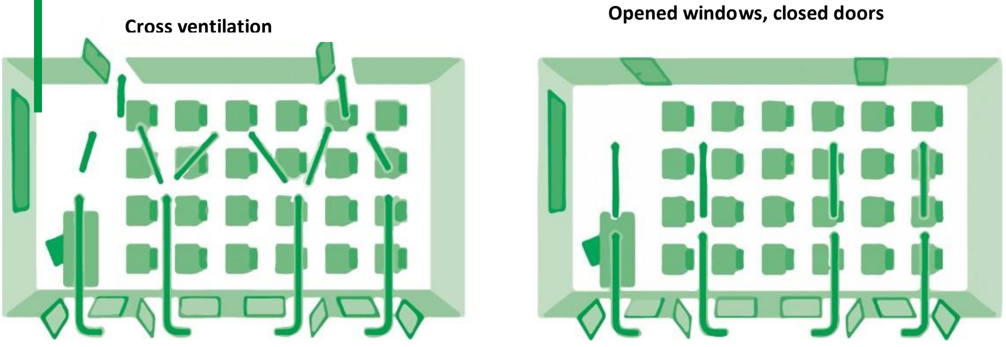

Figure 6

For adequate renewal, the amount of air entering should be the same as the amount of air leaving, otherwise the system would function as in the two previous cases. To achieve this, the grilles must be correctly designed and positioned, both in terms of layout and height, so that the air flow in the room is as great as possible and there are no areas where the air is not renewed. In addition, the air inlets and outlets must be operating at the same time, because otherwise the operating regime of the installation varies, behaving like one of the two previous cases.

No impeller and no extraction: there are no impeller or extraction grilles in the room where the worker with MCS is located. This situation is common and is the most harmful to the worker. There is no air renewal in the room, so it is left to the whims of the air movement that may occur.

In this situation, more shaded areas are created, or in other words, areas of the room where the air is not renewed.

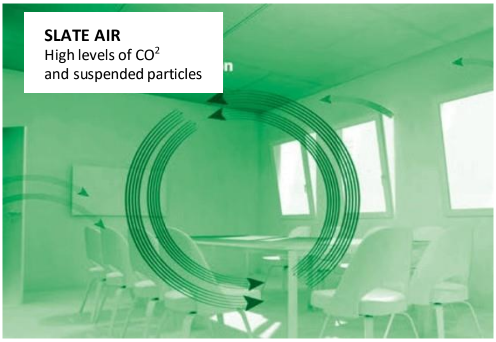

Figure 7

Air filtration systems

There are several systems that can be used to achieve adequate air filtration to provide the air quality that workers with MCS need. The options proposed here are one possibility. The aim of this section is to provide a general overview of how the installations work and to give an idea of how they can be improved or which solution best suits the actual needs of the working environment. All air treatment and movement systems have filters to protect the equipment itself and/or to treat the air before the building itself. For this reason, part of these systems is generally exposed in order to identify any improvements that the building may need or to make the right choice for an optimal working environment.

Filters

Filters are elements made of porous material, such as felt, paper, sponge, carbon, stone, etc., through which air is passed to remove any suspended particles.

Filters are usually found in the air intake circuit from the outside, before the air treatment equipment, to clean the outside air and protect the equipment itself, or in the building's indoor air return system, to remove impurities from inside the building and before the air treatment equipment, to protect it.

The regulations stipulate that pre-filters must be installed to keep air treatment units and ventilation units clean, as well as to extend their useful life. It also provides information on the placement of final filters, which must be located after the treatment section and, when the premises are particularly sensitive to dirt (premises where contamination by mix of particles must be avoided), after the impeller fan, ensuring that the air distribution over the filter section is uniform[319]. This is the case in areas where a person with MCS is working. The smallest particles are the ones that can most affect our body, as can be seen in Figure 8, since they are the ones that enter our body through the bloodstream.

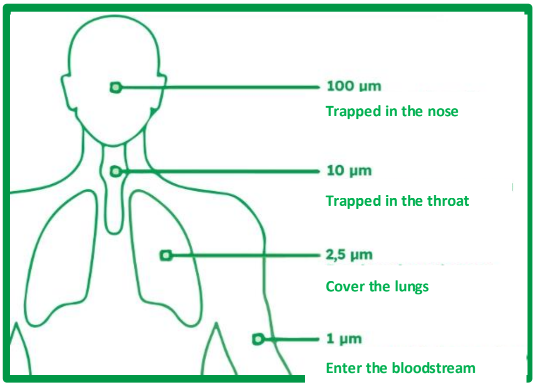

Figure 8

This means that we have to look for filters or filter sets that prevent the existence of these particles in the work environment as much as possible. Suspended particles vary greatly in size, so sieves with pores of different sizes are used. To achieve maximum cleaning, filtering, or sifting of the air, it is passed through a group of filters, placed in series in the direction of travel, in which the size of the sieve goes from largest to smallest, thus retaining the particles in each of the filters. An example of this arrangement can be seen in Figure 9.
Sometimes, filters are installed that work chemically and are capable of absorbing certain dissolved chemical components, such as the one numbered 2 in Figure 9.

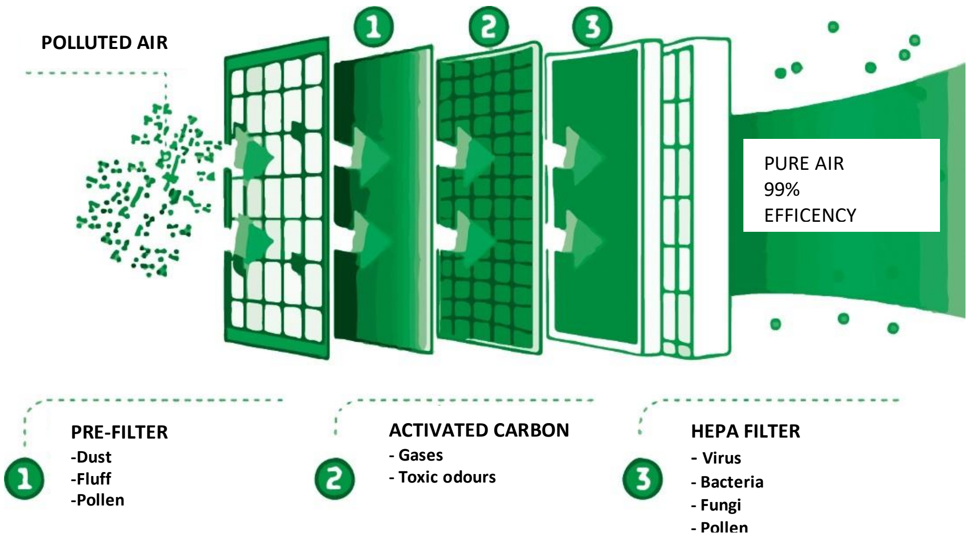

Figure 9

As the filter is an element that retains unwanted agents, over time it becomes clogged or breaks if not properly maintained, losing its effectiveness. Therefore, it is essential to identify the maintenance of these filters in the occupational risk prevention plan and the adaptation of the workstation for a person with MCS, always taking into account their proper placement, storage, expiration date, cleaning and disinfection methods, replacement, periodic inspections, etc.
Another fundamental parameter to bear in mind is that not all air

treatment equipments withstand the installation of all filters available on the market. Each equipment manufacturer provides the technical characteristics of the filters that can be installed, and it is not possible to install others because they would not fulfill their purpose or the device would not work. This is because, for the filter to work, the air must be passed through it at a specific pressure, temperature, humidity, and speed, which not all air treatment equipments can achieve.
As mentioned above, it is necessary to filter the air that enters the building from outside, as indicated by our current regulations[320].

The minimum filtration classes to be used are determined based on the outdoor air quality (ODA) and the indoor air quality (IDA), and are identified in Table 5.

OUTDOOR AIR QUALITY	INDOOR AIR QUALITY			
	IDA 1	IDA 2	IDA 3	IDA 4
ODA 1	F9	F8	F7	F5
ODA 2	F7 + F9	F6 + F8	F5 + F8	F5 + F6
ODA 3	F7 + GF* + F9	F7 + GF* + F9	F7 + GF* + F9	F5 + F6

Table 5: Filtration classes.
* GF = Gas filter (carbon filter) and, either chemical or physical-chemical (photocatalytic) filter, which will only be necessary if ODA 3 is reached due to excess gases. Source: RITE

Outdoor air quality (ODA) is classified according to the following levels:

> **ODA 1:** pure air that is only temporarily polluted, such as by pollen.
>
> **ODA 2:** air with high concentrations of particulate matter and/or polluting gases.
>
> **ODA 3:** air with very high concentrations of polluting gases (ODA 3G) and/or particles (ODA 3P).

Regulations require filters to be installed based on the air quality in the city where the building is located and the indoor environmental conditions of the building. **When seeking to enable a space for staff with MCS, it is recommended to be more restrictive in the selection of filters and to increase the level of requirements based on workstation where the worker is placed.** The incorporation of a G4+F7 filter is also recommended to quantitatively improve the indoor environment.

Ultraviolet light

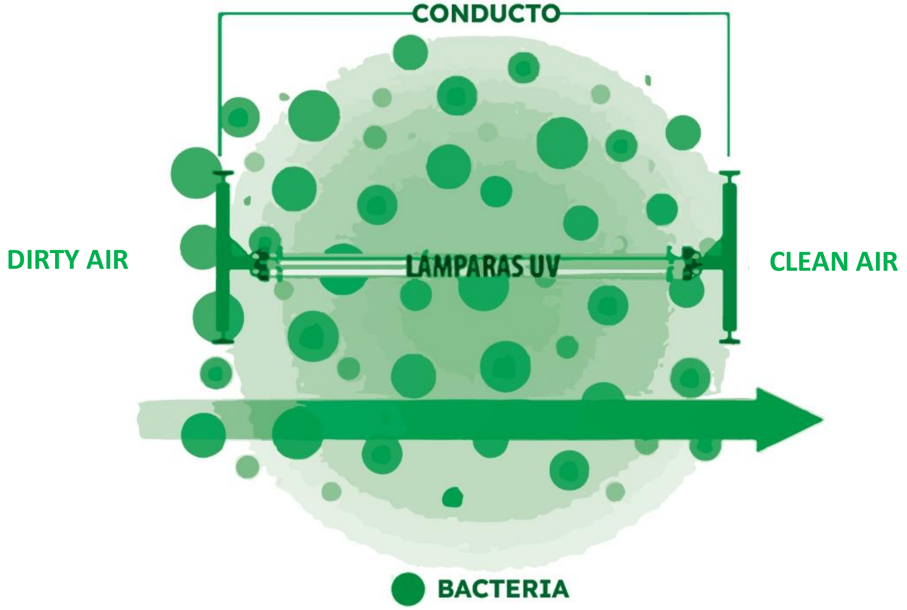

Figure 10

To increase the effectiveness of the filters, there is the option of including ultraviolet light lamps in the air ducting system, as shown in Figure 10.

It is a system based on the germicidal effect of ultraviolet light, which impacts the DNA of bacteria, viruses, mites, fungi, etc., and has a deactivating power that prevents them from continuing to reproduce. Due to its disinfectant and sterilizing properties in a clean process, it avoids the use of irritating chemicals. This solution is commonly used in other sectors such as medicine.

These lamps should be placed at strategic points where they can reach the entire air flow and allow for a specific exposure time to ultraviolet light. As with filters, light lamps must be placed in locations that allow for their use and do not pose a danger to humans, as they affect us directly.
Their installation requires a small study, as they need a certain air speed and flow rate for the solution to be effective. It is a highly recommended option for treating the air that enters spaces used by people with MCS.

Air conditioning system

An air conditioning system is a set of mechanical components that operate using different energy sources and are capable of modifying the temperature of the air they treat. In some cases, they can also modify the humidity or speed of the circulating air, among other parameters.

These systems can be found according to their technology.
The first term indicates how the outdoor unit works and the second how energy is transmitted to the indoor components:

Air-to-air: also known as direct expansion systems. They use outside air and with a refrigerant fluid they modify the quality of the indoor air. Their main characteristics are:

1. They are simple and the most economical option to install, which is why they are the most widespread.
2. They can heat and cool the air with the same installation.
3. They recirculate indoor air.
4. They are available as split systems, in their choice for homes and small spaces. This means that they have an indoor unit connected to the outdoor unit by refrigerant piping. This way, they have filters in the outdoor unit to protect the

machine and in the indoor unit for the same reason, and they should have filters to clean the indoor air.

5. They can also be installed in larger facilities when these have ducts that distribute the treated air from the outdoor unit to the indoor outlets. This means that the air passes through more areas that are less accessible, such as ducts that may not be accessible. It is important to clean these ducts regularly. In some cases, this solution allows for denser filters because filtering can be centralized in a mixed filtering and ventilation solution.

6. Other characteristics: they usually run on electricity and the cost of use fluctuates with the cost of electricity, they are very versatile in use, there is a wide variety on the market, etc.

Air-water: they use outside air and a refrigerant fluid to modify the temperature of an internal water circuit that is used by internal emitters such as underfloor heating, fan coils, radiators, etc., which are what temper the indoor air. Their main features are:

1. They have higher performance, which allows them to generate domestic hot water (hereinafter DHW).

2. They require a higher initial investment, but consume less at the same power in cold and heat.

3. In this case, the supply of outside air must be provided by a separate installation.

4. The interior filtration is in each emitter, so depending on the equipment in the room of the person with MCS, it may or may not allow the installation of the filters necessary to achieve the required air quality.

Water-water: this solution extracts energy from the external water and transfers it to an internal water pipe system that has emitters at its end point. The secondary circuit is similar to the previous case. Geothermal energy is an example of this type of system.

Characteristics:

1. Very versatile in the generation of cooling, heating, and DHW. Everything depends on the type of external energy.
2. Large initial investment but long-term savings, as it takes advantage of existing external energy potential, making it a renewable system.
3. The impact on workplace adaptation for a person with MCS is similar to the previous air-water case.

Water-air: these systems use water to transfer the temperature to a heat exchanger that transfers it to the air. The implications for a person with MCS are similar to the air-air system.

A mixed system, which filters the air and supplies outside air, is the Air Handling Unit. For a better understanding, refer to section for Air Handling Unit (AHU).
There is no specific recommendation for spaces used by people with MCS, as the important thing about these solutions is that they meet the necessary set parameters (temperature, humidity, filtration, etc.) and that they are easy to maintain and service.

Portable air treatment equipment

These portable air treatment devices are commonly known as air purifiers. They are presented as an alternative solution for spaces used by workers with MCS when the technical capacity of the existing installation in the building does not allow for integrated solutions, the ideal being to achieve a comprehensive technical solution for the entire building. This solution only affects the area where it is located and does not treat other areas such as corridors, bathrooms, etc., which the worker may need to use.

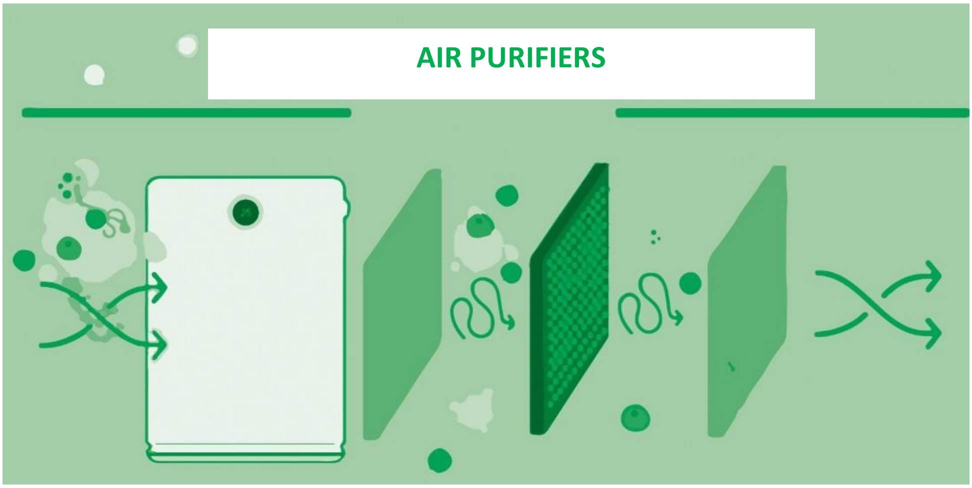

Figure 11

These are electrically powered devices that pass air through a series of filters distributed inside them, and depending on the specific characteristics of these filters, they treat the air by modifying its characteristics, capturing unwanted agents and returning the modified air to the room.

There are many devices sold on the market as air purifiers, ranging from devices that are integrated into ventilation systems to portable devices that can be moved from one room to another.
When choosing from the wide variety available on the market, it is important to consider at least the following characteristics:

Types of filters: it must allow the use of the filters necessary for the intended purpose. Not all air purifiers support HEPA[321] or activated carbon filters.

Filtering capacity: each device will have a defined volume of air that it can treat per hour. Therefore, it is essential to take into account the volume of air in the room where it will be working in order to choose the right device.

Maintenance: All units require ongoing maintenance and must come with instructions for use and maintenance to ensure proper operation. In addition to following the manufacturer's instructions, it is recommended to:

a. Follow the manufacturer's maintenance instructions. When adapting a workstation for a person with MCS, it is advisable to define who will be responsible for the maintenance and upkeep of the equipment.

b. Filters that are easy to find on the market. Make sure that the manufacturer's spare parts are available for purchase throughout the entire useful life of the device.

c. Easy-to-replace filters.

d. Probes. These devices use probes under which they operate. It is necessary to check periodically that they have not deteriorated.

Basic functions. It is recommended that the device has at least the following indicators, meters, and/or probes, which will allow it to:

a. Detect the need to change and replace filters when they have lost their effectiveness and warn when they need to be changed.

b. Measure the air quality in the room and be able to activate automatically according to the setpoint indications.

c. Schedule operation times, thus avoiding manual activation, which may not occur.

d. Multiple airflow speeds. Allows selection of both manual and automatic modes.

e. Alert when air quality exceeds certain thresholds, thus indicating that the space is not suitable for a worker with MCS.

Noise and vibrations: these devices contain fans and other components that emit noise and vibrations. It is very important to bear this in mind, because noise and vibrations are both environmental pollutants in themselves. The technical specifications will indicate the noise and vibration emissions of the device. It is necessary to bear in mind that this data is valid in optimal operating conditions and when the equipment is new, and will probably vary with use. They must have elements that prevent the transmittance of vibrations.

Air outlet speed: the aim is to ensure that air movement in the workspace is very low while it is occupied. This equipments should have optional user-selectable settings so that, for example, a high speed can be programmed when the room is empty, thus cleaning the room more quickly.

Outdoor air renewal. This feature is not usually available in portable equipment, so the room where a person with MCS works must have ventilation that allows the necessary air renewal per hour to be achieved.

Air intake. It is necessary to check the technical specifications for the maximum air intake distance allowed by the device. For example, in the case of a long room, it may not be able to reach all the air in the room. The temperature of the room also has an influence; it may be continuously drawing in the lowest air in the room, as warm air rises, so it is advisable to place it at mid-height, coinciding with the breathing height of the person with MCS.

Location: it should be installed in the best place according to the technical specifications. As the air intake and exhaust areas are very close together (they are in the same device), it does not generate cross ventilation, which is the optimal way for ventilation to work in a room. Therefore, it is very important to position it in such a way that it does not create air recirculation, or in other words, that the unit itself does not capture the air it expels. For this reason, it must be separated from walls or elements that obstruct the air inlet and outlet. It is also recommended not to place it next to other equipments or areas with volatile or diluted compounds, as this will shorten the life of the filters.

Avoid drafts that remove treated air from the room and introduce untreated air.

Do not use in particularly humid areas as this affects its performance, such as kitchens, showers, or similar rooms.

Programming for use. The time of use will be as necessary depending on the environmental needs of the location. It is recommended to turn it on before the person affected by MCS arrives so that the environment is prepared and correct upon their arrival.

Ionizing system. Sometimes these devices can emit an electromagnetic field in order to make dirt molecules heavier so that they fall to the floor. It is necessary to assess whether exposure to this electromagnetic field is appropriate, as it can be counterproductive for people with electrohypersensitivity.

Ozone generators. Purifiers that use this type of disinfection are not recommended. They work by transforming ambient oxygen (O2) into ozone (O3), which not only reduces the amount of O2 in the environment but also increases the amount of ozone, which is harmful to health.

Personal protective equipment. Masks and other

Masks

Masks are items that cover the mouth and nose of the worker, with the aim of protecting them from inhaling possible agents that are harmful to their health.
If these masks are used to carry out a work activity, they are considered PPE, with all the implications that this entails, and it should be remembered that they are the last resort for adapting a workplace and should never be proposed as the first option. They must not be treated with chemicals that could be transferred to the worker, nor should they shed any type of fiber.

Furthermore, it should be noted that most masks only filter particles up to a certain size, generally that of a virus, and are not effective in eliminating chemicals dissolved in the air. It should be noted that masks do not eliminate the risk or improve the environment in which the person is located; they only act as a barrier and prevent the inhalation of certain harmful agents.

They must have the characteristics, performance, and requirements that enable them to perform their air filtering function, but they must also be functional, non-intrusive, and allow the work activity to be carried out.

When choosing the mask, the following must be taken into account:

- The degree of protection required for the risk situation.
- Anatomical fit suitable for the person who will wear it. Choosing the right size and shape for the face is essential.
- Ensure that the mask does not interfere with work activities.
- Duration of use. Masks have a maximum duration of use, which may be reduced if the environment is heavily contaminated with unwanted agents. Ambient humidity is another factor to consider.
- It is recommended that workers who will wear them participate in the final decision.
- Ensure that masks have a quality mark certifying that they comply with the specified filtration requirements.
- Expiration date.
- Maximum usage time.
- Reusability. Some masks are reusable if certain actions are taken to enable this, such as cleaning and disinfection. The ease or complexity of these actions should be taken into account when choosing it.

There are various types of masks, which are commonly grouped from lowest to highest protection as follows:

Hygienic masks: these must comply with the UNE 0064 standard for non-reusable hygienic masks and the UNE 0065 standard for reusable hygienic masks for adults and children. This indication must appear on the label, otherwise the product has not been tested to comply with this specification. They are generally used for bacterial protection. An example can be seen in Figure 12.

Figure 12

Surgical masks: these are designed to prevent the spread of infectious agents. These masks only filter the exhaled air and are therefore not suitable for protecting workers with MCS.

Their purpose is the opposite, as they protect those around the person wearing the mask, preventing the spread of viruses when sneezing, coughing, or talking. Their bacterial filtration efficiency (hereinafter referred to as BFE) can be type I or type II.

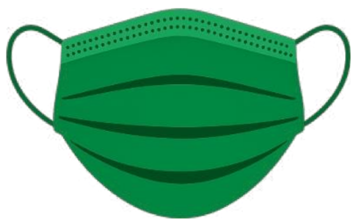

Figure 13

The reference standard used in their manufacture is UNE-EN 14683:2019+AC:2019, surgical masks. Requirements and test methods. These are shown in Figure 13.

High-efficiency masks: these masks filter the air you breathe, preventing contaminating particles from entering your body. They have filters that can be exchanged and chosen according to your needs and the manufacturer's specifications. There are different shapes and options, as can be seen in Figure 14. These are the ones recommended for workers with MCS. They are classified according to their degree of protection: FFP1 (78% efficiency), FFP2 (92% efficiency), and FFP3 (98% efficiency). The filters are classified as P1, P2, and P3, with P1 being the least efficient and P3 the most efficient. Masks are usually reusable, when indicated with an R, and it is the filters that are disposable and cannot be reused. The reference to the quality standard is UNE EN-149 for respiratory protection devices, which should be identified on the packaging.

Figure 14

In all cases, the manufacturer's instructions must be followed, such as maximum usage time, reuse, storage, or disposal.
Autonomous breathing apparatus is also an option. These are mentioned for information purposes only.

Other

It may be necessary to wear protective goggles to prevent the environmental agent from coming into contact with the eyes. In this case, they should be attached to the skin to prevent outside air from entering.

Air renewal elements

Ventilation providing outside air is necessary to achieve adequate indoor air quality. This ventilation can be achieved by:

Mechanical ventilation: controlling the supply and characteristics of the air at all times. This can be divided into:

a. **Single-flow system.** Mechanical extraction and natural intake: This allows the indoor air to be filtered but not the air entering the building. Not to mention the heat loss associated with this solution.

b. **Dual-flow system.** Mechanical extraction and intake. Filters the air inside the building and the outside air entering it. This is the most recommended solution because it allows for greater control of the air quality breathed by the building's occupants. Advantages:

    - It usually allows for higher indoor air quality due to the incorporation of filters.
    - Improves thermal comfort. Outside air is treated before entering the building.
    - Better energy efficiency. The thermal inertia of the air expelled to the outside is exploited.

Natural ventilation: ducts are designed using fluid mechanics to achieve the desired hourly air changes.

Below is an example of a very common piece of equipment in medium to large buildings that is used for ventilation and also allows air to be filtered, modifying its characteristics.

Air Handling Unit (AHU)

The air handling unit, commonly known as AHU, is a piece of equipment used to change the parameters of the air that passes through it. This device consists of a series of modules that perform different functions. These functions are air intake, mixing and impulsion, and treatment, and it is capable of modifying the characteristics of the air through filtering and temperature modification, and in some cases, it can even change the relative humidity of the environment.

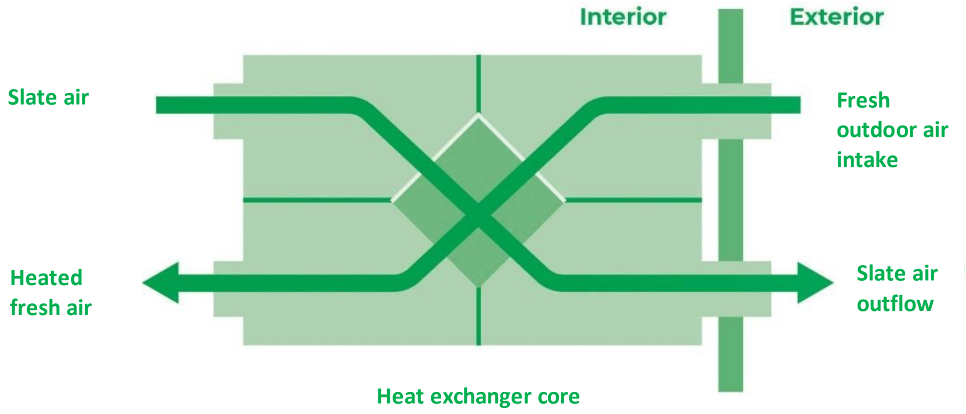

Figure 15

Due to how it works, it is usually placed at the top of buildings and uses ducts to create a system that allows it to reach the entire building.
This equipment must always be protected with a filter section, the class of which shall be that recommended by the manufacturer of the recovery unit; if no recommendation exists, they shall be at least class F6[322].

The most critical parts are the air mixing system and the parameterization. It is therefore recommended to keep the filters under close control to ensure that the air is mixed and treated correctly, and to monitor the operation of the probes, as these enable the equipment to measure the air parameters and consequently perform the actions for which they are parameterized. These probes deteriorate and/or become uncalibrated over time, and on other occasions the equipment becomes de-parameterized or loses setpoint data, meaning that the machine is unable to achieve the required air characteristics.

Materials in contact with the worker

In this case, it is estimated that the toxic substance enters the body through the eyes, mucous membranes, and skin. Therefore, the barriers to be used in this case are designed to protect these entry points.

The INSST has translated into Spanish a series of chemical agent control sheets from the advice provided by the Health and Safety Executive in its COSHH Essentials model, thus providing basic recommendations for good practices at work for different operations, in order to control exposure to hazardous chemicals in the work envirnment. These recommendations are for workers in general, but it is essential to bear in mind that people affected by MCS have a much lower tolerance to these chemicals, so it will be necessary to reduce exposure even further in these cases.

Toxins enter the body through the eyes, mucous membranes, or skin, causing damage that is additional to the harm caused by the toxin itself when inhaled. It is important to identify how harmful substances come into contact:

- The skin, mucous membranes, or eyes come into direct contact with the toxin in liquid, solid, aerosol, or immersion form.
- When the toxic material in the form of particles, vapor, or spray is deposited in the route of entry into the body.

- The dust or vapor may be generated as a result of work activity or incidentally.
- Touching surfaces that are toxic to people with MCS.
- Removing clothing contaminated with a product that is toxic to people with MCS. Either through contact with the eyes, mucous membranes, or skin, or because it volatilizes into the environment and is inhaled.
- Through splashes or ingestion.

If the contaminating product comes into contact with the hands of a worker with MCS, this toxin can spread to other parts of the body through rubbing or scratching, or by depositing it on clothing or surfaces that the person touches.

Control measures

In this case, we will focus exclusively on contact control, since inhalation has already been studied in the previous section. As these workers are highly sensitive to exposure to products, it is essential to control the materials that come into contact with them.

When selecting products for spaces that will be used by workers with MCS, and those that may be worn as uniforms, accessories, and even tools, it is essential to study their degradation, as this is how the toxin affects the worker.

All materials will degrade, but the influence on workers with MCS depends on the speed and form of degradation. Therefore, it is recommended to use products that degrade very slowly and that in their manufacture do not contain other rapidly degrading by-products or volatilize particles into the air.

Therefore, the recommendation is based on the use by the worker:

Clothing: if the worker has to wear any type of uniform, it must meet the needs of a person with MCS. Therefore, uniforms, work coats, or similar items should be made of natural fibers such as organic cotton, wool, or linen, with non-toxic dyes, preferably organic. It is essential that this clothing be washed with MCS-friendly soaps and be free of fragrances.

Work tables: Untinted glass tables without any type of covering are recommended, provided they are not exposed to actions that could damage them. This material is one of the most stable on the market in terms of decomposition or emission of particles into the environment, and its degradation can take thousands of years. Wooden tables are not recommended, as they are not 100% natural and are treated with chemical compounds that prolong the life of the wood, as well as dyes, varnishes, or paints that can peel or evaporate. At first instance, the use of metal tables is also not recommended, as they are often treated with by-products to prolong their durability with compounds that are toxic to a person with MCS, as well as oils or similar substances.

Tools or items to be used with the hands: depending on the tolerance or degree of impairment of a person with MCS, the use of gloves may be recommended to avoid direct exposure to the toxins that may be released by this type of instrument.

It will be necessary to take into account the installation of different materials in the workspace. Their placement may cause elements to volatilize into the environment, so it is recommended to study the time frames for incorporation into the workplace by a person with MCS. It is important to analyze indirect poisoning, which occurs when workers with MCS perform other activities in the work environment, but not for directly performing their job. This is the case with using the toilet or eating, for example, which are actions that can introduce chemicals into the body that affect the health of the worker.

Outdoor work

In the case of workers outdoors, it should be remembered that they must comply with the parameters identified above. In outdoor work, as classified by the INSST, it focuses its efforts on drawing up a list of preventive measures to avoid the harmful effects of heat and cold, as well as solar radiation in outdoor work. As an example, the following box lists the measures to be taken during the summer.

1. Acclimatize to the heat gradually
2. Plan work to avoid or reduce exposure during midday hours
3. Provide shaded rest areas and take breaks more frequently
4. Adapt the pace of work
5. Stay hydrated
6. Wear loose-fitting, breathable clothing
7. Cover the head and protect the eyes by wearing hats and sunglasses, for example
8. Apply sunscreen and reapply it regularly
9. Avoid working alone
10. Call 112 if heatstroke is suspected

As can be seen, it is a matter of protecting oneself from temperatures and solar radiation, a situation similar to other seasons of the year. People affected by MCS may be more sensitive to these external agents than the INSST suggests, so it will be necessary to monitor these measures closely. The clothing, hats, sunglasses, etc., used must be suitable for people with MCS, as must sunscreen.

Other actions

In order to maintain adequate indoor air quality for all workers in general and specifically for those suffering from MCS, in addition to having adequate facilities that allow the indoor air quality identified in the previous points to be achieved and its maintenance in accordance with actual needs, other actions can be taken to promote optimal indoor air quality:

- Avoid using chemicals indoors, such as non-natural cleaning products, air fresheners, paints, etc.
- Avoid materials that release volatile organic compounds into the environment during their lifetime and/or degradation, such as formaldehyde or similar substances.
- Avoid using equipments or items or performing actions that may introduce any type of pollutant or smoke into the indoor environment, such as the use of butane stoves, the introduction of combustion gases into the interior through the opening of windows in areas with high vehicle traffic, smoking areas, or near fireplaces, the creation of smoke from burning incense or candles, etc.
- The cleaning equipments used inside the building and the way they are used should aim to avoid stirring up particles settled on surfaces and to retain them, such as vacuum cleaners with suitable filters, mops, or damp cloths that retain particles, among others.
- Cleaning items, such as cloths, mops, etc., should only be used in the area where the worker with MCS is located. This prevents these items from becoming contaminated if cleaning products (cloths, rags, mops, etc.) are used in the rest of the building.

- The determination and scope of the area used by workers with MCS must always take into account common areas, such as bathrooms, as these are usually spaces that are cleaned with powerful disinfectants and are poorly ventilated, as well as the rest area, where aggressive cleaning products for people with MCS are also often used.
- If the same cleaning products are not used in the space used by the worker with MCS and in the rest of the building, it is necessary to specifically analyze the air flow in the building in case unwanted contamination could occur.
- It is recommended that, during the cleaning of the building, the worker with MCS is not present and that a reasonable amount of time passes so that any particles that may have been released by this activity have settled.
- When rooms do not have forced interior ventilation or when it is insufficient, it is recommended to carry out natural cross ventilation through windows if the quality of the outside air allows it. In this case, the entire building must meet the same standards of cleanliness and indoor air quality because air flows from other areas of the building will occur.
- Avoid adding moisture to the environment. If there are areas with these emissions, such as showers, kitchens, laundry rooms, etc., they should be adequately ventilated and sectioned off so that moisture is not transferred to the rest of the building.
- Use materials that retain as little dust and moisture as possible and that allow for easy and regular cleaning. It is recommended to avoid the use of certain carpets, fabric curtains or blinds, rugs, panels from freeze-dried plants, porous materials, or similar.

- The use of natural plants indoors may be appropriate because they filter certain pollutants, but always controlling the ambient humidity that they may generate on the space where they are located.
- It is recommended to actively ventilate the area where the person with MCS is located while the person is not using the space, and to wait at least one hour after doing so, in order to achieve a suitable environment before use and avoid airborne particles. This can be done with clocks on the control panels or settings on the control panels of the facilities.
- The use of the same space by third parties not affected by MCS must be dealt with organizationally within the entity, as they may contaminate the clean environment required by the person with MCS.
- It is appropriate to share with the person affected by MCS all the measures to be implemented in their workplace to adapt it to their use, as he/she, as the person most interested and knowledgeable about his/her condition, can make suggestions to improve the adaptation of the workplace.

We emphasize the fundamental need to have an adequate design of the space and facilities that will be occupied by workers with MCS, choosing materials and technical solutions that meet their needs, just as it is essential to have optimal maintenance of the facilities and environment.

It is essential to have elements, systems, or equipments that achieve the level of safety and health in the workplace described above, which is necessary for people affected by any pathology, but it is also essential to have a maintenance and performance verification plan for this equipment, systems, or implemented solutions, to ensure that the measures established are sustained over time.

The option of teleworking is always available, but it should be the last resort, only when the degree of impact on the worker with MCS makes any other alternative impossible and all technical and organizational measures have been taken in the workplace. It is necessary to treat all workers without discrimination and give them the same opportunities for personal and professional development[323]. This is conveyed to us by our Constitution as a fundamental right: "Spaniards are equal before the law, without discrimination on the basis of birth, race, sex, religion, opinion, or any other personal or social condition or circumstance"[324].

The means of transportation to and from the workplace to the home or residence of the worker affected by MCS should also be taken into consideration in the adaptation of the workplace, as the use of an inadequate means of transportation can also affect the health of the worker.

Relationship between work performance and indoor air quality

A study conducted by the Harvard School of Public Health[325], which focused on indoor air quality and its relationship to productivity in the workplace, revealed that good air quality increases worker productivity by 8%. It also increases cognitive performance by 60% and improves sleep quality by 6.4%.

However, not only does good indoor air quality in buildings have a direct relationship with worker productivity, but it also reduces absenteeism by 20%.
The study consisted of analyzing the concentration and cognitive ability of workers by placing them in various scenarios where indoor environmental factors were altered.

In one scenario, ventilation was increased, reducing carbon dioxide levels and eliminating all toxic products commonly found in an office. In another case, one group of participants was studied in a normal office environment, while another group was placed in a VOC-free space.

The study concludes that a workplace with inadequate ventilation has a negative impact on the cognitive functions of the workers who are there. The explanation is that if the volume of air is fixed, for example in a room where people are working, there will be more pollutants and less oxygen, and therefore the brain will be less oxygenated and its performance will decline. It can therefore be concluded that the indoor air quality of buildings affects not only people with MCS, but the entire population in general.

Conclusions

The effects of toxins on a person with MCS can occur through different routes of contact and are aggravated when the exposure time increases or environmental conditions favor absorption.

In terms of exposure, the route with the greatest impact is air, but it is necessary to take into account other routes of access that allow the absorption of toxins.

Certain professions are particularly affected by MCS, such as cleaning and hairdressing staff. It is suggested that the physiological profile of workers is common to other professions, but that in this case they develop the disease to a greater extent, so it is likely that exposure to these toxins over time can cause apparently healthy people to become ill. It is also likely that there are several routes of entry for toxins into the bodies of these workers, so measures should be taken to implement barriers to prevent access to their bodies and improving the workspace, as proposed here. It is also important to take into account the worker's commute to the workplace, as the working environment may be completely suitable for a person with MCS, but the means of transport may not be.

It is essential to conduct a specific study of each individual, as every patient is different, to understand the degree to which they are affected by MCS, to know which compounds affect them most, and to identify any associated pathologies they may have developed, in order to determine the best measures to implement. For example, if they have developed asthma but their digestive system is not affected, the toxin is probably having the greatest impact through the airways, although to reach this conclusion it is necessary to know the person and the measures they take in their daily life.

In general, it is recommended to adequately control the air quality in workspaces, use natural materials, and, if natural materials are not available, at least choose materials that degrade slowly.

Reference to the images used in the chapter:

Figure 1: Particulate matter (PM10 and PM2.5). Source: https://airedemadrid.madrid.es

Figure 2: Source: https://echa.europa.eu/es/support/substance-identification/what-is-a-substance

Figure 3: Source: https://echa.europa.eu/es/support/substance-identification/what-is-not-a-substance

Figure 4: Distribution diagram of an AHU. Source: https://www.caloryfrio.com/construccion-sostenible/

Figure 5: Main indoor air quality pollutants in offices and how they move through the building. Source: https://envira.es/calidad-aire-interior-oficinas/, taken from INSST.

Figure 6: How cross ventilation works. Source: https://irpen.wordpress.com/2021/01/25/ventilacion-en-recintos-shared/

Figure 7: Spaces with poor ventilation. Source: https://www.agenciasdecomunicacion.org/

Figure 8: Relationship between particle size and their entry into the body. Source: https://www.solerpalau.com/

Figure 9: Source: Anikasa

Figure 10: Air purification by ultraviolet light. Source: https://www.atborealis.com/sistemas-ultravioleta/

Figure 11: Representation of an air purifier. Source: https://www.caloryfrio.com/construccion-sostenible/

Figure 15: Source: https://tecna.es/ventilacion-mecanica-controlled/

298
The International Labor Organization (ILO) is dedicated to promoting social justice, internationally recognized human and labor rights, pursuing its founding mission: social justice is essential for universal and lasting peace. and lasting peace. As the only tripartite agency of the UN, the ILO brings together governments, employers, and workers from 187 Member States to set labor standards, formulate policies, and develop programs promoting decent work for all, women and men." See https://www.ilo.org/es/acerca-de-la-oit

299
Law 31/1995, of November 8, on the prevention of occupational hazards. Head of State. "BOE" No. 269, of November 10, 1995. Reference: BOE-A-1995-24292 https://www.boe.es/buscar/act.php?id=BOE-A-1995-24292

300
Royal Legislative Decree 2/2015, of October 23, approving the revised text of the Workers' Statute Law. Ministry of Employment and Social Security. "BOE" No. 255, of October 24, 2015. Reference: BOE-A-2015-11430 https://www.boe.es/buscar/act.php?id=BOE-A-2015-11430

301
In this chapter, the terms "work condition" and/or "workplaces" shall have similar meanings.

302
"When this Law refers to workers and employers, these terms shall also be understood to include, respectively, on the one hand, personnel with an administrative or statutory relationship and the public administration for which they provide services, under the terms expressed in the third additional provision of this Law, and, on the other hand, the members of the cooperatives referred to in the previous paragraph and the cooperative societies for which they provide their services." (L 31/95, art. 3.1, second paragraph). This definition of employer is taken as a reference throughout the chapter.

303
Royal Decree 39/1997, of January 17, approving the Regulation on Prevention Services. Ministry of Labor and Social Affairs. Official State Gazette (BOE) No. 27, of January 31, 1997. Reference: BOE-A-1997-1853. https://www.boe.es/buscar/act.php?id=BOE-A-1997-1853

304
PM10: suspended particles with an aerodynamic diameter of up to 10 µm. PM2.5: suspended particles with an aerodynamic diameter of up to 2.5 µm.

305
Relative humidity is the ratio between the amount of water vapor contained in the air (absolute humidity) and the maximum amount of water vapor that the air can contain at that temperature (absolute saturation humidity).

306
Source: https://www.who.int/news-room/fact-sheets/detail/household-air-pollution- and-health

307
Source: Ministry of Labor and Social Affairs, National Institute for Occupational Safety and Health. "Occupational Risk Assessment."

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Royal Decree 486/1997, of April 14, establishing minimum health and safety requirements in the workplace. Ministry of Labor and Social Affairs. Official State Gazette (BOE) No. 97, of April 23, 1997. Reference: BOE-A-1997-8669. https://www.boe.es/buscar/act.php?id=BOE-A-1997-8669

309
Royal Decree 1027/2007, of July 20, approving the Regulation on Thermal Installations in Buildings. Ministry of the Presidency. "BOE" no. 207, of August 29, 2007. Reference: BOE-A-2007-15820. Technical Instruction IT 1.1.4.2.2 Indoor air quality categories based on building use. https://www.boe.es/buscar/doc.php?id=BOE-A-2007-15820

310
Royal Decree 1027/2007, of July 20, approving the Regulation on Thermal Installations in Buildings. Ministry of the Presidency. "BOE" no. 207, of August 29, 2007. Reference: BOE-A-2007-15820. Technical Instruction IT 1.1.4.2.5 Extraction air.

311
Source: https://echa.europa.eu/es/about-us/who-we-are/organisation

312
ECHA (European Chemicals Agency)

313
Sources:
https://www.sfcsqm.com/ https://confesq.org/
https://echa.europa.eu/es/home
https://docs.wixstatic.com/ugd/bb48a3_12673556610f4a96b0062be2ec8cfef9.pdf

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Government of Spain. Ministry of Labor and Social Economy. National Institute for Occupational Safety and Health. "Occupational exposure limits for chemical agents in Spain. 2024." January 2024. Legal deposit: M-2620-2024. Access: https://www.insst.es/documents/94886/6896817/LEP+2024.pdf/2da36018-5d52-12e7- 3b6a-d99544aa5a07?t=1708070663412

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Royal Legislative Decree 8/2015, of October 30, approving the revised text of the General Social Security Law. Ministry of Employment and Social Security. "BOE" no. 261, of October 31, 2015. Reference: BOE-A-2015-11724. Art. 156. https://www.boe.es/buscar/act.php?id=BOE-A-2015-11724

317
Royal Legislative Decree 8/2015, of October 30, approving the revised text of the General Social Security Law. Ministry of Employment and Social Security. "BOE" no. 261, of October 31, 2015. Reference: BOE-A-2015-11724. Art. 157.

318
Royal Decree 773/1997, of May 30, on minimum health and safety requirements for the use of personal protective equipment by workers. Ministry of the Presidency. Official State Gazette (BOE) No. 140, of June 12, 1997. Reference: BOE-A-1997-12735. https://www.boe.es/buscar/act.php?id=BOE-A-1997-12735

319
Royal Decree 1027/2007, of July 20, approving the Regulation on Thermal Installations in Buildings. Ministry of the Presidency. "BOE" No. 207, of August 29, 2007. Reference: BOE-A-2007-15820. IT 1.1.4.2.4 Filtration of minimum ventilation outdoor air. Art. 4 and 5.

320
Royal Decree 1027/2007, of July 20, approving the Regulation on Thermal Installations in Buildings. Ministry of the Presidency. Official State Gazette (BOE) No. 207, of August 29, 2007. Reference: BOE-A-2007-15820. IT 1.1.4.2.4 Filtration of minimum ventilation outdoor air. Art. 1. Outdoor ventilation air shall be introduced into buildings after being properly filtered.

321
HEPA stands for High Efficiency Particulate Air. These are air filters that can capture up to 99.95% of pollen, dust, mold, or other particles circulating in the environment that are up to 0.3 microns in size.

322
Royal Decree 1027/2007, of July 20, approving the Regulation on Thermal Installations in Buildings. Ministry of the Presidency. "BOE" no. 207, of August 29, 2007. Reference: BOE-A-2007-15820. IT 1.1.4.2.4 Filtration of minimum ventilation outdoor air. Art. 8.

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Spanish Parliament. "The Spanish Constitution," Art. 14. 1978, Last update published on 02/17/2024. "BOE" no. 311, dated 12/29/1978. Access: https://www.boe.es/buscar/act.php?id=BOE-A-1978-31229

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Adaptation of work environments and workstations

For Electrohypersensitivity

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CEMPROTECTA

3.2

Electrohypersensitivity in the work environment

All environmental illnesses are influenced by various risk factors present in the environment.

Electrohypersensitivity (EHS), like all other so-called environmental illnesses, is influenced by three groups of risk factors (also called exposomes).
If we work to minimize the negative effect of these risk factors, we contribute to improving the health of the person affected by the disease.

These three groups of risk factors are clearly defined by the biology of the habitat:

Physical risk factors (electromagnetic fields)
Chemical risk factors
Biological risk factors

In order to properly adapt a workplace for people affected by electrohypersensitivity, it is very important to consider the three groups as a whole, but of the three, the group that has the greatest influence is the one that describes physical risk factors. In the second part of this chapter, we will describe these physical factors, other related risk factors, and what measures we should take to minimize their negative effect on electro hypersensitive people. We will not describe chemical risk factors because these are covered in a separate chapter of this book.

Adapting a workplace for people suffering from electrohypersensitivity always poses challenges due to the specific characteristics of the workspace.

We can quantify how safe a work environment is for a person with electrohypersensitivity by using limit values that have been largely agreed upon by the scientific community interested in the phenomenon of electrohypersensitivity.

In this chapter, we will mainly use the limit values recommended by the **EUROPAEM EMF Guideline 2016**[326], which specifies general exposure limit values according to the type of electromagnetic field to be considered and, more importantly, includes specific limit values for sensitive individuals.

As the EUROPAEM EMF Guideline 2016 does not provide recommended limit values for additional physical risk factors such as continuous electric fields, continuous magnetic fields, radioactivity, geological disturbances, indoor air quality, mold, and bacteria, we will apply the values described in the German technical standard for habitat biology, SBM-2024[327], which provides them.

Not significant	Slightly significant	Highly significant	Extremely significant
< 0,3 V/m	0,3 - 1,5 V/m	1,5 - 10 V/m	> 10 V/m

Graph 01.
Limit values for alternating electric fields (potential-free) according to SBM-2024

Not significant	Slightly significant	Highly significant	Extremely significant
< 20 nT	20 - 100 nT	100 - 500 nT	> 500 nT

Graph 02. Limit values for alternating magnetic fields according to SBM-2024

Not significant	Slightly significant	Highly significant	Extremely significant
< 0,1 μ/m^2	0,1 - 10 μ/m^2	100 - 1.000 μ/m^2	> 1.000 μ/m^2

Graph 03. Limit values for electromagnetic waves according to SBM-2024

Although the EUROPAEM EMF Guideline 2016 and SBM-2024 cover almost all physical risk factors that can affect a person with electrohypersensitivity, there are currently no official recommended limit values for electromagnetic interference (also known as "dirty electricity") of the conducted, radiated, or combined type.

Conducted interference is any interference that travels through the electrical wiring of an installation. Radiated interference, on the other hand, is interference that emanates from a generating element at a significant distance, as if it were a wave. In a combination of the two, the properties of both can be observed acting at the same time.

However, the North American professional biology community has proposed a table of limit values for conducted interference, based on experience in assessments for electro hypersensitive individuals, which we include here because it is a physical risk factor that is increasingly present in the workplace.

No significativo	Débilmente significativo	Fuertemente significativo	Extremadamente significativo
< 50 mVpp	50 - 250 mVpp	250 - 2.000 mVpp	> 2.000 mVpp

Graph 04. Limit values for conducted electromagnetic interference

Verification of whether exposure values in a workplace are safe for electro hypersensitive individuals is achieved through the use of professional meters that can provide reliable values, which we will then compare with those recommended in the EUROPAEM EMF Guideline 2016 for sensitive individuals and in SBM-2024 for values within the non- significant range.
The EUROPAEM EMF Guideline 2016 is an initiative of the working group on electromagnetic fields of the European Academy for Environmental

Medicine in which renowned scientists come together to define the problem of the disease known as electrohypersensitivity, providing a theoretical basis for its description and offering reference limit values for affected individuals.

The latest version of the SBM-2024 technical standard is an initiative of the Institut für Baubiologie und Nachhaltigkeit IBN (Institute for Building Biology and Sustainability IBN) to establish reference limit values originally for rest areas, divided into four ranges for people affected by Electrohypersensitivity.

We believe that applying the values in the non-significant range, whenever possible, would be most appropriate.

The Institut für Baubiologie und Nachhaltigkeit IBN was founded in 1976 in Germany as a result of the joint work of a group of geophysicists, architects, chemists, biologists, and engineers who decided to define the factors that make a healthy living space and its surrounding environment possible.

Need for limit values

It is very important to work with recommended limit values for people affected by electrohypersensitivity and, therefore, it is essential to use those described in the EUROPAEM EMF Guide 2016 and the SBM-2024 values when we cannot find reference limit values for certain risk factors in the EUROPAEM. Below, we define the recommended limit values for each of the physical risk factors that determine a workplace adapted to a person suffering from electrohypersensitivity.

Alternating electric fields

The alternating electric field is measured in volts per meter (V/m).

- For alternating electric fields with frequencies between 15 Hz and 3,000 Hz, the recommendation is not to exceed 0.3 V/m.
- For alternating electric fields with frequencies between 3 kHz and 300 kHz, the recommendation is not to exceed 0.01 V/m.

Grounding

The grounding system must be correctly installed and have a ground resistance value below 6 ohms.
It must also be free from significant electromagnetic interference.

Alternating magnetic fields

The alternating magnetic field is measured in nanoteslas (nT).

- For alternating magnetic fields with frequencies between 15 Hz and 3,000 Hz, the recommendation is not to exceed 30 nT.
- For alternating magnetic fields with frequencies between 3 kHz and 300 kHz, the recommendation is not to exceed 0.3 nT.

Electromagnetic interference

At present, conducted electromagnetic interference (commonly referred to as "dirty electricity") does not have recommended limit values in either SBM-2024 or the EUROPAEM EMF Guide 2016. However, in the United States, recommended limit values have been suggested for conducted

electromagnetic interference (those present in the wiring of electrical installations), based on the experience of conducting hundreds of assessments for electro hypersensitive individuals.
We have compared the results of our electromagnetic interference assessments with those obtained by professionals in the United States and concluded that the limit values they recommend are perfectly consistent with our experience.
It should be noted that, at present, no limit values have been suggested within the community of habitat biology specialists for radiated electromagnetic interference (that which can propagate through the air and have a very definite effect within a given radius of action). This is a field of research that still needs to be explored in greater depth, and we hope that a multidisciplinary approach will be able to offer recommended limit values in the very near future.

The recommended exposure limit values would be as follows:

For conducted electromagnetic interference with frequencies above 10 kHz, the amplitude (signal intensity) should not exceed 250 mVpp (millivolts peak to peak).

Electromagnetic waves

The recommended exposure limit values are as follows: Electromagnetic waves are measured in microwatts per square meter (µW/m2).

- For electromagnetic waves with frequencies between 30 MHz and 300 GHz, the recommendation is not to exceed 0.1 µW/m2.
- For limit values for electrostatics, magnetostatics, radioactivity, lighting, geological disturbances, and indoor environment (RH%, carbon dioxide, and ions), we need to use technical standard SBM-2024.

Continuous electric fields

Continuous electric fields are measured in volts (V), and the recommended exposure limit values are as follows:

> For surface voltages, values should be below 100 V and have a discharge time of less than 10 seconds.

Continuous magnetic fields

Continuous magnetic fields are measured in microteslas (µT), and the recommended exposure limit values are as follows:

> For flux density differences (in metallic elements), values should be below 1 µT (microtesla).

Radioactivity

Gamma radiation is measured in nanosieverts per hour (nSv/h) and the recommended exposure limits are as follows:

> - For gamma radiation, an increase in the pulse rate or dose (as a percentage) is considered, and the percentage increase should be below 50%.
> - For radon gas concentration, the recommendation is not to exceed 30 Bq/m3.

Geological disturbances

The recommended exposure limits are as follows:

> For terrestrial radiation disturbance (as a percentage), the percentage should be less than 10%.

Acoustic waves

For airborne noise, impact noise, and structural acoustic transmission, the weighted sound pressure levels should be as follows for dB(A), dB(C), and dB(Z): less than 25 dB(A), less than 32 dB(C), and less than 35 dB(Z), respectively. dB(A), dB(C), and dB(Z) are weighted scales that provide different types of information. The weighted scale dB(A) is normally used to evaluate the effect of sound in the range audible to humans.

When frequencies are below 20 Hz, it is mandatory to evaluate dB(Z) values, which provide more information about the actual levels of infrasound in the workplace. The weighted dB(Z) scale evaluates the presence of linear decibels. We can only evaluate the actual effect of infrasound on health if we measure the sound pressure in a medium using linear decibels.

Lighting

Natural lighting should always be preferred**.**

As for **artificial lighting**, the light spectrum should be:

> Homogeneous or continuous, without marked peaks and without significant blue light content, with a high color rendering index (above 95) and, if possible, with a high near-infrared component.

Flicker must be 0%.

Lighting used indoors should always be adjusted to the time of day when we perform tasks at our workplace:

- 100-100,000 lux during the day
- 10-100 lux in the evening
- less than 1 lux at night.

The color temperature during the day should be 4,000-6,000 K (Kelvin) and 1,500-3,000 K in the evening.

Indoor environmental quality

The recommended exposure limits would be as follows:

- For relative air humidity (RH, as a percentage), the recommended range would be between 35% and 55% relative humidity.
- For carbon dioxide, CO_2, the recommended value would be below a concentration of 700 ppm (parts per million).
- For small ions (per cubic centimeter of air), the recommended value would be above 500/cm^3.

Mold and bacteria

The recommended exposure limit values would be as follows:

> For moulds and their spores, as well as its metabolites, the size of the infestation (surface area in square centimeters) must be **0 cm^2.** Mold hyphae, spore-producing structures, or microscopically detectable spores per square centimeter should not be detected.

Likewise, there are species of mold that are more toxic than others. For example, the presence of Aspergillus penicilloides, Aspergillus versicolor, Chaetomium globosum, Stachyobryus chartarum, and Wallemia sebi species has a high probability of causing inflammation and a clear suppression of the immune system.
The bacterial count should be similar to or lower than that found outdoors. There should be no contamination with bacterial metabolic products (endotoxins, MVOCs, etc.). In the case of particularly critical germs such as pseudomonas, legionella, actinomycetes, or actinobacteria, they should not be detectable or only minimally detectable in the air, materials, drinking water, hygiene areas, bathrooms, and kitchens.

	Not significant	Slightly significant	Highly significant	Extremely significant
Size of the infestation surface in square centimeters cm^2	0	0 - 20	20 - 5000	> 5000
Mold hyphae, spore-producing structures, or microscopically detectable spores per square centimeter cm^2	None	Isolated	Many	In large quantities

Graph 05. Limit values for molds and their spores, as well as their metabolites

Lowest possible values

In all cases of workplace adaptation, the objective is to achieve a workplace with the lowest possible exposure values.

Workstation adaptation

Definition of the scenario

Both the descriptions given of risk factors and the measures to be implemented to adapt the workplace for an electro hypersensitive person are based on an indoor workplace scenario, given that outdoors many variables would come into play that would be extremely difficult to control. However, we are convinced that many of the measures to be implemented can be adapted to outdoor workplaces. We would like to make it clear that adapting a workplace involves first assessing its specific characteristics and seeking solutions that result in the lowest possible exposure for the affected person using the minimum use of resources. In most cases, the most complex solutions are not always the best solution, which is why we should make it very clear that a solution based on shielding should always be the last measure to be applied when other measures have not worked.

Alternating electric fields

Alternating electric fields are produced when we use an electrical network where the flow of electrons takes the form of a wave (of a sinusoidal type) that changes (or alternates) polarity, repeating fifty times per second. This same change in polarity generates a specific frequency of 50 Hz (fifty repetitions of polarity change) in the voltage supplied by the Spanish electrical network.

Such rapid polarity changes are interpreted by our bodies as a highly destabilizing physical element, requiring us to constantly adapt and generating continuous stress.

The stress produced by a change in polarity or alternation, especially when we are exposed to a low-frequency electromagnetic field, induces parasitic currents and associated electric fields that end up circulating throughout the body, which in turn interact with nerves and muscle tissue[328].

It is important to remember that exposure values to these alternating electric fields decrease with the square of the distance, so the distance we are from these fields is crucial to avoid any type of exposure.

In the Spanish electricity supply network, the frequency of the electricity we use in our workplaces should always be 50 Hz, but since the electrical quality of the grid is never optimal, in the best case scenario we can expect to see frequencies well above 50 Hz, normally reaching up to 1,500 Hz.

Normally, in the workplace, we can detect alternating electric fields whenever we are near any electrical cable or accessory that forms part of the electrical installation. Therefore, they will be more present near light fixtures, power outlets, plugged-in electrical appliances, junction boxes, electrical panels and sub-panels, etc.

Any electrical appliance plugged into a power outlet will always have an alternating electric field running through the appliance itself, as well as through the plug that connects it to the power outlet. However, this alternating electric field is greatly reduced when the electrical appliance is grounded.

Alternating magnetic fields

As in the case of alternating electric fields, alternating magnetic fields are also produced when we use the electrical grid, but in this case, for an alternating magnetic field to occur, there must be a current flow, for example, an electrical or electronic device that is in operation consuming power. Alternating magnetic fields are directly proportional to the alternating electric current produced.

Therefore, the greater the current, the greater the alternating magnetic field produced. Similar to alternating electric fields, the use of distance to minimize the effects of alternating magnetic fields also applies to this type of field. In the case of alternating magnetic fields, this is very important, since we will always try to distance ourselves before using other solutions, as the alternating magnetic field can easily pass through building materials without suffering any reduction, and the strategy of grounding has no effect on this type of electromagnetic field.

When distancing does not fully work, the only option is to completely shield the generating source by enveloping it entirely, but in most cases this is not technically feasible, added to the high price per linear meter of any specific shielding material for alternating magnetic fields.

Electromagnetic interference

When we use electrical appliances that contain a high amount of electronics and are optimized for energy saving, we always have to expect them to add a large amount of electromagnetic interference through the wiring of the electrical installation (conducted interference), as well as interference traveling through the air (radiated interference) or a combination of both. Such electronics produce non-linear loads, loads where the voltage wave (electrical component) is out of phase with the current wave (magnetic component). This phase shift creates distortions in the form of harmonics (multiples of the 50 Hz frequency) and transients (extremely high voltages and currents, but of extremely short duration).

It has been shown that it is the transients that ultimately affect human biology and the health of electro hypersensitive people[329]. This type of interference is actually intermediate frequency electric and magnetic fields, halfway between low frequency and high frequency, which means they share certain characteristics of both. Their frequencies are usually in the kilohertz range (thousands of hertz) and create a window of maximum biological impact[330].

In this chapter, we will focus exclusively on the characteristics of conducted electromagnetic interference and how to eliminate it, since the knowledge we have in habitat biology of radiated electromagnetic interference and its effect on electro hypersensitive people is still very limited.

This electromagnetic interference is also known as "dirty electricity" because it reduces the electrical quality of any electrical installation, adding components that should not be present, since the electrical wiring in a home is optimized to withstand a frequency of 50 Hz and such interference adds frequencies in the range of thousands of hertz, turning the electrical wiring into an emitting element, as if it were a large antenna. As the frequency passing through a cable increases, there is an increase in the surface current density in the cables, moving towards the outside of the cables and no longer concentrated inside them. This phenomenon is known as the skin effect in electrical wiring.

Electromagnetic waves

What we call electromagnetic waves are electromagnetic fields with a high frequency that can be transmitted through a medium such as air. When this happens, the electrical and magnetic components behave as a single unit. This unit has, on one side, the electrical component moving in the vertical plane and, on the other, the magnetic component moving in the horizontal plane.

What we call wireless communication technologies are a clear example of electromagnetic waves where an electromagnetic field is transmitted through the air carrying information. Examples of such technologies include: mobile phones, radars, WiFi, Bluetooth, DECT for domestic cordless telephony, LoraWan for smart water and gas meters, devices prepared for the Internet of Things, etc. For people with electrohypersensitivity, this type of electromagnetic field is much more intrusive than low-frequency fields because its impact does not diminish as easily with distance, meaning that the source of emission could be a neighboring building or a cell phone base station 1 kilometer away.

Continuous electric fields

Continuous electric fields, also known as static electric fields, occur superficially when there is an accumulation of electric charges on an object. Unlike alternating electric fields, they have no frequency and can be produced artificially or naturally. Ionization is a factor that conditions the appearance of this type of field when molecules become electrically charged, turning into ions through the gain or loss of electrons.
For this very reason, there are objects or materials that charge more easily, generating high-voltage electrostatic charges (discharge shocks are noticeable from 2,000 volts onwards) to which an electro hypersensitive person may be exposed, especially when approaching or touching such objects or materials. All synthetic objects or materials have the ability to retain electrostatic charge on their surface; the less natural they are, the greater their ability to retain it.
To this fact, it should be added that people with electrohypersensitivity suffer from a marked imbalance of minerals that makes their skin extremely dry. This is because, having been continuously exposed to electromagnetic fields, their bodies show marked signs of oxidative stress [331]

with the corresponding decrease in endogenous antioxidants such as vitamin A, vitamin C, and zinc. The continued lack of these substances in electro hypersensitive people causes the skin to become particularly dry [332], and for this reason they are prone to static electric shocks because dry skin acts as an insulator that hinders the natural discharge of any surface charge. In a workplace, the greater the presence of artificial ions produced by synthetic materials, the greater the overall reduction in natural ions in the air and, likewise, the greater the feeling of stress in the environment.

The strategy to follow in this case is to use natural materials for all surfaces in the workplace whenever possible.

Continuous magnetic fields

The Earth's magnetic field consists of a continuous magnetic field, and all life on Earth has developed under its influence. Every cell is distributed and organized within our planet's magnetic field. The magnetic field produced by the Earth protects us from cosmic influences that could damage our biological systems. The solar wind (a flow of protons, alpha particles, ions, and electrons from the sun) alters this continuous magnetic field, which many electro hypersensitive people notice when geomagnetic disturbances are very strong. There are other continuous magnetic fields of artificial origin that alter our interaction with the Earth's magnetic field; in a building, these are produced by:

Steel or iron metal structural slabs, metal reinforcement in the foundation, water and heating pipe systems, steel in bed base, upholstered furniture, metal furniture, door and window frames.

Radioactivity

Radioactivity or ionizing radiation is the result of exposure to radioactive elements naturally present in layers of the Earth, to those that come from space, or to artificial elements produced by humans. Radioactivity causes irreversible damage to biological matter at the molecular level, the most important factors being the following:

Alpha radiation. Composed of alpha particles with positively charged helium nuclei. Its penetration capacity in tissue is a fraction of a millimeter and its range in air is a few centimeters. Its greatest risk lies in airborne transmission, as in the case of radon gas.

Beta radiation. Composed of electron radiation and negatively charged. Its penetration capacity is about 4 millimeters and its range in air is a few meters.

Gamma radiation. This is extremely high-energy radiation with very short wavelengths and extremely high frequencies. We usually see this radiation when alpha and beta radiation disintegrate.

X-rays. Their mode of action is similar to that of gamma radiation, and their harmful effects are also very similar.

Neutron radiation. This is composed of neutral particles. When fast neutrons are present, they pass through all materials without any problem.

Cosmic radiation. This radiation comes from space and is composed mainly of gamma radiation and neutron radiation. At several thousand meters above sea level, its harmful effect is very significant.

In the workplace, the most common is that we feel strongly affected by gamma radiation emitted by certain construction materials used in the workplace and by the inflow of alpha radiation in the form of radon gas.

Many materials may already have high levels of radioactivity depending on their origin, especially in recent years when certain distributors have begun to introduce building materials manufactured in Asian countries where pollutant regulations are not as strict as in Europe.

Radon gas is a gas that comes from minerals that produce radioactive emitting isotopes in their decay chain from uranium. It is a radioactive gas and a strong emitter of alpha radiation. Although the alpha radiation from radon gas cannot pass through solid elements, its gaseous form can seep through areas where the seal is not optimal and thus be inhaled directly, reaching the lungs, where the radioactive elements can directly affect the tissues.

Geological perturbations

These types of physical phenomena are also known as geological disturbances or geopathies. This phenomenon is similar to what we observe in the presence of natural radioactivity generated on Earth. While radon creates radioactive alpha particles, geological disturbances produce radioactive gamma particles and neutrons. As we have already seen, in the specific case of neutrons, we are talking about high-energy particles that easily pass through any solid element. That is why people with environmental illnesses are always advised not to spend too much time in any area affected by intense geological disturbances. The two types of geological disturbances whose existence we can prove using objective and subjective scientific methods are water veins and faults. In the case of water veins, these produce strong friction at some level of the Earth's crust, which concentrates neutron radiation in very specific areas coinciding with the path of the water flow they create and the resulting friction. In the case of faults, certain types of irregularities in some layer of the Earth's crust, in the form of fractures or cracks, also produce neutron radiation in very specific areas, although in this case their path is completely linear with a very limited amplitude.

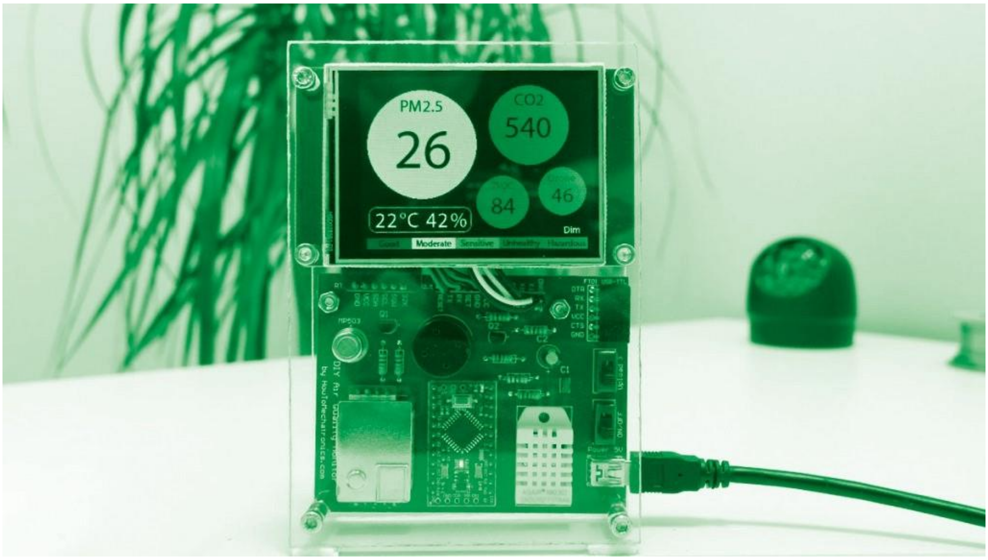
The problem with exposure to neutron radiation is that the energy it produces is many times more intense than that produced by alpha particles. That is why it is always recommended to avoid areas affected by this type of radiation, with people with weakened immune systems being the most susceptible to its effects.

Indoor environmental quality

When we talk about good indoor air quality in a workspace, we are not only referring to good levels of CO2, relative humidity, and temperature, but also to an optimal electroclimate. The electroclimate refers to the correct balance of positive and negative ions in the indoor environment, which prevents the proliferation of electrostatic charges that directly cause stress, nervousness, and depression.

To achieve this, we recommend promoting good ventilation to help maintain optimal CO2 levels, while stabilizing relative humidity and temperature to create a healthier workplace.

Since relative humidity and temperature levels inside an indoor space depend on both internal factors and the outdoor climate, it is essential to monitor them constantly to obtain the best results. Monitoring can be carried out easily using simple measuring devices that provide the three parameters mentioned above and even have the capacity to take long-term measurements, storing the data in memory for later analysis.



Lighting

Light is an important factor to consider in the workplace, as poor lighting reduces performance and promotes general fatigue. It is important to favor the use of natural light whenever possible in order to respect human biological rhythms, which depend on the evolution of sunlight throughout the day. For this reason, it is important that electro hypersensitive people have the opportunity to be exposed to natural light with all its light components, which have a modulating effect on our biological processes, especially our immune system. Two of its most important components are ultraviolet radiation and infrared radiation. Ultraviolet radiation is responsible for influencing cells to generate vitamin D, which modulates calcium and phosphorus in the body, stimulates white blood cells, and trains our circadian clock (the clock of human biological processes dependent on sunlight). Infrared radiation has a greater capacity to penetrate cells. On the one hand, it regulates the production of adenosine triphosphate (ATP), a substance that enables the manifestation of energy in our body; on the other hand, it affects the

mitochondria so that they produce melatonin, a substance with powerful antioxidant properties that enables the elimination of biological waste.
To improve the biocompatibility of lighting, it would be important to check whether light intensity, color rendering index (CRI), type of light spectrum used, color temperature (in degrees K), type of electromagnetic fields generated, and flicker percentage are those recommended in habitat biology.

Acoustic waves

Although it has been studied that audible sound in the form of noise has a clear effect on human health, sounds below or above our sound detection limits have a greater capacity to damage our nervous system when we suffer from some type of environmental illness[333].

Infrasound and ultrasound can affect the health of people who are more sensitive, or who have become more sensitive due to a very prolonged exposure to electromagnetic fields. It should be clarified that infrasound and ultrasound are not electromagnetic fields per se, but rather mechanical pressures in the air which, depending on their intensity and nature, can have a harmful effect on human biology. One of the most pronounced symptoms in people who have been subjected to continuous exposure to infrasound is abnormal hardening of the heart tissue[334]; in the case of continuous exposure to ultrasound, the symptoms observed are a completely altered central nervous system and prone to inflammation.

We call sounds with a frequency below 20 Hz infrasound and those with a frequency above 20,000 Hz ultrasound. A significant deterioration of the nervous system is particularly observed in the presence of infrasound and ultrasound when high intensity levels are produced. These sounds, which are not detected by our ears, have a very marked effect on people with a very advanced degree of electrohypersensitivity. Infrasound is usually produced when there is machinery capable of generating high levels of mechanical pressure in the air, for example, machinery for loading and unloading grain in large silos, wind energy turbines, recycling plants, outdoor aerothermal units, etc.

In relation to wind energy turbines, the distance at which the infrasound emitted ceases to affect the health of electro hypersensitive people is around 15 to 20 km, unless there is a land mass such as, for example, a mountain to block it.

On the other hand, we observe ultrasound when there are devices that use a lot of electronics or sophisticated electronics, for example, professional rack servers for data storage, some sound inhibitors, or even insect repellents that work when plugged into power outlets.

Biological contaminants

Although this is a risk factor that is diametrically different from physical risk factors, the intention of adding it here is because there is increasing scientific and medical evidence that the presence of biological contaminants in a space continuously used by people with environmental illnesses has a devastating effect on their health.

The assessment of indoor air quality in thousands of homes and workplaces where people with such illnesses live and work indicates that when the health of an affected person does not improve despite the elimination of electromagnetic and chemical pollution, the assessment of possible biological pollution and the mitigation of its cause are the actions that ultimately lead to the person's full recovery.

In a workplace, there are two main elements of biological contamination that must be kept under control so as not to amplify the symptoms of electrohypersensitivity in the affected person.

The first element is related to the presence of bacteria (actinomycetes and gram-negative bacteria).

A second factor is linked to the presence of toxic mold. It is interesting to note that the symptoms observed in people affected by toxic mold and bacteria closely mimic the symptoms observed in people affected by electrohypersensitivity or multiple chemical sensitivity[335].

For this very reason, whenever we observe symptoms in a person that are very typical of electrohypersensitivity or multiple chemical sensitivity, we should immediately consider the possibility that the workplace is affected by some type of biological contamination.

Other Factors

There are other factors that can significantly harm people with electrohypersensitivity, both indoors and outdoors, and specifically for certain jobs that are carried out in contact with or near these facilities: frequency inhibitors, Tetra antennas, radio transmission systems, military radars, high- and medium-voltage antennas, transformers, etc. In these cases, these factors must be analyzed exhaustively and individually in order to implement the appropriate protective measures.

Implementation

Our recommendation is to achieve and maintain a workplace where the exposure values associated with physical risk factors are as low as possible, while maintaining balanced levels of natural electromagnetic fields free from any factors that disturb them, whether artificial or natural (geological disturbances).

We will detail this implementation by describing each of the risk factors mentioned above. For the correct implementation of workplace adaptations for an electro hypersensitive person, it is very important to consider them interacting as a whole.

Alternating electric fields

To begin with, there are four basic strategies for reducing alternating electric field values in any workplace where there are electro hypersensitive individuals:

a. **Keep sources of radiation away from people:** The exact distance depends on the type of source we want to distance ourselves from, which will be about 2 meters for small electrical appliances (desktop computers, laptops, printers, portable hard drives, and peripherals) and about 5 meters for large electrical appliances that consume more power or have a large amount of electronics (racks with multi-port switches, multifunction printers, routers, servers, etc.).

b. **Ground these power sources using the building's grounding system.**

   All electrical appliances or elements with metal parts should be connected to the grounding system of the building to ground at all times any alternating electric field that may be produced in the workplace. All elements with metal parts, such as kitchen furniture, pipes, communications racks, and cabinets, should be mechanically connected using grounding cables (green/yellow colours) with a cross-section of 4 or 6 millimeters, using connectors that make good contact and pressure.

The electrical panel must be organized to install, if not already present, a specific busbar (metal bar, which will serve to connect all the aforementioned metal elements to the grounding system). This connection is called equipotential and should be separate from the other ground connections in the building.

If there are electrical devices that generate a lot of electromagnetic interference, we recommend that, instead of using conventional copper wire cable for the ground connection, connectors with slightly flexible mesh cable be used.

c. Disconnect any power sources that are not in use:

This strategy involves designing the electrical installation in the workplace so that circuits with electrical appliances plugged in can be disconnected without affecting the pace of work.

One must begin by assessing which circuits (controlled by their corresponding circuit breakers) cannot be disconnected under any circumstances. Once these have been signaled, the ones that can be disconnected will be determined, and thereafter tests to see if exposure levels decrease significantly need to be carried out.

These circuit breakers can be disconnected manually, but if for some reason this is not possible, the installation of automatic switches is recommended, which would avoid having to disconnect them manually all the time.

d. **Properly shield the installation's wiring.** When using shielded cable, it is important to remember that for it to work properly, it is essential that the grounding system is correctly installed, has a ground resistance value below 6 ohms and is free from significant electromagnetic interference.

Checking that an earthing system is working properly must be carried out by qualified personnel using the appropriate equipment. At a minimum, multifunction equipment should be used that has the option of measuring loop impedance by default for three-phase, single-phase, or two-phase installations (still present in some urban environments in Spain).

This check will never be valid if, on the contrary, the personnel use a simple multimeter.

The fourth strategy should be implemented if the previous three strategies do not help to significantly reduce alternating electric field levels.

Alternating magnetic fields

Experience shows us that in most cases, the sources of alternating magnetic fields can be internal or external.
In the case of external sources, we would have to check that there are no high-voltage lines, underground lines, or zone transformers belonging to the electricity supply company nearby. The latter are usually located on the street and marked with a yellow sign indicating the hazard of electrocution.

Zone transformers are problematic because they can create high values of alternating magnetic fields within the workplace when there is little distance between them, but sometimes the currents transmitted through the wiring entering and leaving these transformers are not balanced, and this ends up producing high values of alternating magnetic fields over a very large area, for example, a small area of a neighborhood or a few streets.

In our experience, underground lines are also very problematic because, even though they do not carry high voltage, they generate a fluctuating alternating magnetic field that can be very high within a radius of about 12 meters.

This is something that must be taken into account prior to adapting the workplace, since if the alternating magnetic field comes from both a transformer and an underground line, shielding solutions are extremely expensive and very difficult to implement, given the limited cooperation that electricity supply companies usually offer when informed of the problem, and because for the shielding to be effective, we would have to completely cover the area where the transformer is installed or completely wrap the underground cable.

In the case of internal sources, an inventory must be made of the electrical appliances behind the ceiling, floor, and walls adjacent to the workplace. The floor below probably has lighting installed in the ceiling, such as certain types of fluorescent lighting (with and without electronic ballasts) or halogen lighting with transformers, which end up producing very high levels of alternating magnetic fields. This problem could be solved by replacing the fluorescent lighting on those floors with grounded LED lighting without drivers, and the halogen lighting with halogen lighting without transformers.

Communication racks that generate alternating magnetic fields with high values and frequencies are particularly problematic in workplaces. These racks should be placed well away from workstations, especially if they are in adjoining rooms.

A similar situation occurs with aerothermal installations: it is not usually the heat pump that generates high alternating magnetic fields, but rather the outdoor unit, which in most cases generates extreme alternating magnetic fields associated with high frequencies and with a radius of action of approximately 5 meters.

As in the case of alternating electric fields, maintaining a safe distance is the best preventive recommendation to avoid the harmful effects of alternating magnetic fields on electro hypersensitive people.

If there is no other option but to use shielding to reduce exposure, it should be noted that shielding for alternating magnetic fields uses very specific materials, so not all other materials available on the market would be suitable for this specific case. A specific material for shielding alternating magnetic fields does not directly block these fields, but rather displaces them to other areas, which is why we said earlier that the best way to achieve good shielding in these cases is to shield the source entirely.

The best shielding materials for alternating magnetic fields are manufactured by Yshield and G-Iron. We suggest using Yshield products when the magnetic flux density is low and G-Iron products when the values are high or extreme. Remember that this shielding material must always be grounded.

Electromagnetic interference

If we encounter problems related to conducted electromagnetic interference, it is very important to check whether the source comes from outside or is generated within the electrical installation of the workplace.

If it occurs internally, one solution would be to replace the electrical devices that are producing the electromagnetic interference. These are usually devices designed to be energy efficient, as they require a considerable amount of electronics to achieve this. The more electronics the device has, the greater the likelihood that it will generate electromagnetic interference. In our experience, the devices that produce the most electromagnetic interference in the workplace are desktop computers, laptops, and poor-quality LED lighting.

If the source comes from outside and we have no direct control over it, we would need to define the source precisely with the help of an oscilloscope, which provides us with the amplitude values (the intensity of the interference and its associated frequency). In our experience, electromagnetic interference originating from outside is usually caused by inverters used in photovoltaic systems, followed by any device that operates using a frequency converter, such as a mini-split air conditioner.

The values obtained should be compared with the values in graph 4. If the recommended limit values are exceeded, we can consider minimizing conducted interference by using shielded electrical cable, ground cable with a cross-section of 4 or 6 mm, and installing interference filters that would have to be adjusted to the specific type of interference previously detected with the oscilloscope.

The phenomenon of electromagnetic interference is complex, and there are no generic filters that eliminate all types of interference equally. Filters must be adjusted to the specific characteristics of each type of electromagnetic interference detected.

When addressing electromagnetic interference, special mention should be made of standard photovoltaic power generation installations, as they are one of the technologies that introduce the highest amount of electromagnetic interference into the electrical grid: a set of harmonics and voltage/current transients that add to the 50 Hz voltage frequency, contaminating the electrical installation with frequencies and wave amplitudes for which it was not originally designed.

These are frequencies in the kilohertz range (VLF and LF bands of the electromagnetic spectrum) that can be generated by different devices and technologies, especially those that use a lot of electronics.

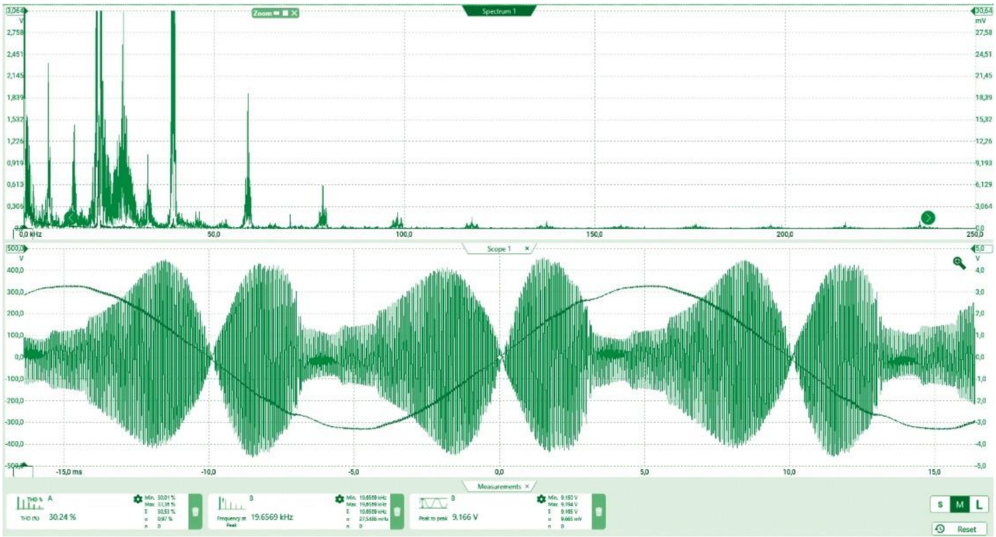
In the case of photovoltaic installations, electromagnetic interference is mainly produced by the installation's inverters. This is due to the rapid and constant switching process that this device performs when converting the direct current generated by the photovoltaic panels into the alternating current required for the operation of most electrical appliances.

Such interference in the form of electromagnetic fields is introduced into homes by the inverter through the wiring and affects people with electrohypersensitivity.

There are specific technical solutions for photovoltaic installations to correct this interference:

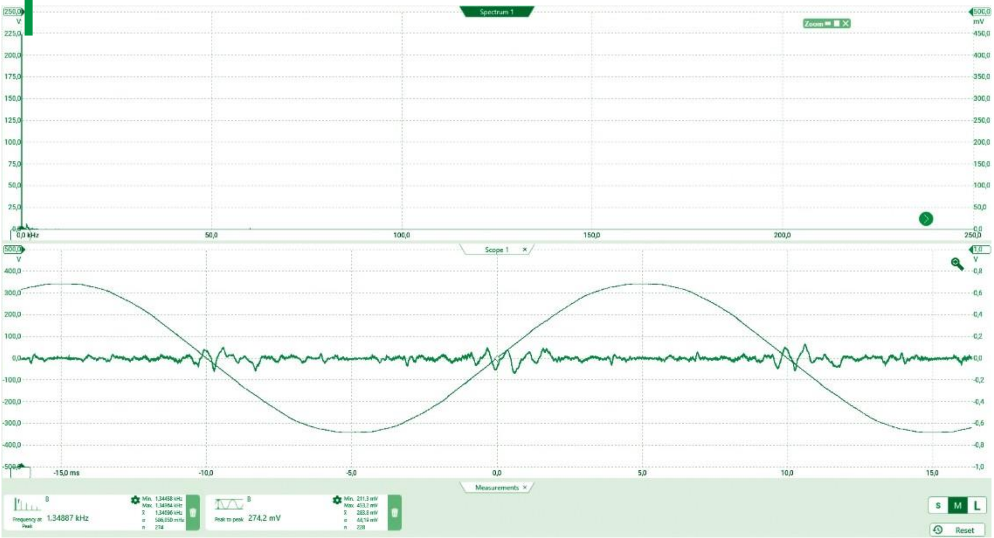
1. Choose inverters from well-known European manufacturers and avoid Asian manufacturers (especially Chinese manufacturers). Among the European inverter manufacturers we

have found that SMA, Fronius, and Kostal generate less interference. Choosing a specific model can be more complicated because it depends on whether the photovoltaic installation is connected to the electrical grid or is 100% isolated from it. When taking measurements, we have observed that the Piko MP Plus model from the manufacturer Kostal does not introduce any type of electromagnetic interference into the installation's wiring, but this is an inverter that has to be connected to the electricity grid and is not suitable for photovoltaic installations that are 100% isolated from the electricity grid. Even though we know that other brands generate less electromagnetic interference, as a preventive measure, we recommend always using filters to further minimize electromagnetic interference in the electrical installation. For comparison, graph 6 shows the electromagnetic interference conducted by the wiring produced by a Chinese-made inverter.



Graph 06.
Electromagnetic interference produced by a Chinese-made inverter.

In graph 7, we can see that electromagnetic interference from a European-made inverter is almost non-existent. A Chinese-made inverter can generate almost 10 times more interference than a European-made inverter.



Graph 07.
Electromagnetic interference produced by a European-made inverter.

2. The wiring used in the electrical installation must be shielded, especially in the section between the inverter and the main electrical panel of the home, and must be well separated from other cables by using cable trays, which in turn must be grounded.

3. Check whether any of the components of the photovoltaic installation have wireless communication technology (WiFi, Bluetooth, or similar). If you cannot replace the component with one that does not use wireless communication technology, check the settings of that component to disable this technology.

4. Ensure that the grounding cable of the photovoltaic system has the appropriate cross-section to avoid skin effects (the tendency of the electromagnetic field to move towards the outside of the cable when voltages/currents of VLF/LF frequencies pass through it), is correctly sized, and is properly connected to the general protection system (grounding installation) of the building.

   Photovoltaic panels and inverters should be installed as far away as possible from areas where there are electro hypersensitive people. Panels should never be installed on the floor directly above a workstation. We have observed that, depending on how these panels are installed, in the worst-case scenario, they can redirect currents, creating alternating magnetic fields with frequencies above 2 kHz, which cause electromagnetic interference within a radius of 1.5 to 2 meters. For this reason, we recommend always maintaining a safe distance of at least 5 meters between the photovoltaic panels and the workplace.

   Since the inverter not only adds electromagnetic interference to the electrical installation wiring, but also to the home's grounding system, it would be advisable to install a specific filter in the grounding system to prevent contamination.

Electromagnetic waves

In the case of electromagnetic waves, no type of wireless technology should be used near the workplace where there is an electro hypersensitive person.

It is becoming increasingly difficult to establish a safe distance, given that many wireless technologies currently used for telemetry (remote data transmission) use solutions with increasingly wider coverage areas,

and with protocols for easily passing through solid objects.
Despite this, a minimum safety distance of around 40 to 60 meters could be recommended for electro hypersensitive people.

If the workplace is close to a mobile phone base station (location where mobile phone antennas are installed), the distance to that base station should be verified. For people with electrohypersensitivity, the recommendation would be to stay about 2 kilometers away from the mobile phone base station when the workplace has direct exposure to the base station's signals.
This distance, which at first glance might seem very large, is justified by the fact that the new generation of mobile telephony (5G technology), in its lowest frequency band, generates signals that can travel even greater distances than 4G signals in their lowest frequency band. The lower the frequency of a signal, the greater its ability to pass through solid objects and travel long distances.

When exposure from a mobile phone base station is not direct, as is the case with a workplace located on the lower floors of a building, or when it is surrounded by other buildings that act as a barrier to signals from the base station, it will not be necessary to be so far away, and in many cases only a few hundred meters will be required. The exact safety distance we need to maintain can only be determined by measuring the workstation in order to determine the distance that the electro hypersensitive person should maintain in order to avoid damage to his/her health.

Among the most common technologies found in workstations are WiFi (in all its variants, including alarm systems based on this technology), DECT cordless telephony, and Bluetooth technology for interconnecting devices. It is important to always make an inventory of all electrical devices present in the workstation or in adjoining rooms, and inquire whether they use any type of wireless communication technology.

Many electrical devices on the market have wireless communication capabilities added to them, activated at the factory, regardless of whether the user actually uses them or not, and in the worst case, this technology cannot be deactivated, so it would be necessary to resort to shielding these devices.

Given that both WiFi (especially that operating in the 2.4 GHz frequency range) and DECT cordless telephony have a range of several meters through walls, an inventory must be made that reflects the exact location of all devices that use such technologies, in order to assess whether the workstation of the electro hypersensitive person is a safe place and, if the safety distance is not the recommended one, consideration should be given to replacing such devices with others without wireless technology.

As always, if we cannot find a simple solution that eliminates exposure, we will have to carefully consider the design and implementation of specific shielding for electromagnetic waves. We can only design the correct shielding for a surface if we take measurements beforehand using a professional device with adequate sensitivity and a directional antenna. This is important in order to determine the most suitable type of shielding material, as well as the level of attenuation required for that material.

In cases where surfaces such as walls need to be shielded, the most commonly used shielding solutions include shielding paints and meshes. Paints work well when exposure levels are not very high, with up to 2 or 3 coats of paint being applied. After 3 coats, the attenuation is no longer very significant. They usually contain carbon and graphite in their composition. Rigid shielding meshes work best when the exposure levels are very high or extremely high, and even better shielding is achieved when we separate one layer of mesh from another, for example, if we place them separately in a cladding. The materials that are usually used as conductors in their composition are copper and nickel, and in other cases stainless steel.

Other forms of shielding include copper and nickel felts or paper sheets that usually contain zinc or aluminum. There are also fabrics for various uses, which usually contain stainless steel or copper and silver.

Electromagnetic waves often enter through window glass, as glass that has not undergone any special treatment tends to behave as a material that is completely permeable to electromagnetic waves, offering no attenuation whatsoever. To reduce the entry of electromagnetic waves through window glass, we would have to replace it with low-emissivity solar-treated glass, as this undergoes a specific treatment involving the addition of metallic particles, which reflect between 90% and 95% of electromagnetic waves in most cases. On the other hand, the window frame must be made of aluminum to reduce the entry of electromagnetic waves through the frame. We recommend checking the technical specifications of low-emissivity glass beforehand to ensure that its transmittance value (U value) is equal to or less than 1. This information guarantees that the glass will actually be able to limit the entry of electromagnetic waves into the workplace through the windows.

If it is not possible to change the glass, another solution would be to install a metallic mosquito mesh, preferably stainless steel, in an exterior frame, as a metallic mosquito mesh acts as a shielding mesh because its mesh opening diameter is smaller than the wavelength of most available wireless technologies and therefore cannot pass through.

Since many people affected by MCS ask whether the smell of paint can be a problem, the answer is yes, but only during the application process of the shielding paint, as it must then be covered with at least three coats of eco-friendly paint. After testing dozens of shielding paints available on the market, our recommendation would be to use only those from the German brand Yshield, which offer the best results in terms of shielding.

Since it is always recommended to ground all types of electromagnetic wave shielding, it is very important to bear in mind that we not only need a grounding system with an optimal ground resistance value (below 6 ohms), but also one that is free from electromagnetic interference.
To verify that the grounding system is free of interference, tests must be performed using an oscilloscope.

It should be clarified that the reason for grounding electromagnetic wave shielding is not so that the shielding works, but because electromagnetic wave shielding material is highly conductive, and we do not want the alternating electric field that could be near the surface to be shielded to end up expanding and amplifying across the surfaces where we are going to apply it. It is more a matter of safety than functionality.

We specify that the grounding system must be free of electromagnetic interference because when conducting shielding material is installed, it will divert the alternating electric field to ground but at the same time it could conduct electromagnetic interference through all the surfaces where the shielding material has been installed if it is not verified that it is free of interference. In this sense, when we design a shielding system, we must be very careful to prevent such interference from being amplified by the shielded surfaces.

If we cannot eliminate electromagnetic interference in the grounding system (which is very common in densely populated urban environments), we would have to consider using a specific filter for the grounding system. The problem with having a grounding system contaminated by electromagnetic interference, especially when the frequencies are very high, is that these frequencies end up recirculating throughout all the surfaces where the shielding has been applied.

The application of shielding in a workstation for electro hypersensitive people always requires rigorous study and design to prevent the person from being affected by problems arising from poorly executed shielding.

The greatest difficulty we see when it is necessary to adapt the workstation taking electromagnetic waves into account is limiting and controlling the radiation produced by personal devices used by other workers.

It must be made very clear that under no circumstances may mobile phones, wireless headphones, tablets, or even smartwatches be used anywhere in all of the workstation of an electro hypersensitive person.

It is very important that the person responsible for ensuring the biocompatibility of the workspace with the electro hypersensitive person has basic knowledge of bioelectromagnetism and knows how to use electromagnetic field meters, both low and high frequency. We recommend that this person use two meters, one for evaluating low-frequency electromagnetic fields and another one for evaluating high-frequency fields. For low frequency (alternating electric field and alternating magnetic field), the Safe and Sound EM3 meter can be used, and for high frequency (electromagnetic waves), the Safe and Sound Pro II meter can be used. Always remember that these meters are not intended to be used to make decisions about the correct application of shielding in the workstation.

Safe and Sound EM3 meter

Safe and Sound Pro II meter

It is also important to know that there are shielding fabrics used to make clothing that electro-sensitive people can wear to protect themselves from electromagnetic waves in the workstation. However, the use of this type of clothing ends up being a double-edged sword. On the one hand, the fabric reflects high-frequency radiation very well, but as it contains conductive metal threads, there is also the possibility that it may attract certain low-frequency electromagnetic fields (especially alternating electric fields) in uncontrolled environments, which could end up negatively affecting the electro hypersensitive person.

Our recommendation would be to use this type of clothing for very specific situations, such as when the person affected has to travel from one workplace to another or has to take public transportation.

Continuous electric fields

Given that continuous electric fields (electrostatics) occur on the surface of certain materials, an inventory of the types of materials present in the workplace must be made.

The more natural the materials used, the less likely it is that electrostatic will form in the environment.

We can use furniture made of untreated wood or wood that has been treated with a non-synthetic preservative. A wood treatment based on natural products does not allow electrostatic charge to build up on the furniture.
Remember that wood is not a material that easily grounds alternating electric fields. Therefore, wooden furniture in the workplace should not be in direct contact with electrical cables. Wood does not ground alternating electric fields properly, but it does dissipate unnecessary electrostatic buildup.

Among the recommended fabrics that work best to minimize electrostatic charge, we would first have cotton and linen, followed by wool, as this fabric allows the creation of a small amount of electrostatic charge.
Therefore, we can partially cover furniture made of non-natural materials with all-natural fabrics to prevent electrostatic accumulation. If electrical appliances are grounded, the electrostatic concentrations in the environment are dissipated.

However, we do not recommend that users reduce the accumulation of body voltage (basically an alternating electric field) by connecting directly to an installation's grounding system, since in any urban environment, no matter how small, the ground is completely saturated with electromagnetic interference that ends up contaminating the grounding systems.

In most modern buildings, the probability of encountering continuous artificial magnetic fields is very high, given that, in one way or another, construction materials made from metallic elements are always present. Most modern buildings have metal slabs in their structure. The metal elements that are most likely to become magnetized are those made from steel or iron. This does not happen with stainless steel or aluminum, as these two metal elements do not become magnetized.

Regardless of whether we can choose metal elements that do not generate static magnetic fields, it is best to keep electro hypersensitive individuals away from areas close to the building's structural elements and slabs, and not to use furniture in the workplace that contains large amounts of metal parts, especially if they are made of iron or steel.

Sometimes measurements at workstations show low values near metal elements, but other times the values can be very high. In any case, the general recommendation usually given in habitat biology is to avoid the presence of metal elements, as they could interact with and amplify other types of electromagnetic fields, such as electromagnetic waves.

It is best to determine in advance the safest location for the workstation of the electro hypersensitive person, since continuous magnetic field shielding is very expensive and never guarantees optimal performance, unless the source generating this type of field is completely covered. Something similar occurs when we want to shield alternating magnetic fields.

The recommended strategy involves including as few metal elements and materials as possible in the workplace. If this is not possible, we will choose to use those made of aluminum or stainless steel. Normal steel is not an option because it can easily become magnetized.

Setting up a computer connected to the Internet

If using a desktop computer, it should be placed at least 2 meters away from the user and use a power supply with a shielded cable and a Schuko plug (with ground connection).

The external monitor must not only be connected to the power supply via a shielded cable with a Schuko plug, but it must also be low-emission, certified with the Swedish TCO seal, and feature Eye-care, Flicker-Free, and Low Blue Light Plus (blue spectrum filtering) technologies. If the electro hypersensitive person cannot tolerate the external monitor because it is too close to their body, one strategy could be to use a projector connected to the computer as a screen.

The mouse should be of the simplest type, with a long extension cable that allows connection to a computer located two meters away. Mice with a lot of electronics should be avoided, as they could cause discomfort in the hands of the affected person. Therefore, mice with many buttons and backlighting should be avoided. The simpler the mouse, the better.

The keyboard should be mechanical with minimal electronics, and the recommendation is similar to that given for the mouse: avoid keyboards with many options and backlighting.

If the person is using a **laptop**, the setup would be the same, including the screen (or projector), mouse, and keyboard, as we do not want the body of the laptop to be close to the user. It is important not to type directly on the laptop keys, as all the computer's electronics are located just below the keys, which is where the highest levels of alternating electric fields are concentrated, especially alternating magnetic fields with frequencies above 2 kHz.

Since both desktop and laptop computers operate with switched-mode power supplies connected to the facility's power outlets, which end up generating conducted electromagnetic interference in the wiring, we must try to eliminate such interference. We therefore recommend that, whenever possible, electro hypersensitive individuals work at their workstations with a laptop powered by an external battery that offers a long battery life.

In the case of **desktop computers,** since they cannot run on batteries, it is essential that we use them with a specific filter that eliminates interference from the wiring.

In cases where several electrical devices need to be plugged in at the same time in the workstation, it is recommended to use **shielded power strips** without built-in filters, as these filters end up producing high-frequency alternating magnetic fields. These shielded power strips reduce the alternating electric field in the area around the sockets, which could spread to the area where people are sitting.

If only some devices need to be used, it is recommended to use individual bipolar switches (which disconnect both the phase and neutral wires) for each device, so that they can be selectively disconnected without being exposed to unwanted alternating electric fields.

The logic behind using individual bipolar switches is that many electrical appliances continue to emit alternating electric fields even when they are not in operation. Simply by being plugged in, the voltage (or associated voltage) remains present in the appliance cables. Only when we unplug them does the voltage disappear, but it is more practical to use individual switches to avoid having to unplug the appliances often.

All electrical appliances used should have a type F plug (Schuko plug type), which ensures that the appliance’s enclosure is properly connected to the building's grounding system. By doing so, the alternating electric field is diverted to ground, greatly reducing the presence of alternating electric fields in areas near electrical appliances used in the workstation.

This laptop must be connected to the Internet via an Ethernet cable, but using a category 8 SSTP (shielded twisted pair) cable.
Even so, the alternating electric field coming from the router through the SSTP cable must be minimized, so it is very important to ground the

router itself, since most routers sold in our country do not have a Schuko-type plug with a ground connection.
To easily ground this type of router, there are specific adapters available on the market for this purpose.

Radioactivity

Gamma radiation

We can observe high levels of gamma radiation when we introduce certain building materials.

For example, we observe elevated levels in the presence of certain types of stones, tiles, when the cement or concrete used contains slag or ash left over from smelting, or even in some types of wood (either because the wood has been treated with pesticides containing radioactive compounds, or because it has been close to radioactive elements that have ended up contaminating it).

It is essential to measure the materials closest to the work area and compare the resulting values with those obtained when measuring the outside area. If the comparison indicates unhealthy levels, the best solution is to replace the affected materials with others whose values are within the non-significant range.

Radon gas

However, in the case of radon gas, it is very important to constantly monitor levels through long-term measurements in order to get a more accurate idea of the actual exposure to which the person is subjected.

Radon gas levels in an indoor space can vary greatly depending on the time of year and prevailing weather conditions. First and foremost, we recommend keeping the workstation well ventilated, as radon concentrations decrease significantly when air is continuously renewed. This does not mean ventilating excessively for long periods of time, but rather using cross ventilation (door and window fully open) for 2 to 4 minutes in winter, 4 to 10 minutes in spring/autumn, and 12 to 20 minutes in summer.

It should be remembered that there are areas of Spain where the risk of radon is higher than in other parts, with Galicia and Extremadura being the areas where concentrations can be very high.
The Nuclear Safety Council has published a national map of radon gas concentrations to give us an idea of which areas are most affected[336]. In any case, we always need to measure concentrations in the workplace and see whether or not there is a significant risk.

Geological disturbances

It is important to implement the concept of geological disturbances when adapting the workstation. We can understand them as if they were any other type of radioactivity present in nature, but with the distinguishing feature that their energy is extremely intense, so we should never seat an electro hypersensitive person right in the area affected by any of these disturbances, and even less so at the intersection of a water vein and a fault.
There is an objective way to evaluate the workplace, which is to use a neutron counter to detect both water veins and faults. Its use is common practice in habitat biology. With the information provided by the neutron counter, we can locate the workstation in neutral areas that are not affected by geological disturbances.

It should be remembered that, to date, there is no scientifically proven shielding method available to mitigate these disturbances, and the best recommendation is to distance oneself from their area of influence.
Above all, it should be remembered that no geological disturbance is negative per se, as it all depends on the quality of the energy they have; some have a more destabilizing energy than others, and others have a very weak energy. In any case, it is best to avoid them.

Indoor environment

The workplace must be monitored to constantly evaluate relative humidity and temperature levels, paying close attention to relative humidity levels, which determine the electrostatic conditions within a given space.

The recommendation is that relative humidity should always be between 35% and 55%. Variations above or below this range can be expected, especially when the weather changes, but what we must avoid is constant values outside the recommended range. Maintaining relative humidity values in an indoor space within the aforementioned range offers advantages, allowing us to limit the appearance of biological contamination, especially that linked to toxic mold, bacteria, and viruses, while reducing the likelihood of electrostatic discharge on non-natural synthetic surfaces.

The recommended temperature for a workplace should be between 18 and 22 °C, depending on the specific activity being carried out.

With regard to ionization levels (proportion of positive and negative ions), care should be taken to ensure a higher concentration of negatively charged ions. There is currently debate as to whether CO_2 levels have a counterproductive effect, but in view of scientific studies carried out by experts in indoor air quality, is best to consider CO_2 as an indicator of other pollutants within the room. Therefore, as a preventive measure, CO_2 levels should be within the non-significant range. Once relative humidity and temperature are under control, it is important to ensure that the presence of synthetic materials is kept to a minimum in order to limit the formation of static electricity. As far as possible, it would be important to replace all synthetic and/or toxic materials with natural materials that have a high hygroscopic capacity (ability to regulate humidity in an interior space).

Acoustic waves

The workplace should be free of infrasound and ultrasound that could overload the people affected.

To this end, apart from the usual strategies for minimizing airborne and impact noise, in the case of infrasound, we should not have outdoor air conditioning or aerothermal units installed near workstations. It has been observed that these devices generate levels of infrasound that are difficult to tolerate for people with electrohypersensitivity. If it is not possible to cool the workplace completely using passive methods based on bioclimatic principles, we can always use split systems without an outdoor unit, but we must check that they do not use inverter technology, as this creates a lot of electromagnetic interference conducted through the wiring.

In the case of ultrasound, we recommend keeping all types of devices with highly sophisticated electronics and complex operating processes (mainly switching) at a distance, such as data servers, routers, or enterprise-grade switches.

Lighting

Natural lighting should be encouraged as much as possible to stimulate the proper modulation of the immune system. Since some people are sensitive to infrared radiation, we should ensure that natural light is controlled so as not to saturate spaces and overload inflamed immune systems.

When implementing a biocompatible artificial lighting system, we need it to meet the following requirements:

- The light intensity must be appropriate for the room.
- The color rendering index (CRI in percentage) must be at least 85%.
- The light spectrum must be complete or as balanced as possible.
- The color temperature for a workstation must be 5,000º K (Kelvin degrees).
- The number of electromagnetic fields generated must be minimal and there must be no flickering.
- As the day progresses, the color temperature should be reduced with a greater presence of an orange spectrum, which is what stimulates the production of melatonin by our brain in the evening/night.
- The lighting should be incandescent or, failing that, eco-halogen.

Under no circumstances do we recommend the use of LEDs, even though some manufacturers market their products as "biocompatible." Very few LED lights do not have a counterproductive effect. This is because this type of lighting does not comply with the recommendations given in the previous paragraph.

Any type of lighting connected to the mains and using alternating current should use shielded electrical cable and have its metal parts earthed (class II lighting comes already by default prepared to be grounded).

Given the ubiquity of LED lighting in the workstations, we recommend the preventive measure of wearing glasses with filters to eliminate the predominance of the blue spectrum, which inhibits melatonin production by blocking our natural circadian cycle. It is important that these filters are amber-colored, as they are the ones that offer the best protection; while other filters with a faint yellow tint offer almost no protection.

Biological contaminants

It has been shown that both mold and bacteria begin to work in synergy when the relative humidity levels within a workspace exceed 50%, and at 80% their presence becomes visible, developing a very high level of toxicity.
For this reason, it is very important to follow our recommendations for maintaining indoor air quality.
It is important to remember that where there are no water-related problems, we will not see problems with mold or bacteria growth.

However, it should be made clear that when we already have an obvious water-related problem, the best thing we can do in the case of mold is to remove the affected parts; in the case of bacteria, the solution is simpler, because it only requires thorough cleaning of the surfaces and areas where there is excessive and uncontrolled growth of these microorganisms.

In the case of mold problems, the best strategy is to follow standard protocols that recommend that mold should never be removed or "killed" using biocidal chemicals[337]. The vaporization of substances with antiseptic properties is also discouraged. The scientific community's consensus for mold remediation is to first solve the problem that caused the mold, isolate the affected rooms, remove the affected parts without contaminating other rooms, clean thoroughly, and reapply biocompatible materials that prevent the growth of microorganisms.

In the case of bacteria (actinomycetes and gram-negative bacteria), the best recommendation is to maintain thorough cleaning of areas where water is used continuously, such as bathrooms or kitchens used by workers. No complicated cleaning protocols are necessary; cleaning with soapy water (using eco-friendly liquid soap) and microfiber cloths is more than sufficient, and can be finished with a light spray of 8% hydrogen peroxide solution.

Future challenges for adapting work environments

Although one of the most important challenges when adapting a workstation for people with electromagnetic hypersensitivity is to respond to two important characteristics of the condition: the specific degree of electromagnetic hypersensitivity of the affected person, and the specific type of electromagnetic field to which the person is most sensitive, the adaptation must necessarily involve minimal exposure to any type of field. Although the specific degree of electrohypersensitivity of affected individuals can vary from mild to extreme, if they are continuously exposed to electromagnetic fields that they appear to "tolerate," their electrohypersensitivity can end up being debilitating and preventing them from carrying out their working life normally. The constant evolution of technological developments will increasingly include technology that we do not know how it will interact with the biological characteristics of a person affected by electrohypersensitivity.

The best strategy would be to help the affected person feel safe in their workplace. A sense of security can help the affected person feel mentally, emotionally, and physically protected from the exposure caused by the emergence of new types of electromagnetic fields, the effects of which on our health are unknown. We cannot know for sure where technological advances will lead in terms of creating new types of electromagnetic environmental pollutants, but we can use technological knowledge to protect the affected person, whether through the use of shielding, filtering, or improving the electroclimate in the workplace.

Conclusions

We consider it very positive to provide a whole series of risk factors, especially physical ones, that need to be taken into account when adapting workplaces for people with electrohypersensitivity. We would like this list to serve as a roadmap so that in the near future every company can understand the importance of the specific needs of the affected person and have a document, in the form of a checklist, with all the points that must be taken into consideration when adapting the workplace.

We also consider it important to have recommended reference values for electro hypersensitive individuals that allow us to verify that the adaptations are in line with the specific characteristics of the condition. We have often encountered occupational risk personnel who, due to sheer ignorance, have not known how to apply reference values adapted to sensitive individuals, having to apply the exposure limit values for electromagnetic fields as set out in Royal Decree 299/2016 of July 22 on the protection of the health and safety of workers against risks related to exposure to electromagnetic fields.

It is important to bear in mind that the limit values set out in Royal Decree 299/2016 do not take into account the specific sensitivity levels of individuals suffering from electrohypersensitivity.

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Success stories

In workstation adaptations for people with Multiple Chemical Sensitivity and/or Electrohypersensitivity

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CHAPTER

4

More and more people are experiencing adverse reactions to common elements in the work environment, such as perfumes, cleaning products, wireless radiation, and electronic equipment, among others. These reactions, associated with diagnoses such as Multiple Chemical Sensitivity (MCS), or Electromagnetic Hypersensitivity (EHS), not only affect physical health, but also pose a profound challenge to continuing being employed for those who suffer from them.

In most cases, remaining in the job depends on finding environments compatible with their health conditions, which requires specific adaptation measures and, above all, institutional willingness.

This chapter recounts the experiences of people who have requested workstation adaptations (WSA) in order to continue working without putting their health at risk. Of the 37 people who responded to the initial questionnaire, only 12 were granted some form of adaptation. Most of those who succeeded were women, civil servants or public employees between the ages of 50 and 65, diagnosed with MCS, EHS, or both conditions. The adaptations granted range from changing locations and eliminating Wi-Fi to using purifiers, partial teleworking, or reorganizing duties. However, the number of people who did not receive a favorable response or who directly left their jobs due to lack of adaptations is even higher. In these cases, there are often ignored medical reports, long and ineffective processes, and a notable lack of awareness on the part of companies or colleagues. The reality is that many people with these conditions are forced to work in conditions that worsen their health, or to leave their jobs due to physical, emotional, or legal exhaustion.

In this context, the eight cases discussed in this chapter give voice and shape to these experiences. Through specific stories, they show the barriers they encounter, the strategies they have implemented, and the conditions that have made it possible—or impossible—for them to be able to continue working. These are not just individual stories, but examples that reflect a structural problem and the need for fairer and more effective responses.

> Because behind every diagnosis there is a person with a vocation, skills, and the right to work in safe conditions. And behind every successful adaptation, there is a shared effort that deserves to be known, valued, and replicated.

Profile of the people who have achieved adaptation.
Of the 12 people who have been granted WSA:

- Six individuals have a combined diagnosis of MCS and EHS. All are women between the ages of 50 and 65, with a recognized degree of disability (mostly less than 45%) and employed by the public administration. Although all formally requested the WSA through the formal channels, it was only fully granted in three cases. In the remaining cases, it was either partially implemented or not granted at all, despite the favorable report.
- Two people diagnosed solely with EHS, both men, without recognized disability, public sector workers, and with effective adaptations applied in full, allowing them to continue in their jobs.
- Four people diagnosed exclusively with MCS, women between the ages of 50 and 65. Most work in the public administration, although one belongs to the private sector. In two cases, the adaptation was effective, in another it was partially applied, and in the last case it was unfeasible, leading the worker to apply for permanent incapacity for work.

In general, cases in which satisfactory adaptation was achieved share some key characteristics: middle-to-high age, employment relationship with the administration, clear medical reports, and in some cases, support from associations or unions. The positive attitude of the environment —management, occupational risk prevention (ORP), colleagues— has been fundamental to success.

Profile of people who did not achieve adaptation. In contrast, 16 people applied for WSA but did not obtain it, despite having followed the proper procedure. Of these:

- 10 have been diagnosed with MCS and EHS, aged between 30 and 65. Most do not have official recognition of disability, either because they have not applied for it or because it is still in process. Although all applied for adaptation through the ORP units, none received an effective solution. Some were relocated to equally unsuitable workstations, others continue to work with progressively deteriorating health, and two have had to leave their jobs or apply for permanent incapacity.
- Six people have exclusively an MCS diagnose, and their requests for adaptation have also been unsuccessful. In most cases, the environmental barriers were structural and impossible to eliminate without relocation. One case was dismissed; in another, the worker voluntarily left his/her job.

In these cases, there is often a lack of understanding on the part of the work environment, difficulties in getting along with colleagues—who are unable or unwilling to change their habits—and resistance from companies to implement changes. This leads to situations of occupational exclusion and deteriorating health, reflected in frequent sick leave, dismissals, or job abandonment.

People who have not requested adaptations. Finally, four people who responded to the questionnaire did not request any adaptation but wanted to participate.

This data collection provides a statistical and human context for the cases discussed in the body of the chapter. These individual stories highlight the unequal access to adaptation measures, the limited preventive culture in some sectors, and the urgent need to move towards truly inclusive and healthy work environments for people with environmental illnesses.

Partial workstation adaptations for people diagnosed with Multiple Chemical Sensitivity and Electro-Hypersensitivity

Partial workstation adaptations can significantly reduce environmental barriers without eliminating them completely. These measures may include changes to the work environment, organizational adjustments, or the use of specific equipments. Below are examples of adaptations that have enabled people with Multiple Chemical Sensitivity (MCS) and/or Electrohypersensitivity (EHS) to continue working.

CASE 1:

University professor with MCS and EHS

Employee profile

Female university professor, civil servant with a full-time permanent contract. Diagnosed with Multiple Chemical Sensitivity (MCS) and Electrohypersensitivity (EHS).

Context

For years, the affected worker performed her duties in an office adjacent to a bathroom, where cleaning products and disinfectants from the drainage system emitted fumes through a trapdoor that had been opened and later on improperly sealed. Despite reporting this situation on several occasions to the maintenance department, no effective solutions were implemented. At that time, the worker was unaware of the importance of avoiding such constant exposure, which is now suspected of influencing the development of her chemical sensitivity. Years later, when she was diagnosed, Occupational Health was informed and decided to relocate her to another office, reserving the previous one for occasional use as a meeting room.

Symptoms

Exposure to chemical agents: fibromyalgia pain, fatigue, mental fogginess, difficulties in thinking, working memory alterations, and problems maintaining fluid communication. Added to this are neurological disorders such as auditory hypersensitivity, mental distraction, irritability, and reduced patience in the lecture room.

When exposed to electromagnetic fields: musculoskeletal pain in the jaw, neck, and face, increased general pain, extreme exhaustion, and persistent sensation of flu-like discomfort. In addition, insomnia, non-restorative sleep, and, in the last months, signs of possible heart damage under investigation. The worker also reports the onset of depression, which she links to the physical and emotional strain of living with these conditions.

Environmental barriers

- Exposure to conventional cleaning products, perfumes, and detergents used by students and campus staff.
- Electromagnetic radiation from institutional Wi-Fi, cell phones, nearby antennas, and, recently, dirty electricity generated by the installation of photovoltaic panels on the building where she works.

Adaptations achieved

For SQM:

- Application of a specific cleaning protocol in her office and classrooms, using compatible products.
- Change of office to an environment with less reactive materials (floors, walls, and furniture).
- Facilities, inherent to the position, for teleworking in functions such as class preparation and research.

For EHS:

- Relocation to an office with lower electromagnetic exposure, away from cell phone towers and areas with a high concentration of wireless devices.
- Initially, the Wi-Fi signal in classrooms was reduced, although this measure was reversed due to its impact on other teaching groups. From then on, more sustainable alternative solutions were sought, such as reassigning classrooms with lower connection demand, as the system allows the signal to self-regulate in terms of power.

Key factors in the adaptation process

The involvement and willingness of the Occupational Health team, especially in the initial phase of the process, allowing for dynamic adaptation and accomodated to the evolution of symptoms.

The existence of a previous case in the institution of another teacher with severe MCS, which served as a favorable precedent for speeding up adaptations.

The presentation of clear medical reports linking EMF exposure to the deterioration of her health.

Limitations of the adaptation

While adaptation to MCS is formalized and managed by Occupational Health, adaptation to EHS falls to Management, without an official agreement guaranteeing its stability over time.

This dependence on administrative decisions outside the prevention area creates uncertainty, especially in the face of structural changes such as the installation of new emission sources (e.g., solar panels), whose planning did not take into account biocompatibility criteria, which has significantly worsened workstation adaptation, something that could have been avoided with better coordination (communication).

Exposure to chemicals brought in by students (perfumes, fabric softeners) continues to be a risk factor, although this is mitigated by the limited hours of face-to-face teaching inherent to the position.

Overall assessment of adaptation

> **Institutional attitude:** Active listening, favorable predisposition, and willingness to negotiate and facilitate adaptation.
>
> **Effectiveness of the adaptation:** It has been carried out at a level that has made it possible to maintain—albeit with limitations—teaching and research activity, although exposure levels continue to progressively weaken her health.

Conclusion

Despite current limitations, the involvement of various institutional actors has allowed this teacher to continue developing her academic vocation, albeit with limitations. However, there is a clear need to move toward formal recognition of EHS within prevention structures, with better coordination between the departments involved. The affected party also highlights the role of associative support as a key element in obtaining information to identify viable technical solutions.

CASE 2:
Primary school teacher with MCS and EHS

Worker profile

This is a primary school teacher who works in large schools, where she changes location every year as she does not have a permanent position. This circumstance forces her to manage the necessary adaptations again in each new school. Her diagnosis includes Multiple Chemical Sensitivity (MCS) and Electrohypersensitivity (EHS), with a recognized disability of 17%, currently under review.

Symptoms

Symptoms caused by exposure to chemicals include itchy eyes, facial redness, rash and cracks on the tongue, closure of the glottis, dyspnea, headache, and extreme fatigue. Exposure to electromagnetic fields causes ear congestion and pain, paresthesia, facial redness, and a strong feeling of exhaustion.

Environmental barriers

The main environmental barriers affecting her health in the workstation are:

- Chemicals used for cleaning the center.
- Air fresheners and perfumes.
- Personal hygiene products and laundry detergents used by colleagues and pupils.
- Electromagnetic fields generated by WiFi, cell phones, digital screens, computers, and photocopiers.
- School supplies, such as paints, sprays, markers, etc.

Adaptations achieved

For MCS:

- Installation of an air purifier in her classroom.
- Exclusive use of specific cleaning products in both her classroom and an assigned bathroom.
- Authorization to recommend that colleagues and pupils avoid using perfumed products or products with strong chemicals, although compliance cannot be enforced.
- Authorization to avoid using school products that smell strongly.

For EHS:

No specific measures have been implemented, as the adaptation was officially granted only for MCS, despite clear symptoms related to electromagnetic exposure.

Personal strategies and institutional support

The teacher often requests to be assigned to groups of young children, who generally use fewer scented products, and on some occasions, she has been allowed not to attend field trips or to do so in her own vehicle, as a protective measure. Although she has generally found her superiors and colleagues to be supportive, her relationship with the occupational risk prevention service has required greater effort and negotiation. In contrast, she has found the occupational health doctor to be understanding.

She has also had to deal with occasional conflicts with cleaning companies, which sometimes do not respect the exclusive use of products compatible with her health condition.

Overall assessment of adaptation

> **Institutional attitude:** There is partial recognition of her situation, with formal measures for MCS, but no specific actions for EHS.
>
> **Effectiveness of adaptation:** The measures implemented in her classroom have improved her immediate environment, but she continues to face residual and unpredictable exposures, especially to electromagnetic fields and products brought in by other people.

Conclusion

Thanks to a combination of formal measures, partial support from her environment, and personal strategies, the teacher has been able to continue working. However, she ends the week with symptoms and a high level of exhaustion, reflecting constant exposure to triggers. This case shows how the quality of adaptations depends not only on technical measures, but also on the attitude and collaboration of the educational environment. Despite the progress made, her experience highlights the need for a more comprehensive and inclusive approach for workers with MCS and EHS.

CASE 3:
Vocational training teacher in graphic arts with MCS

Worker profile

Vocational training teacher in intermediate-level graphic arts, specializing in pre-press, diagnosed with multiple chemical sensitivity (MCS) and electrohypersensitivity (EHS). She has a recognized disability degree of 33%.

Symptoms

When exposed to chemicals, she experiences symptoms such as shortness of breath, throat irritation, coughing, headaches, digestive problems, and extreme fatigue, which means she always arrives home exhausted. As for the symptoms resulting from exposure to electromagnetic fields (EMFs), they are less severe, but she experiences musculoskeletal pain and fatigue.
During the initial phase of the disease, when she had not yet been diagnosed and was suffering from symptoms without understanding their origin, she went through a period of depression.

Environmental barriers

- Inks and solvents used in the printing facility of the educational center.
- Perfumed products (colognes, fabric softeners, personal hygiene products) used by teachers and students.
- Conventional cleaning products used in bathrooms and common areas.
- EMF generated by computers, digital screens, WiFi, and cell phones.

Adaptation process and support

The process of applying for and obtaining the adaptation was long and complex. From the time she submitted her official request, it took two years for the workstation adaptation to be implemented, including four months of sick leave. During this time, she received essential support from an association of people affected by MCS, which drafted a letter explaining her situation, and from a workers' union, which guided her through the bureaucratic process and directed her requests to the appropriate authorities.

Once the adaptation was granted, her exclusion from the printing room, where exposure to inks and solvents was particularly harmful, was formalized. Since then, she has remained in other areas of the educational center that are less harmful to her health.

It is important to note that this adaptation is linked to her current center, so if she transfers to another high school, she will have to start the entire assessment and adaptation process again, with the corresponding delay.

Adaptations achieved For

MCS:

- Official exemption from teaching classes in the printing facilities.
- Relocation to classrooms with lower chemical exposure.
- Inclusion of compatible cleaning products in the center's protocol (although these are not always strictly adhered to).
- General recommendation to students and teachers to avoid perfumes and scented products.

For EHS:

No specific measures have been implemented, as the impact is moderate and EMF exposure has been tolerated with certain precautions.

Day-to-day implementation

Some teachers have stopped using perfumes, and students in her class cooperate by avoiding scented products.
In specific cases where student attend class wearing strong fragrances, they are seated away from the teacher to minimize exposure, although despite this measure, the teacher is already feeling unwell that day...
Although the adaptation includes the use of specific cleaning products, more aggressive ones have sometimes been used, causing reactions. This forces her to keep a close eye on the cleaning staff to avoid incidents.

Overall assessment of the adaptation

Attitude of the administration: Although the adaptation was finally implemented, the process was excessively long.

Effectiveness of adaptation: The exclusion of the printing facility has been decisive, but residual exposure to chemicals persists and no specific measures have been taken to address EMFs.

Conclusion

Thanks to the adaptation achieved and the support of her work environment, as well as personal care, the teacher has been able to keep her teaching work. However, she remains exposed to residual triggers and ends her days feeling tired and with recurring symptoms. This case highlights the importance of support from associations and unions in the adaptation process, as well as the limitations of a slow administrative system that is ill-suited to these emerging diseases. It also highlights the need for stricter enforcement of measures, especially with regard to cleaning, and the urgent need to effectively address EHS in prevention plans.

Total Adaptations and Comprehensive Solutions

Total adaptations are those in which structural and organizational measures are implemented to eliminate or significantly minimize triggers, ensuring that the affected person can perform his/her work under equal conditions. These solutions usually require greater involvement from the company or institution, as well as a specific review of the workstation and the workspaces in which the work activity is carried out.

Success stories in adapting workstations for people diagnosed with MCS

CASE 4:

Civil servant in the public administration with MCS

Worker profile

Civil servant in the public administration, responsible for attending face-to-face work meetings with other workers and transcribing the proceedings for an official publication. She has been diagnosed with Multiple Chemical Sensitivity (MCS) and does not have official recognition of disability.

Symptoms

Symptoms vary depending on the duration and level of exposure to chemicals. She may experience respiratory tract irritation, inflammation of the tongue, mouth ulcers, difficulty breathing, severe headache, and tachycardia. Prolonged exposure also triggers gastric problems (diarrhea), as well as photophobia and phonophobia.

Environmental barriers

- Perfumes, detergents, fabric softeners, and personal hygiene products present in the work environment (clothing, skin, and hair of coworkers and visitors).
- Cleaning and disinfecting products used in bathrooms and common areas.

Origin of the problem

The trigger for the illness was heavy exposure during renovations at the workplace, where materials such as paints and varnishes were used. Staff returned to work the day after the renovations were completed, without adequate ventilation, which led to critical exposure.

Adaptation process

After the first symptoms appeared, she submitted an adaptation request to the Occupational Risk Prevention Service (ORP), explaining what had happened. The response from the occupational health doctor was quick and effective, initially recommending teleworking, which continued throughout the pandemic period.
Once stabilized, the worker requested to return to her on-site workstation, but with specific adaptation measures. Although the occupational risk prevention service was cautious in order to avoid risks, they positively assessed the information and technical arguments that the worker herself compiled and presented, based on regulations and specialized literature.

Adaptations achieved

- Reassignment to an individual office, where she works independently, without sharing space with other colleagues.

- Installation of an air purifier in her office.
- Change of cleaning products throughout the center, replacing them with eco-friendly products that the person can tolerate.
- Use of masks in brief face-to-face meetings with other workers, which helps to reduce exposure.

Key factors in the adaptation process

Application of the Occupational Risk Prevention Law, which recognizes people with MCS as "particularly sensitive workers". Rapid and effective clinical assessment by the occupational health doctor. Good attitude on the part of superiors, the Occupational Risk Prevention Service, and coworkers.

It was not necessary to resort to associations, as current legislation and specialized sources were sufficient to justify the adaptation.

Limitations of the adaptation

Although the adaptation has been effective and has allowed her to return to face-to-face work, there are still occasional exposures that are difficult to control. The use of a mask during face-to-face meetings is a palliative measure, offering partial protection depending on the environment and the products present.

Overall assessment of the adaptation

Institutional attitude: Excellent willingness to collaborate and implement measures within a reasonable timeframe.

Effectiveness of the adaptation: The work environment is sufficiently adapted, although exposure to triggering factors in shared situations cannot be completely avoided.

Conclusion

Thanks to an agile adaptation process based on Occupational Risk Prevention regulations, this worker has been able to keep her job and duties without having to prove disability or resort to external support. The case shows how good institutional coordination, together with the proactivity of the person affected, can lead to functional solutions that guarantee job continuity in safe and dignified conditions.

CASE 5:

Laboratory Technician in the Public Administration with MCS

Profile of the worker

Laboratory technician with more than 20 years of experience as an intern in a public hospital. Diagnosed with Multiple Chemical Sensitivity (MCS) and with a recognized degree of disability between 33% and 44%. At the same time, she had a position on leave of absence in the public administration as an entry-level clerk.

Symptoms

Exposure to chemicals causes tiredness, muscle fatigue, chest pain, tachycardia, arrhythmias, itchy throat, migraines, and brain fog (cognitive confusion).

Environmental barriers

Cleaning and personal hygiene products used by colleagues and users both in the hospital and on public transport.

Disinfectants and hospital chemicals, omnipresent in laboratories and healthcare areas, made it impossible for her to remain in the center even as a patient.

Adaptation process and administrative situation

The worker requested an adaptation of her position as a laboratory technician through the hospital's Occupational Risk Prevention Service. Despite her request and the recognition of her diagnosis, she was not granted the adaptation. She was ultimately dismissed from the center on the grounds of functional incapacity for the position, which meant a professional loss after two decades of service.

Faced with this situation, she requested to return to her position on leave of absence as an entry-level clerk, managed by the regional administration. The Civil Service contacted her and offered her the possibility of adapting the new position. The worker explained her needs: a position far from the urban center of Madrid, without close contact with colleagues, and in an environment free of irritants. The response was positive.

After taking up her new position, she was reassessed by the occupational health doctor, who confirmed her situation and endorsed the adaptation. The new position was adapted to her conditions, ensuring an environment compatible with her disease.

Adaptations achieved

- Individual position, without direct contact with other workers.
- Location outside the city center to avoid high levels of pollution and environmental chemical exposure.
- Exclusive use of cleaning products suitable for people with MCS.

Key factors in the adaptation process

Having a leave of absence within the administration was key to finding a viable job opportunity after her dismissal.
The administration at the new destination was very helpful, which facilitated the smooth adaptation of the workingstation.
The support of external associations was not necessary, as the worker managed the process directly with the administration.

Limitations of the adaptation

Adaptation was not possible in the original job, which meant the loss of a skilled job in which she had accumulated extensive experience. The change in professional category led to a 50% reduction in income, as the new position as an entry-level clerk has lower salary conditions.

Overall assessment of the adaptation

> **Attitude of the administration in the new position:** Excellent receptivity and rapid adaptation.
>
> **Effectiveness of the adaptation:** The new environment is suitable and allows her to work without symptoms, although the professional change has had significant economic consequences.

Conclusion

The worker has been able to resume her working life in conditions compatible with her health, although this has meant a substantial loss of income and giving up her career as a laboratory technician. This case reflects the importance of having alternatives within the public administration when adapting the original position is not feasible, and highlights the need to review the economic impacts of the solutions adopted, especially when they affect long-term, highly qualified workers.

Success stories in adapting workstations for people diagnosed with electrohypersensitivity

Adaptations for people with Electrohypersensitivity (EHS) are often more difficult to implement due to the lack of widespread recognition of this condition. In some cases, the solution has involved modifying the immediate environment (shielding, changes to emission sources), while in others it has been necessary to relocate the person within the same organization. Two representative examples are presented below.

CASE 6:

Physiotherapist with EHS in public healthcare

Worker profile

Physiotherapist in the public health system, diagnosed with Electromagnetic Hypersensitivity (EHS). No official recognition of disability.

Symptoms

When exposed to electromagnetic fields, especially microwave radiation, the worker accumulates static electricity in his body, which, over time, leads to symptoms such as insomnia, headaches, irritability, anxiety, nervousness, and chronic fatigue.

Environmental barriers

Exposure to electromagnetic radiation in the electrotherapy room, especially from the use of microwave devices, without specific shielding.

Adaptation process

The worker submitted official medical reports from the public health service confirming the diagnosis of EHS and requested an assessment by the SESCAM Occupational Risk Prevention Service (ORP). Although the occupational health doctor accepted the documentation and recognized the need for adaptation, the process was slow, and a year passed between the request and the implementation of the measures, during which time he required temporary incapacity for work (TIW).
During that time, he reported the situation to the ORP Service and the Labor Inspectorate, which led to environmental measurements being taken. Although the levels detected were within legal limits, they were intolerable for him, given his hypersensitivity.
Despite the initial slowness, the worker reports a positive attitude on the part of the ORP and his colleagues, who showed understanding of his situation.

Adaptations achieved

- Exclusion from the electrotherapy room and exemption from the use of microwave equipment.
- Reorganization of duties so that he could continue to perform his professional work without being exposed to EMF-generating devices.

Subsequent circumstances

Afterwards, the physiotherapist obtained a permanent position within the healthcare system. When choosing his destination, he opted for a

Healthcare center that does not have microwave-based electrotherapy equipment, ensuring a work environment completely free of electromagnetic fields that affect his health. In this new location, he has been able to work without symptoms and with full functionality.

Key factors in the adaptation process

Presentation of clear and specific medical reports. Personal determination, including the filing of formal complaints that led to technical interventions.
Collaboration from the work environment, both from the Occupational Risk Prevention Service and from colleagues.

Limitations of the adaptation

The process was excessively long, leading to periods of sick leave and unnecessary delays in the implementation of simple measures. Although exposure was avoided, the adaptation involved functional restrictions, as certain tasks associated with the job could not be performed.

Overall assessment of the adaptation

> **Institutional attitude:** There was receptiveness and reasonable measures were implemented, although the process was slow.
>
> **Effectiveness of the adaptation:** It allowed the employee to continue working, although with functional adjustments necessary to protect his health.

Conclusion

This case highlights how appropriate adaptation—albeit delayed—can enable a healthcare professional with EHS to continue working. It also underscores the importance of having options within the public system that allow workers to choose environments that are compatible with his/her health, as well as the need to shorten response times when there is a medical diagnosis and evidence of harmful exposure, even if it is within the general legal limits.

CASE 7:
High school teacher with EHS

Worker profile

Technology teacher at a public high-school, a career civil servant with a full-time permanent contract, with a confirmed diagnosis of Electrohypersensitivity (EHS). He is between 50 and 65 years old and does not have official recognition of disability.

Symptoms

Symptoms resulting from exposure to electromagnetic fields (EMFs) include hyperglycemia (he is insulin-dependent diabetic), headaches, tachycardia, restlessness, tinnitus, and muscle pain. Accumulated exposure also affects his sleep quality and overall energy level.

Environmental barriers

- Mobile phone base stations.
- High-voltage towers.
- Wi-Fi and cell phones.
- Cordless phones.

Adaptation process

At his first assignment, the teacher was able to carry out his work normally until the digitization of classrooms brought about the health problems described above. He was on sick leave for a week, after which he returned to teaching at the same school, but in an area where the Wi-Fi signal was weak. After a while, thanks to medical reports and various letters sent to different authorities, he managed to get the Wi-Fi network replaced with a cable network in the five classrooms that had been set up. The problems ended until, after a while, the educational center began to be used as a special education center, which meant that teachers had to travel to the educational centers assigned to them. The problem for the teacher arose again, as all the centers had Wi-Fi systems in place. After researching each center individually, the teacher, with the support of the Education Delegation, which already had the relevant reports from the Occupational Health Service, was offered a position 15 km away in a brand-new center where all the classrooms were connected by cable. At the new school, as the center's ICT manager, the teacher himself developed the installation of the computer rooms, setting up the cable networks together with his students as part of the educational content.

Adaptations achieved

- Exclusive use of Ethernet cable for classroom connectivity.
- Only two routers are permanently switched on, located in peripheral areas of the center; the rest are activated only on demand, under his direct supervision.
- Control of router activation according to teacher presence or need, with him as the person responsible.
- Prohibition of mobile phone use in his classroom, except in airplane mode.
- No cordless phones anywhere in the center.
- Regular checks to ensure that ground connections are working properly.

- Awareness-raising among teaching staff, including welcome protocols for new teachers in which they are informed about the measures adopted.
- General respect for the conditions necessary for his health, both by the management team and the rest of the teaching staff and students.
  In addition, the professor has led awareness campaigns on the risks of electromagnetic fields in his educational environment.

Key factors in the adaptation process

- Clear medical diagnosis, accompanied by official reports.
- Strong personal initiative, both in the search for a destination and in the implementation of technical solutions.
- Progressive awareness-raising in the educational environment, especially among teaching staff.
- Informal institutional recognition, which has allowed for a practical balance without the need to certify disability or request external support.

Limitations of adaptation

- Dependence on his presence to control the routers, which requires constant monitoring.
- The solution, although effective, depends largely on his management skills and the current support of those around him.
- Risk that conditions may change if the adaptation model is not consolidated into formal regulations.

Overall assessment of adaptation

> **Institutional attitude:** Good receptivity on the part of the Delegation and the team at the new center.
>
> **Effectiveness of adaptation:** The measures implemented allow the teacher to continue working normally and without symptoms.

Conclusion

This case demonstrates how a combination of personal initiative, technical knowledge, institutional awareness, and collaboration from the environment can facilitate effective and sustainable adaptation in cases of EHS. The teacher's experience has not only served to protect his health, but also to promote a more conscious educational approach to the impact of EMFs, extending the benefits of adaptation to the entire educational community.

Success Story in the Adaptation of a Workstation for Semicircular Lipoatrophy

Semicircular lipoatrophy (SL) is a skin condition characterized by localized and reversible loss of subcutaneous fat tissue, forming linear or semicircular depressions in the skin, mainly on the thighs and, in some cases, on the forearms. Although it does not usually cause pain or functional discomfort, its appearance is related to the work environment, especially in offices and spaces with high electromagnetic loads and static electricity.

This condition is associated with factors such as prolonged exposure to low-frequency electromagnetic fields, the accumulation of static electricity on work surfaces, low ambient humidity, and continuous pressure from certain areas of the body against furniture.

It is more common in workers who spend long periods sitting at desks with metal frames or surrounded by electronic equipment.
Although LS is not formally considered a variant of EHS, it is directly related to exposure to static electricity and low-frequency electromagnetic fields in offices and enclosed spaces. It is a condition that usually improves when sources of exposure are eliminated or reduced.

CASE 8:

University Professor with Semicircular Lipoatrophy in a Lower Limb

Worker profile

University professor who works in an office environment with prolonged exposure to electronic equipment. She was diagnosed with Semicircular Lipoatrophy (SL), a rare condition associated with work environments with low-frequency electric fields and accumulated static electricity.

Symptoms

The worker noticed a visible change in one of her legs, with linear depressions in the skin. After visiting her university's occupational health service, she was referred to dermatology, where the clinical diagnosis of SL was confirmed.

Environmental barriers

- Low-frequency radiation from nearby electronic equipment (computers, wiring, plugs).

- Static electricity accumulated on office furniture and floors.
- Possible external electromagnetic radiation from outside, through the windows.

Adaptation process

Once the diagnosis was confirmed, the university's Occupational Risk Prevention Service (PRL) acted quickly, initiating an environmental assessment process and implementing a series of corrective measures aimed at eliminating risk factors.

Adaptations implemented

- Relocation to a new office, away from areas with a high density of electronic equipment.
- Installation of an antistatic mat connected to a ground connection to ensure the continuous discharge of static electricity from the body.
- Furniture (desk, chair, computer) placed within the area protected by the mat.
- Protection of windows with anti-radiation plastic to reduce exposure to possible external electromagnetic emissions.
- Replacement of keyboard and mouse with wireless versions, minimizing contact with conductive elements.
- Relocation of the seat away from sockets and areas with high electrical loads.
- Assessment of relative humidity, which was considered adequate, ruling out the need to add a humidifier.
- Optimization of the air conditioning system to improve ventilation and air distribution in the office.

Results obtained

Complete disappearance of the injury after a few weeks of applying the adaptation measures.
No relapses or new symptoms, allowing her to continue teaching without interruption.
Maintenance of job functionality without compromising her health.

Overall assessment of the adaptation

> **Institutional attitude:** Excellent response from the ORP, with early and effective intervention.
>
> **Effectiveness of the adaptation:** Precise technical measures that resolved the problem definitively.

Conclusion

This case shows how early detection, accompanied by an appropriate technical assessment and the implementation of personalized measures, can successfully resolve a health problem related to the work environment. The complete disappearance of semicircular lipoatrophy demonstrates the importance of properly assessing factors such as static electricity, low-frequency electric fields, and sources of external radiation in workspaces, especially in educational and office environments.
Furthermore, this case complements the previous ones by broadening the spectrum of environmental pathologies related to exposure to invisible physical factors, and highlights the role of the ORP Service as a key agent in the prevention of emerging risks.

Conclusions of the chapter

The cases presented in this chapter, together with the data collected during the analysis phase, allow us to draw clear and necessary conclusions about the current situation of people with Multiple Chemical Sensitivity (MCS), Electrohypersensitivity (EHS), and other conditions associated with environmental factors in the work environment. These conclusions not only highlight the complexity of the adaptation processes, but also the importance of an early, informed, and empathetic institutional response.

a. Workstation adaptation is possible and effective

Cases in which appropriate adaptations were implemented show that it is feasible to maintain the professional activity of affected individuals when action is taken quickly and with technical rigor. Measures such as the use of air purifiers, the elimination of Wi-Fi, physical relocation, the control of cleaning products, or the redesign of spaces have allowed many people to continue working in safe conditions.

b. The institutional environment is decisive

A constant factor in successful cases has been the goodwill of occupational risk prevention services, occupational health services, management teams, and colleagues. Where there was active listening, dialogue, and understanding, it was possible to find functional solutions, even without the need for large investments. Conversely, in cases where there was disinterest, excessive bureaucracy, or ignorance, the health and job stability of those affected were seriously compromised.

c. Personal initiative has been key in many processes.

Many of the adaptations were achieved thanks to the proactivity of the workers themselves, who provided medical documentation, sought technical solutions, proposed viable alternatives, or even led the changes in their own workplaces. This burden of personal responsibility, although valuable, also reflects the lack of clear institutional protocols in most cases.

d. The employment relationship influences access to rights

Most people who have successfully achieved adaptation work in the public sector and have stable employment (civil servants, permanent contracts). In contrast, in the private sector—especially with temporary contracts—success rates are minimal or non-existent. This points to a structural inequality that leaves people with environmental conditions in precarious work environments in a situation of particular vulnerability.

e. Recognition of the degree of disability does not always guarantee adaptation.

Although some people had recognized degrees of disability, this did not automatically translate into an effective response from the administration. In several cases, adaptation was not implemented or was only partially implemented, demonstrating that formal recognition is just one more element in a complex process that also depends on institutional interpretation and political will.

f. Environmental barriers are not harmless

The cases described highlight the serious impact that seemingly harmless environmental factors (cleaning products, perfumes, Wi-Fi, static electricity) on health. Several accounts describe a progressive deterioration that has led to frequent sick leaves, job losses, or permanent incapacities for work. The inadequacy of the environment not only harms those who have already been diagnosed, but could also be contributing to new conditions among the working population.

g. A clearer regulatory and preventive framework is needed

Today, the management of these situations continues to depend largely on the individual judgment of prevention professionals and the sensitivity of the work environment. It is urgent to move toward official protocols and specific legislation that recognize these pathologies as disabling conditions, define compatible environments, and guarantee the rights of those affected.

Concluding remarks

These eight real cases, together with the aggregate analysis of all the situations compiled, offer a concrete and pluralistic view of what it means to live and work with environmental pathologies. Despite the obstacles, many people have found ways to remain active, productive, and committed to their work. The key has been a combination of institutional will, creative solutions, human support, and ethical commitment.

This collective experience highlights a pending debt to occupational health in the 21st century: recognizing emerging risks, preventing their occurrence, and adequately supporting those who already suffer from them. Because protecting those who are most vulnerable also means protecting the quality, safety, and dignity of work for all.

Conclusions and Epilogue

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CHAPTER

5

The Green Book on Workplace Adaptation for People with Multiple Chemical Sensitivity (MCS) and Electrohypersensitivity (EHS) represents a significant step forward in raising awareness and understanding of two conditions that, until recently, remained invisible in the field of occupational health. Its publication, promoted by CONFESQ, is a pioneering contribution that combines scientific evidence, lived experience, technical analysis, and a commitment to human rights.

The *Green Book* not only offers knowledge, but also opens up a horizon for action so that public administrations, companies, prevention services, and society understand that work inclusion of people with MCS and EHS is not an impossible challenge, but a matter of will, justice, and effective enforcement of fundamental rights.

The work carried out by CONFESQ and the participating experts represents a qualitative leap in understanding MCS and EHS from a comprehensive perspective. Its value lies in its biomedical, legal, and technical rigor, and in its ability to place people at the center, showing the human dimension of these conditions and their impact on working and social life.

This document responds to an urgent demand: to provide tools to decision-makers—in prevention, human resources management, or public planning—to adapt work environments to the needs of all workers, including those living with these conditions.

CONFESQ's leadership has made it possible to articulate a collective and specialized vision, bringing together scientific knowledge, professional practice, and lived experience. These types of alliances between the associative movement and the technical community are essential for generating structural transformations. This publication therefore marks a turning point in the social and regulatory treatment of MCS and EHS in Spain.

Progress and structural shortcomings

The chapters of *the Green Book* show that, despite scientific advances and growing social awareness, people with MCS and EHS continue to encounter significant obstacles in the recognition of their rights.

In the **health** sector, there is still a lack of unified clinical protocols, referral units, and specific training in environmental medicine. Those affected continue to follow fragmented pathways and, in many cases, face situations of misunderstanding or denial of their diagnosis.

In the **regulatory and labor** sphere**,** the absence of explicit recognition of these conditions in **Royal Decree 888/2022** and **Royal Decree 1851/2009** limits access to benefits and official recognition of disability. This shortcoming has a direct impact on employability, job stability, and the possibility of accessing adequate protection measures.

Although **Law 31/1995 on Occupational Risk Prevention** establishes the obligation to protect particularly vulnerable workers, its practical application is uneven. There is a lack of awareness in prevention services and human resources departments, as well as a lack of technical tools adapted to these emerging realities.

The challenge is to move from theoretical recognition to effective action: ensuring that labor rights, health, and accessibility are consistently applied to people with MCS and EHS. The shortcomings identified are not due to technical impossibility, but rather to a lack of structural will. There is sufficient scientific basis, international experience, and case law to move toward full recognition of rights.

Adaptation of work environments and the principle of universal accessibility

One of the main contributions of *the Green Book* is its ability to translate scientific evidence into concrete solutions. The technical proposals demonstrate that the adaptation of workstations is possible, effective, and sustainable when applied with criteria of universal accessibility, environmental health, and prevention.

The highlighted measures—replacing harsh chemicals, improving ventilation, creating fragrance- and radiation-free zones, and using low-toxicity materials—benefit not only people with MCS and EHS, but the entire workforce. Prevention, understood as anticipating and caring for the work environment, becomes an opportunity for innovation and organizational improvement.

This approach is in line with the principle of **reasonable accommodation** and the corporate obligation to protect particularly sensitive workers. Inclusion depends both on technical resources and on a preventive culture based on respect, empathy, and cooperation.

Occupational adaptation must be part of universal **accessibility**, which involves designing physical, technological, and social environments that can be used on equal terms. MCS and EHS should not be treated as exceptions, but rather as part of human diversity that environments must take into account from the design stage.

Key elements for workstation adaptation

The *Green Book* summarizes measures that guide preventive action, the redesign of spaces, and reasonable accomodations. Among the essential elements are:

a) General principles

- Individual assessment and active participation of the worker.
- Reversible and reviewable measures depending on the evolution of symptoms.
- Coordination between prevention services, management, and the affected person.

b) Environmental conditions

- **Air and ventilation:** constant renewal, HEPA and activated carbon filters, CO^2 control, controlled humidity, and stable temperature.
- **Cleaning products:** exclusive use of eco-friendly and fragrance-free products, with specific maintenance protocols.
- **Materials:** avoidance of volatile organic compounds; prioritization of natural wood, stainless steel, or glass.
- **Electromagnetic fields:** reduction of unnecessary emitters, use of shielded cabling, wired networks, and application of the ALARA principle.
- **Safe zones:** fragrance- and radiation-free spaces for work or rest.

c) Organizational adjustments

- Partial or total teleworking with preventive monitoring.
- Flexible working hours and prioritization of compatible tasks.
- Redistribution of functions to avoid exposure.
- Internal communication and awareness protocols.

d) Surveillance and training

- Specific protocols for medical and environmental monitoring.
- Training of healthcare and technical personnel in MCS and EHS.
- Inclusion of environmental health and organic disability modules in prevention.

e) Best practices

The most effective adaptations combine technical measures with environmental awareness, formal recognition of the situation in prevention, and associative support.

These guidelines form a realistic and replicable roadmap that should be integrated into any occupational health policy committed to universal accessibility.

Collective challenges to advance rights

The *Green Book* identifies challenges that require the coordinated involvement of administrations, the business community, and associations:

- Formally recognize MCS and EHS in regulations on disability, health, and employment.
- Develop common protocols for prevention and health surveillance.
- Promote research and the collection of reliable data.
- Promote inter-institutional coordination between health, employment, environment, and disability.
- Incorporate a gender and human rights perspective, recognizing the feminization of these pathologies.

These challenges can only be addressed through cooperation. CONFESQ's experience shows that organized civil society can generate knowledge and transformation. COCEMFE shares this vision and believes that defending the rights of people with MCS and EHS is part of defending the rights of all people with organic disabilities.

Associative cooperation for the future we want

The path opened up by this *Green Book* does not end with its publication: it begins with it. It represents a starting point for building a framework for the recognition, protection, and real support of people with MCS and EHS.

The *Green Book* reminds us that accessibility is not just architectural or technological: it is a way of understanding coexistence and justice. The full inclusion of people with MCS and EHS is an ethical and social commitment that challenges all institutions.

On this shared path, **COCEMFE and CONFESQ are moving forward together** to ensure that no one is left out of work participation, health, or community life due to a lack of understanding, adaptation, or recognition. That is, ultimately, the meaning of this work: to pave the way, break down barriers, and build environments that care for and respect human diversity in all its forms.

As we have been saying and as reflected in this document:
disability is a matter of rights.

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