

Hygiene, Health And Safety Conditions Public Swimming Pools

SAFETY

This study examines the level of compliance by swimming-pool construction and reform projects with the Health Regulation for Public Swimming Pools in Andalusia (Reglamento Sanitario de Piscinas de Uso Colectivo en Andalucía) and also identifies the nature of any breaches detected. The study takes in 30 swimming-pool design projects in the Costa del Sol, including a check of compliance with legislative requirements, a critical analysis of deficiencies and a Pearson chi-square test to evaluate the relation between breaches and four requisites. A total of 515 legislation breaches were detected; the main shortfalls were lack of slip-resistant material in circulation areas, lack of technical aids for the disabled, inadequate safeguards around the suction points, non-automatic chemical dosing devices and badly sized filters. The study draws the conclusion that the projected swimming pools show a poor compliance with health regulations in terms of risks to the health and safety of users.

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Water-based recreational activities are extremely popular in sun-blessed environments, where holidaymakers often have prolonged bathing periods either in natural watercourses or the sea or in water facilities (swimming pools, aquatic parks, sports centres, Turkish baths, etc.).

The problems of swimming pool accidents and poor water quality are of great concern to scientists and the public at large. There is by now sufficient epidemiological evidence to show a correlation between contaminating agents in the water and the transmission of diseases, mainly of a gastrointestinal type, after contact with the water and also the appearance of bodily injuries and traumas related to the use of the facilities₁.

A European Commission study₂ has shown that water contamination is an issue of concern to 42% of Europeans, the main environmental worry after climate change. Each year over 7 million people visit the Costa del Sol (Málaga, Andalucía), drawn in by its sunny climate (over 325 days of sun a year), by the quality of its beaches, holiday amusements and excellent tourism accommodation spread along the whole of the 150-kilometre coastline. The swimming pools built into these areas are an



The study showed up significant breaches in swimming-pool water treatment and purification requirements

important recreational resource used increasingly by tourists and residents of all ages. Although these leisure and relaxation facilities afford undoubted health benefits, they also pose threats that might have negative consequences on the health of users. These risks are highest in the areas of heaviest tourism. Quality bathing water and minimum safety conditions are therefore essential public health factors.

Public authorities are bound to look out for the health and hygiene conditions of public swimming pools (i.e. non-domestic pools for collective use). In Andalucía this duty falls on the Primary Public Healthcare Services of the Andalusian Health service (*Servicios de Salud Pública de Atención Primaria del Servicio Andaluz de Salud*), the body that provides health services for the general population. Health departments recognise that swimming-pool legislation is a valuable public-health protection tool, laying down the necessary arrangements and instruments to monitor the health and hygiene requisites for swimming pools of public use, marking the limits and demands for minimising health risks and also ensuring safety in the use of the facilities. The Health Regulation on Public swimming pools in Andalusia (*Reglamento Sanitario de las Piscinas de Uso Colectivo de Andalucía*)₃ sets out comprehensible health-and-safety requirements to cover the design, construction and subsequent commissioning and maintenance of the facilities, such as the design of the hydraulic circuit, purification cycle, bather load, type of physico-chemical water treatment, chemical product store , etc.

Swimming-pool use entails potential exposure to risk situations, involving bodily injuries and traumas, risks of a chemical type and, above all, the risk of infectious diseases

Despite the many studies of the dangers posed by swimming pools and their results on public health, there are still uncertainties about how the conception and design stage should be controlled to minimise risks in the stages before opening the pool to the public. In Andalucía the construction and reform of public swimming pools is subject to municipal authorisation; this depends on a favourable health report from the provincial delegate from the Regional Health Ministry (*Consejería de Salud del Gobierno regional*).

The correct wording and subsequent execution of swimming-pool construction and reform projects is recognised to be important₄ in minimising and preventing injuries, accidents and diseases after the facilities have been brought into use. Many decisions taken during this phase impinge later on the health and safety of swimming pool users.

The main remit of this study is to examine whether the technical solutions contained in the construction or reform projects, as reflected in the documents submitted for the municipal licence, meet the standards laid down in the Health Regulation, thereby ascertaining whether the minimum requisites are duly and unmistakably met. An analysis is also made of the relation between the legislative breaches observed and the possible effects on the health and safety of swimming pool users. A secondary objective of this study is to find out whether the gravity of the legislative breaches differs within the different classes of health requirements.

Materials and Method



The study concludes that the health authorities should do more to enforce health and safety conditions in swimming pools of public use.



Suncream or oil adhering to the bather's body might produce slippery conditions at the poolside.



The lack of any specially designed building for storing the chemical products used in swimming pool maintenance is one of the most widespread breaches detected by the study

Sampling

Thirty swimming-pool reform or construction projects, drawn up to obtain the municipal operating licence during 2010, were randomly selected from within the territory of the western Costa del Sol. The pool types were children's pools and multipurpose pools. The activity sectors for which the facilities were designed were hotels, municipal sports centres, beach clubs, homeowner associations and condominiums.

Checklist

The degree of compliance with the swimming-pool health regulation in the design phase was assessed by means of a checklist, including a list of health requirements laid down from article 3 to 25 of the regulation. This legislation lays down standards and stipulations for the water quality, design of the pool tank, water treatment, user information, etc, to reduce the risk to the bathers' health and safety. An examination was made of the technical documentation of each project (descriptive report, annexes and plans), pinpointing any breaches with the specifications laid down in the articles, defining these as any non-conformance or deviation from each legal precept of the regulation by error or omission. A check was also made of whether the technical solutions were properly and clearly described in the documentation in keeping with the current state of the technology and scientific knowledge.



Results

A double entry contingency table was drawn up showing the joint distribution frequency of two variables: class of health requisites and degree of non-compliance. Pearson's chi-square (X^2) test was used to gauge whether the differences between the frequencies of legislative breaches observed and those expected could be put down to chance, under a hypothesis of independence. This statistical test establishes any significant differences in the level $p < 0.05$. Our aim was to find out whether the distribution of the gravity of the infractions differs for each class of health requisites or, on the contrary, if they can be considered to be independent. The software Microsoft Excel 2000 v.9.0.2812 was used to calculate the means, frequencies, Pearson X^2 statistic and graphic presentations.

Results

During 2010 an environmental health specialist examined the technical documentation of 30 public swimming pool construction or reform projects. Table 1 shows the distribution of frequencies observed for each class of health requisite and their breakdown into minor or serious. The number of observed breaches of the Health Regulation for Public Swimming Pools was 515, with a mean of 16 (± 3.6) breaches in each project. 361 breaches of a minor character were observed and 154 serious breaches. 49.13% were bound up with the design of the pool tank, 26.79% with water treatment and purification, 16.89% with surveillance and users, while a lower proportion of breaches, 7.18%, had to do with hygiene and services. Within each category most of the breaches were minor (figure 1).

Table 1. Breakdown of breaches observed

Type of requisite	Type of breach		Total
	Serious	Minor	
Design of bathing zone	93	160	253
Hygiene and services	9	28	37
Water treatment-purification	22	116	138

Surveillance - users	30	57	87
Total	154	361	515

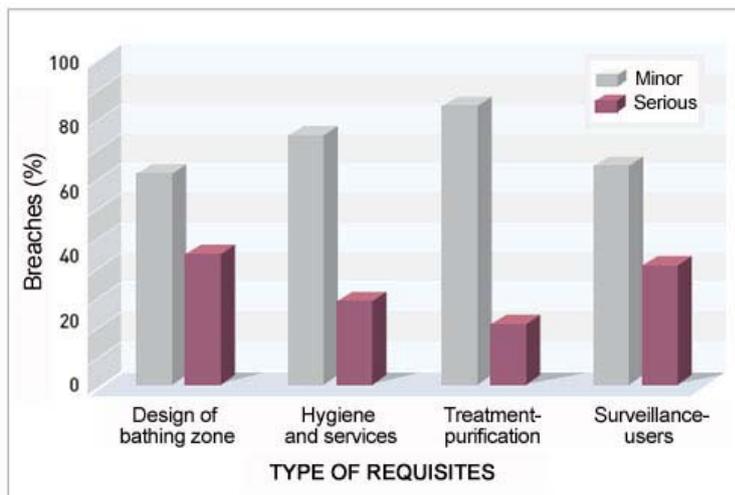


Figure 1. Breakdown of breaches by type of health requisites

The percentage of serious breaches in the bathing area (60.39%) came out much higher than in the rest of the categories (figure 2); in the case of minor breaches about one half of all breaches fell into the category of the bathing area (44.32%), followed by water treatment and purification (32.13%). Table 2 shows a descriptive summary with the commonest shortfalls detected in the technical documentation of the studied set of swimming-pool design projects.

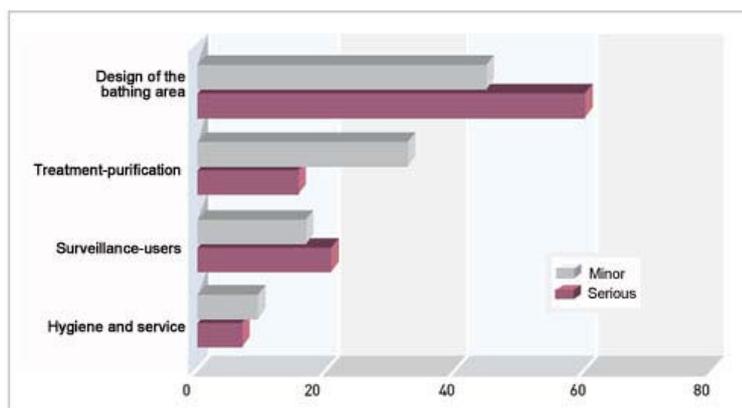


Figure 2. Breakdown of breaches by type of infraction.

Due control of swimming pools in the design phase offers a chance of minimising risks to the health and safety of users before the facilities are brought into use

Characteristics of the bathing area

The gravest legislative breach was the failure of the technical documentation to account for the slip-resistance of the deck around the pool, to ensure the safety of bathers walking barefoot over slippery surfaces covered with films of water, oil, soap, sunscreen, etc. Such situations are inevitable in view of the customary use of swimming pools, and any failure to provide for them with slip-resistant surfaces could produce falls by bathers walking in this area. Equally important are breaches stemming from the failure to fit pool-bottom drains with safety grilles and

guards to prevent risks to bathers, mainly due to suction of parts of the body when the flow rate is too high (thorax, abdomen, intestines, gluteus...) or the more usual forms of entrapment (clothes, hair or limbs) when the drains' protective grilles are badly designed. Minor in character but great in impact was the failure to provide technical aids (crane, hydraulic hoist, ramp, adapted stairs) to help disabled persons enter and leave the pool. This is now a sine qua non to meet legal rules on accessibility and removal of all architectural barriers to the disabled.

The study analyses how far the technical solutions of swimming pool construction or reform design projects abide by the swimming pool health standards

Table 2. Description of breaches of the swimming-pool health regulation

CHARACTERISTICS OF THE BATHING AREA

- **Pool tank.** No indication is given of changes of slope or depth; there are no zones shallower than 1400 mm; the pool-bottom slope is steeper than the established gradient; presence of obstacles (ledges and low walls) within the pool tank that balk water flow; the children's pool is deeper than 40 cm.; the pool bottom does not meet slip-resistance conditions; the drain protection system is inappropriate; lack of authorisation for discharging water from the pool; lack of entrance ramp or technical aids for the disabled; installation of a water slide without observing due safety requisites. The surrounding deck and poolside area is less than 1200 mm wide; failure to meet slip-resistance conditions; inappropriate design of the deck area; poolside obstacles.
- **Step ladders/stairs.** The rise and run of the rungs are unequal in the same ladder; there are no handrails or their number is lower than the width of the free span; they are not adapted for people with reduced mobility; they protrude from the plane of the tank wall and the tread (ramp) does not meet slip-resistance safety conditions; the number of metal stairs is less than one per 25 metres of pool perimeter (or fraction thereof) and their relative distance is more than 15 metres (SU6 safety against drowning risk standard of the Spanish building code [*código técnico de la edificación*])⁶ ; the arms have the same height; some do not go far enough under the water and others reach the pool bottom.

HYGIENE AND SERVICES

- Water quality and origin is not guaranteed
- The number of showers is insufficient and there are no foot showers
- Lack of first aid kits or first-aid room (for pools with a water surface > 600 m²).
- No provision has been made for toilets; insufficient supply of equipment; the toilets are not disabled-friendly or separated by sex. Lack of litter bins or urban waste containers in the pool precinct.

WATER TREATMENT AND PURIFICATION

- **Hydraulic design.** There is no system or valve to prevent water flowback from pool to mains; the perimeter overspill system is discontinuous; no provision has been made for a compensation tank or its design is inadequate; the number of skimmers is less than 1 per 25 m² of water surface; the electro-pump flow is insufficient to complete the purification cycle in less than 4 hours in multipurpose pools; there are no measuring systems for verifying the purification cycle or they are fitted in the wrong place.
- **Physico-chemical water treatment.** The sand filter is not big enough to meet the pool's filtration needs; the chemical-product dosing systems do not have automatic regulation based on the water concentration of the product concerned; there are no chemical dosing devices (acid) for regulating water pH; manual application of chemical products; the UV water-disinfection system does not justify the minimum necessary dose(J/m²).
- **Chemical products.** There is no specific and exclusive premises for storing the biocide chemical products for water treatment; the store shows design deficiencies and is downgraded to a plant room; the safety data sheets of the chemical products are out of date.
- **Sundry.** The parametric limits of chemical compounds in the water do not abide by regulations; obligatory water quality control parameters are omitted and also ambient parameters in indoor pools; the air conditioning system is deficient in terms of hygienic air renewal; the pool tank has no thermal barrier to prevent energy wastage (Regulation on Thermal Plant in Buildings – RITE in Spanish initials) .

SURVEILLANCE AND USERS

- Children's pools are not properly fenced off or the barrier is not standardised (fitted with lock, unclimbable by children, resistant, properly anchored, height of 1.2 m.) to prevent access by children outside the authorised opening time or after the end of the bathing season. Likewise the whole swimming pool precincts does not have a complete enclosure to control user access.
- There is no lifeguard service. Not enough lifebuoys are provided
- The official figures and maximum occupancy of each pool are not displayed and there is also no indication of the pool bylaws

Services and hygiene

The requisite most often breached was the failure to ensure a safe non-mains supply of bathing water. The absence of toilets in the swimming pool and the failure to provide litter bins and urban waste containers were other failures that came to light in the study.

Water treatment and purification

In over half the swimming-pool projects studied the chemical-product dosing system for water treatment (disinfection and maintenance) was not automatic. In other words there was no system fitted with a programmable device that tripped and shut down the dosing operation according to a pre-set level of free chlorine (or other authorised disinfectant) or allowed ongoing analysis of its water concentration to maintain a correct level and an environment free of pathogenic micro-organisms. Instead of such automated equipment, dosing devices based on irregular

sprinkling of the water with the chemical product are used but without any sensors to measure the concentration. Such equipment does not ensure trustworthy regulation of the chemical product and does not rule out the human or random factor (organic matter, bather load, water flow,...) in the dosing procedure. The filters provided for the physical treatment of the water were silica sand filters. Strikingly, their performance features did not meet the required standards for ensuring efficient dirt retention and water quality. Both the filtering section and the filter diameter were chosen without taking hydraulic calculations into account and fell short of the pool purification needs.

On many occasions the project engineers underestimated the need for a specific and exclusive store for biocide chemical products; instead they fell back on the plant room as the storage facility, in breach of the law. This is unacceptable not only in terms of ensuring chemical safety but also because the water purification buildings do not meet the design standards for the storage of chemical products.

Surveillance and Users

In over half of the projects no user information was displayed on maximum occupancy (broken down for each pool) and local bylaws. Infractions also came to light in the number of lifebuoys or their chord was shorter than the regulation length. One of the most important faults in terms of preventing the risk of drowning was the lack of a complete enclosure in many pool precincts to prevent user access, especially children, outside the opening hours or after the end of the bathing season.

The Pearson chi square test was carried out to ascertain whether the observed differences between the category of data could be put down to chance. The results fell within the critical region ($\alpha=0.05$), which would tend to rule out the independence hypothesis (table 3). It would therefore seem that the degree of non-compliance and the category of health requisites are not independent of each other, i.e., at least two of the requisite groups differ according to the type of infraction, suggesting that there is a relation between the categorised data groups. Thus, with a p-value very close to zero there is sufficient evidence to refute the null hypothesis and we decided that there were statistically significant differences, even though the observed and expected frequencies seem to be equal (figure 3). Nonetheless, if we look at the partial values of χ^2 , the water treatment and purification class of requisites accounts for much of the detected variability, while the differences are very small in the rest.

The prevention of bodily harm, accidents and transmission of diseases in public swimming pools calls for the adoption of suitable hygiene and health requisites and specific safety conditions in their use

Table 3. Pearson chi square test

	Valor
Chi square statistic χ^2	19,925 ^a
Degrees of freedom	3
Asymptotic sig. (bilateral)	,000176

a. 0 boxes (0%) have an expected frequency lower than 5. The

minimum expected frequency is 11.06.

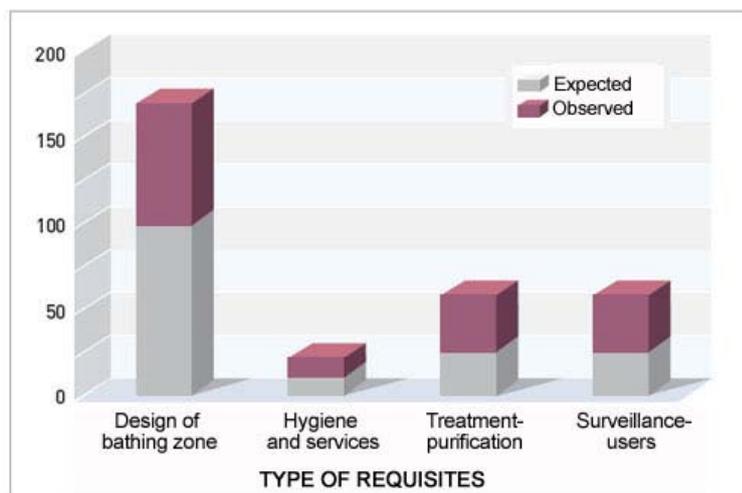


Figura 3. Observed and expected breach frequencies.

Discussion

The results show the importance of increasing public-health surveillance and control of swimming pools during the design-project phase as the stage of the whole process offering the best chance of minimising risks to the health and safety of users. A large sample of swimming pool projects was studied ($n=30$), identifying a significant percentage of minor and serious infractions in relation to health risks for users and safety conditions in the use of the facilities. We assess and weigh up these breaches in this present work.

Improper design of the guards and grilles protecting bathers from the pool-bottom drains could lead to entrapment of fingers, hair, clothes or ornaments of children and adults, leading to injuries and, in extreme cases, death

The enforcement of swimming-pool legislation is being compromised by the low level of compliance found in the projects studied. Our analysis suggests that efforts to prevent bodily harm and diseases should concentrate on compliance with the Health Regulation in the swimming pool design and conception phase.

Breaches found in the design of the bathing area are especially significant in terms of the gravity of their consequences and media impact. Witness some of the commonest breaches in this area. The regulation lays it down that the poolside deck should have a slip-resistant surface, referring thereto in a general but not indeterminate way, insofar as the surfaces should meet certain characteristics in keeping with the particular circumstances obtaining in these circulation areas. In other words the term "slip-resistance" is not absolute, for different floors have different degrees of slipperiness; but the surfaces should offer resistance to slips and sliding under normal use conditions, with the presence of water splashed from the pool or running off the bathers, sunscreen or oils sticking to the body, remains of soap after showering, with the added factor that users are normally walking barefoot. Those projects, therefore, that refer to other causal conditions do not meet the law on this point. Some projects abide by the standard UNE-ENV 12633:2003 referring to barefoot conditions, but some authors⁷ have shown that this does not meet the safety conditions required for walking barefoot

over surfaces impregnated or splashed with slippery agents.

As for the breaches relating to the pool-bottom drains, the regulation calls for suitable guards and grilles to forestall any risk situation. Note here that the regulation does not speak merely of "accidents" which would be a concept of lesser scope. The law is forced to fall back on «indeterminate legal concepts» since it would obviously be impossible to encompass in the law all the technical devices on the market, which are changing at a much quicker pace than the law itself. Nonetheless, working from some minimum logical criteria, technical knowledge and professional experience, it is easy to pinpoint those cases involving health risks in relation to the pool-bottom drains, such as the suction effect or entrapment, which might lead to serious injuries as a result of sucking in parts of the body⁸ (intestines, thorax, abdomen, gluteus, limbs...) or even death by drowning. The preventive measures to minimise risks of this type have been tackled in the European Standard EN 134519,10, laying down the flow rate (< 0.5 m/s), increasing the number of drains and spreading them out evenly, establishing a minimum size for the protective guard and grille openings (< 8 mm-diameter), etc. Inclusion of a non-specific grille in any design project, therefore, does not guarantee abidance by the legislation; this calls for a finer level of detail and development in the design project in keeping with available technical and scientific evidence.

Another factor involved in dangers of this type is the use of protection barriers around the pool itself or fencing off the whole pool precincts. This is one of the most effective recognised measures for preventing drowning¹¹, controlling as it does the access of children and adults outside the supervised opening hours or after the end of the bathing season. Instead of such measures, deficient projects allow only for ornamental elements such as hedges, partial fences, a low or easily-climbable fence, unlockable gates or even direct access from houses or building exits. Such arrangements are ineffective for controlling the entry of users, whose behaviour never exempts the swimming pool tenure holder from the obligation of adopting standardised safety measures.

*Swimming pool regulations are a valid instrument
for safeguarding the health of bathers and
ensuring safe use of the facilities*

One of the commonest breaches is the lack of technical aids for disabled bathers. In general the design projects meet the requisites for entering and leaving the pool precincts but the vast majority fail to remove all architectural barriers to entering and leaving the pool itself. This means that it would be very difficult if not impossible for a disabled person or a person with reduced mobility to use the pool in a safe and autonomous way. The requirement of removing all architectural barriers has raised some controversy, always in relation to the cost of the necessary reforms. This has led to a pronouncement by the Andalusian Ombudsman (*Defensor del Pueblo andaluz*)¹² and the Consultative Council of Andalusia (*Consejo Consultivo de Andalucía*)¹³, who warn the public authorities of the need of bringing public swimming pools into line with today's requirement of ensuring equal access for the disabled community and facilitating their full integration into all ambits of social life.

The differences found between the class of requisite and type of breach were most notable in the category of «water treatment and purification». These breaches are particularly important because poor water quality or insufficient disinfection could impede the removal of pathogenic agents from

the water, potential vectors for passing on diseases to the bathers¹⁴. Here the regulation calls for the use of automatic chemical-product dosing and control systems according to ongoing calculations of the disinfectant present in the water. The commonest breach here is the use of dosing devices whose measuring of the disinfection level is based on the oxygen reduction potential (ORP) or redox. Perhaps the problem here lies in the fact that the Health Regulation specifies the threshold limits of residual free chlorine (0.4 – 1.5 ppm) in the water, i.e., it regulates the ppm level but not the redox values (mV). In general, ORP is not a good technique for measuring the disinfectant level. The logarithmic dependence of ORP on the concentration multiplies the errors in millivolts measured (Nernst's equation, 1889). Swimming-pool water chemistry is complex and the thermodynamic redox equilibrium is seldom met. Due to the abovementioned exponential relation, therefore, small changes in the ORP reading translate into huge swings in the ppm values of residual free chlorine, regardless of the reference electrode. ORP readings are widely misused, badly understood and present significant limitations due to slow kinetic regimes, mixed potentials and electrode failures^{15,16}. It is an instant test; this means that it is not sensitive to chlorine ions and neither should it be used as a direct indicator of residual oxidant due to the pH effect and the temperature of the readings. It does not, therefore, obviate the need of analysing the disinfection level with other standard tests. Automatic control systems based on Photo Ionisation Detectors (PIDs) or amperometric sensors¹⁷ are considered to be chlorine- and bromide-specific and therefore afford a more trustworthy control of water quality¹⁸.

One of the most important water-quality criteria is control of turbidity in the pool; this involves appropriate treatment of the water, which in turn entails correct sizing of the filtration system. Filtration is a critical stage in the elimination of pathogenic micro-organisms; a filter of deficient size will not ensure that water quality is kept within legal limits. One of the commonest project deficiencies in this respect was the selection of sand filters whose cross section and diameter did not meet the performance features established by the corresponding hydraulic calculations. This means that, even if the pool purification cycle was less than the established time of 4 hours, this was achieved at such high filtration rates, normally critical $>50 \text{ m}^3/(\text{h}\cdot\text{m}^2)$, with such a quick water flow through the filter that the dirt was not effectively filtered out and returned to the pool after the purification process.

Failure to display user information (maximum occupancy, bylaws, safety pictograms, indications of depth and changes of slope,...) should not be downplayed in importance, as simple as this fault may seem. Neither should this obligation be fobbed off on non-professionals outside the project. The choice of an inappropriate colour, incomplete warnings or inappropriate text size all impinge heavily on perception of the danger and user understanding thereof¹⁹. Some authors have found a relation between bodily injuries in pools and the absence of depth indications²⁰.

Health regulation of public swimming pools will only be effective if this is properly enforced and it is crucial to look into the factors that might hinder its application

Design engineers and the professional sector in general tend to explain away the high incidence of breaches in terms of the subjectivism of the public authorities, ignorance of the sector and the poor technical quality of the regulations, leading to problems

of legal uncertainty. These critics defend the literal tenor of the regulation without any leeway for interpretations over requisites «unmentioned» in the regulation as written. This outlook obviously does not hold any water. Boiling down the swimming pool Health Regulation to a literal interpretation of the «positive rule» indicates a worrying dearth of arguments and sloppy thinking. The health regulation is much too complex to be understood in such a facile manner; its rules need to be intelligently adapted to each specific case, while public authority professionals need to be able to work with some leeway but within well marked limits, giving due grounds for their opinions in terms of certain health risks. True it is that there have been some cases of an improper use of these general rules. Nonetheless, this legislative approach has been endorsed by the Constitutional Court itself in its judgements 62/1982; 122/1987, FD 3. and 150/1991, FD 5., which have defined the principle of legal certainty in broad and flexible terms that go well beyond mere knee-jerk response to each particular legal requisite.

Hidebound, overly specific rules cannot do real justice to the internal logic of the target sector, with the concomitant risk of gearing the Health Regulation towards satisfaction of the professional sector by paring down the risk situations rather than providing a real safeguard for users. Referral to or application of UNE standards 21,22 or internationally recognised standards (DIN, BS, ANSI...) guarantees greater legal certainty than regulations with painstakingly detailed requisites that, paradoxically, hinder the application of the law and fuel more costs than benefits. This approach ensures that compliance with health requirements is not an ad lib affair and that the provisions of the regulation are not abused. The same health and safety conditions are thereby guaranteed for any European citizen or tourist in an increasingly complex multicultural society.

Our study shows that the design projects do not put forward technical solutions with grounds based on objective conditions. Neither the design of the facility nor the selection of its component parts was the result of a set of technical data objectively obtained from the calculations carried out. A mere declaration of good intentions vis-à-vis compliance with the Health Regulation or churning out chunks of its text as guarantee of legal compliance is just not good enough. Design projects need to be so worded as to offer certainty about the technical solutions put forward, reasonably developed and documented with grounds. A rough idea of the reasons for project breaches would be the following: insufficient health training and instruction, underestimation of health requisites in architecture and engineering projects, cost cutting (undercutting the competition or satisfying the promoter). These translate into insufficient safety measures or substandard equipment, etc. Indeed, the Spanish Supreme Court (*Tribunal Supremo*)²³ has pointed out that the omission of swimming-pool safety measures, shirking healthcare requisites, represents an obvious cost advantage for the tenure holder of the facility concerned, who thereby, to save money in his or her own interest, jeopardises the very legal right (public health) that the health regulation sets out to protect.

To avoid inconsistencies in the wording of projects and ensure their correct implementation, an immediate interpretative task needs to be carried out to select those technical rules that might top up the Health Regulation and be most conducive to the technical valuation criteria. Important support here can be gleaned from the official guides or recommendations drawn up by the professional sectors and public authorities, the interpretation of which should be duly crosschecked against the legal provisions. Publicity campaigns or professional events could be useful tools to help enforce the Health Regulation.

The quantitative and qualitative data culled therefrom could be

extremely useful in terms of improving available information, allocating resources and directing decision-taking in surveillance programmes for public swimming pools. Inspection activities, for example, could increase their effectiveness by means of regulation-enforcement actions wherever breaches have been disproportionately high.

The conclusions we can draw from this study are that breaches of the Health Regulation for Public Swimming Pools (*Reglamento Sanitario de Piscinas de Uso Colectivo*) are commonplace, resulting in poor compliance of the hygiene and health conditions and impoverished safety for users.

This study shows that legislation in itself is not enough to safeguard the health of the users of swimming pools designed and built in the Costa del Sol; effective enforcement of these regulations has to be ensured and it is vital to look into the reasons why the legal provisions are so often breached. The health authorities, for their part, have to work harder to ensure compliance with health and safety conditions in public swimming pools.

Our study has shown that the swimming-pool design projects do not provide technical solutions with proper grounds

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