IMPLEMENTATION OF THE HACCP METHODOLOGY IN SWIMMING POOLS

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ABSTRACT

HACCP – Hazard Analysis Critical Control Points – is a widely disseminated and applied methodology in the food industry and pursues the objective of quality that can and should be applied to other areas where public health could be compromised.

Until public availability, swimming pool water undergoes several procedures, many of which are potentially risk situations – critical points – that are not identified and eventually eliminated or minimized, may condition the adverse health and safety professionals and users of these spaces.

Among the high-risk situations include, for example, physical accidents (fire, electric shock, burns, falls,...); diseases transmitted by biological agents (fungi, bacteria, viruses and parasites) spread by water, air or surfaces; toxic exposure (acute or chronic) promoted by chemical agents per se or its byproducts.

Among the measures available to control risks and dangers we highlight the analytical monitoring of the initiative of managers of pools or other entities, external audits integrated into the Sanitary Surveillance Program Pool at the expense of the Public Health Units, the existence of records specific (for example, the health record book) and standard models for alert situations. Although valid and complement each other, the control measures implemented until now are not a sufficiently integrated and comprehensive approach towards the multitude of risks and hazards that could identify, assess, minimize or cancel.

With this communication, we intend to present a methodology for identifying risks and hazards based on HACCP principles apply to swimming pools from initial conception to its use.

Keywords	Swimming pools, critical points, hazards, HACCP

INTRODUCTION

The HACCP methodology – Hazard Analysis Critical Control Points –, widely disseminated and applied in the food industry, pursues the objective of quality that can and should be applied to other areas where public health could be compromised.

In the case of swimming-pool attendance, it is known that, until the public availability, the pool water passes through several phases, many of which are risk situations – critical points – that are not clearly identified and, therefore, eventually not eliminated nor minimized. However, such conditions may result in adverse health and safety effects for professionals and users of these spaces.

Among the high-risk situations are included, namely, physical accidents (fire, electric shocks, burns, falls, among others); diseases transmitted by biological agents (fungi, bacteria, viruses and parasites) spread by water, air or surfaces; toxic exposures (acute or chronic) promoted by chemical agents per se or by its byproducts.

The concept of hazard analysis and critical control points identification was presented for the first time, in a resumed version, in the National Conference of Food Protection, in 1971, in the United States

(USA). The HACCP methodology itself had begun its development since 1959, by the Pillsbury Company (USA). The supply of meals to cosmonauts flying in crew missions had been adjudicated to this company by NASA, aiming to achieve the maximum food safety (zero defects) the situation required (Campos, 1993).

The HACCP concept is based in the following guidelines (Martins, 1985):

- Potential risks evaluation;
- Identification of critical points, to control the identified risks;
- Establish adequate techniques to verify the critical points and its registry for deviation analysis.

METHODOLOGY

The present work was made supported in a rigorous literature review and the knowledge derived from the authors' field work, as public health professionals.

RESULTS

Among the measures available to control risks and hazards we highlight the analytical monitoring of the initiative of pools' managers or other entities; the need for external audits integrated in the Sanitary Surveillance of Pools Program, under the responsibility of the Public Health Units; the existence of specific records (such as the Sanitary Registry Log) and standardized forms for alert situations. Although its validity and complementary to others, the control measures implemented until now are not a sufficiently integrated and comprehensive approach towards the multitude of risks and hazards that could be identified, assessed, minimized or abolished.

CONCLUSIONS

There is a need for identifying critical points in swimming pools, using standardized methods, in order to develop adequate measures of prevention of health hazards, not only for bathers, but also for workers and general public.

The results also suggest that the intervention areas need to go further beyond the water sanitary control, referring a large number of critical points in which one must direct further efforts, namely: use of coagulant/flocculant, filtration, disinfectant addition, pH corrector addition, water heating, hydraulic circuit, products storage, pool use, cleaning and disinfection, safety and good practices, reviews, maintenance and disinfestations.

Process	Hazards	Preventive measures	Monitoring	Register
Use of coagulant/ flocculant Filtration	Burns, dermatitis, respiratory problems induced by chemical products exposure	Availability of products data safety sheets Handling and using according products' data safety sheets Display safety and health signs Use of personnel protection equipment (PPE) by workers	Visual observation by the head of technicians (non planned audits) to verify: • Maintenance/updating of products' data safety sheets • Products handling procedures • Adequacy/preservation of safety and health signs • Use of personnel protection equipment (PPE) by workers	Inventory management file for products, indicating: Product reception, supplier, quantity, adequate packaging and labeling, safety data file, returns and causes, person in charge. Professional formation chart in which each worker acknowledges: • Having been informed about correct products use; • Having been informed about correct equipments use; • Having been informed of risks and prevention procedures; • Having received PPE (type and number discriminated) Daily records file indicating: • Undesirable events occurring in handling of chemical products (body accidents, accidental spills, ...) and corrective measures adopted; • Detected discrepancies (automatic dosing system); • Daily information of filters differential pressure; • Identification of person in charge. Sanitary Registry Log (SRL): record washing of filters Equipment maintenance file indicating: Review date of filters and automatic dispensers, reviews outcomes, corrective measures adopted, technician's signature
	Water turbidity Increased difficulty in disinfection Increased use of water disinfectants Bathers discomfort Increased risk of accidents in water tanks Increased potential for DBP's formation (filters clogging)	Adopt and attach written procedures regarding products dosing, concentrations, frequency of use, over dosage correction,... according each product specifications Backwashing of filters (at least daily) Correct sizing of filtration units and maintenance of adequate speeds of filtration Installation of pre filters Immediate washing of filters, if they receive water coming from cleaning lower part of the tanks Maintenance/review plans for all automatic equipments	Visual observation by the head of technicians (non planned audits) to verify: • Maintenance/adequacy status of written/attached procedures and its fulfillment • Procedures adopted by technicians in each step of coagulation/flocculation and filtration • Fill correctly registry files and Sanitary Registry Log (SRL)	

Process	Hazards	Preventive measures	Monitoring	Register
Disinfectant addition	Burns, dermatitis, respiratory problems, poisoning, explosion	Availability of products data safety sheets Handling and using according products' data safety sheets Display safety and health signs Use of personnel protection equipment (PPE) by workers	Visual observation by the head of technicians (non planned audits) to verify: • Maintenance/updating of products' data safety sheets • Products handling procedures • Adequacy/preservation of safety and health signs • Use of personnel protection equipment (PPE) by workers	Inventory management file for products, indicating: Product reception, supplier, quantity, adequate packaging and labeling, safety data file, returns and causes, person in charge. Professional formation chart in which each worker acknowledges: • Having been informed about correct products use; • Having been informed about correct equipments use; • Having been informed of risks and prevention procedures; • Having received PPE (type and number discriminated) Daily records file indicating: • Undesirable events occurring in handling of chemical products (body accidents, accidental spills, ...) and corrective measures adopted; • Detected discrepancies (automatic dosing system); • Daily information of filters differential pressure; • Identification of person in charge. Sanitary Registry Log (SRL): record, twice a day, total and residual disinfectant in water tanks Equipments maintenance file indicating: Date of reviews of equipments, results of reviews, corrective measures adopted, signature of person in charge Record of residual disinfectant and events in the SRL (detected discrepancies, identification of the cause, corrective measures, signature of person in charge
	Microbiological contamination of water tanks DBP's formation	Adopt and display written procedures (regarding products dosing, concentrations, frequency of use, over dosage correction,...) according each product specifications Adopt automatic dosing of products See Chapter "Pool use" Adopt and display written procedures (regarding products dosing, concentrations, frequency of use, over dosage correction,...) according each product specifications Adopt automatic dosing of products See Chapter "Pool use"	Visual observation by the head of technicians (non planned audits) to verify: • Maintenance/adequacy status of written/attached procedures and its fulfillment • Procedures adopted by technicians in every step of coagulation/flocculation and filtration • Fill correctly registry files and Sanitary Registry Log (SRL) Regular control of disinfection residual levels in water tanks (at least twice daily)	

Process	Hazards	Preventive measures	Monitoring	Register
pH corrector addition	Burns, skin or respiratory outcome health effects, fires	Availability of products data safety sheets Handling and using according products' data safety sheets Display safety and health signs Use of personnel protection equipment (PPE) by workers	Visual observation by the head of technicians (non planned audits) to verify: • Maintenance/updating of products' data safety sheets • Products handling procedures • Adequacy/preservation of safety and health signs • Use of personnel protection equipment by workers	nventory management file for products, indicating: Product reception, supplier, quantity, adequate packaging and labeling, safety data file, returns and causes, person in charge. Professional formation chart in which each worker acknowledges: • Having been informed about correct products use; • Having been informed about correct equipments use; • Having been informed of risks and prevention procedures; • Having received PPE (type and number discriminated) Daily records file indicating: • Undesirable events occurring in handling of chemical products (body accidents, accidental spills, ...) and corrective measures adopted; • Detected discrepancies (automatic dosing system); • Daily information of filters differential pressure; • Identification of person in charge. Sanitary Registry Log (SRL): register (2xday) total and residual of the disinfectant Equipment maintenance file indicating: • Review date of isolation/painting of water pipes • Result of the reviews • Corrective measures adopted • Signature of the person responsible
	Disinfection action compromised by high/low pH in water Incrustations development in pipes	Adopt and display written procedures (regarding products dosing, concentrations, frequency of use, over dosage correction,...) according each product specifications Automatic injection of product before filters Calibration of pH meter, at least weekly Review dosing system at least weekly (including cleaning of filters and dosing device valves)	Visual observation by the head of technicians (non planned audits) to verify: • Maintenance/adequacy status of written/attached procedures and its fulfillment • Procedures adopted by technicians in every step of water neutralization • Fill correctly registry files and Sanitary Registry Log (SRL) Regular control of pH in water tanks (at least twice daily)	

Process	Hazards	Preventive measures	Monitoring	Register
Water heating	Burns	Isolating water pipes with isothermal materials and normative colors	Visual observation by the head of technicians (non planned audits) to verify conservation state of pipes isolation	Equipment maintenance file indicating: • Review date of isolation/painting of water pipes • Result of the reviews • Corrective measures adopted Signature of the person responsible
	Increased risks of water microbiological contamination DBP´s formation Indoor air quality aggravation (increasing compounds volatilization)	Keeping water tanks temperature ≤ 30°C	Regular control of water temperature in water tanks (at least twice daily)	Sanitary Registry Log (SRL): register (2xday) temperature in water tanks
Hydraulic circuit	Increased risks of water microbiological and chemical contamination	Adopt and display written procedures: • Water renewal (at least 30L/bather/day) • Minimum water renewal of 2% (even in the absence of bathers) • Total water renewal at least once a year Installation of flow meters to control water renewal	Visual observation by the head of technicians (non planned audits) to verify: • Staff accomplishment of written procedures • Adequate filling of all files and SRL	Sanitary Registry Log (SRL): register (2xday) number of bathers and renewed water volume Equipment maintenance file indicating: Review date of flow meters, reviews outcomes, corrective measures adopted, technician's signature

Process	Hazards	Preventive measures	Monitoring	Register
Products storage	Fire, explosion, burns, poisonings, skin or respiratory outcome health effects	Availability of products data safety sheets Storage according to products' data safety sheets (retention basins, products compatibility, ...) Display safety and health signs Use of PPE by workers Verification of correct packaging and labeling when receiving products Restrict local access to authorized personnel only Maintaining adequate ventilation and air temperature Suitable coating of walls, pavements, ceilings, ...	Visual observation by the head of technicians (non planned audits) to verify: • Maintenance/updating of products' data safety sheets • Products handling procedures • Adequacy/preservation of safety and health signs • Use of personnel protection equipment (PPE) by workers • Structure and sanitary conditions of the premises	Inventory management file for products, indicating: Product reception, supplier, quantity, adequate packaging and labeling, safety data file, returns and causes, person in charge. Professional formation chart in which each worker acknowledges: • Having been informed about correct products use; • Having been informed about correct equipments use; • Having been informed of risks and prevention procedures; • Having received PPE (type and number discriminated Daily records file indicating: • Undesirable events occurring in handling of chemical products (body accidents, accidental spills, ...) and corrective measures adopted.

Process	Hazards	Preventive measures	Monitoring	Register
Pool use	Infections/diseases caused by germs present in water and/or indoor air Infections/diseases caused by germs present on surfaces Health outcomes caused by chemical products and DBP's in water and/or indoor air	Adequacy of a constant level of residual disinfectant Prevention of biofilm formation Monitoring microbiological and chemical parameters, in air and water, according to regulations Monitoring, at least twice a day, the residual of disinfectant, pH, turbidity and water temperature Monitoring, at least twice a day, air temperature and humidity Use of calibrated measuring equipment Control analysis performed by accredited laboratory and according to normative periodicity Effective air renewal Control of income air quality See Chapter "Safety and Good Practices"	Visual observation by the head of technicians (non planned audits) to verify: • Adequate filling of all files and SRL • Cumprimento da periodicidade das análises microbiológicas e físico-químicas da água	Sanitary Registry Log (SRL): • Register (2xday) residual of disinfectant, pH, temperature and turbidity in water tanks • Register (2xday) air temperature and humidity Display daily information for bathers of the residual of disinfectant, pH, water and air temperature Display daily information for bathers of the analytical results of water control Equipment maintenance file indicating: Review date of temperature, pH, disinfectant and humidity meters, reviews outcomes, corrective measures adopted, technician's signature Dossier with analytical results of water control, discrepancies identified and correction measures adopted

Process	Hazards	Preventive measures	Monitoring	Register
Cleaning and disinfection	Diseases of skin and mucous membranes, infections: • Contact with disinfectants • Contact with surfaces • Contact with pool accessories	Availability of products data safety sheets Storage according to products' data safety sheets (retention basins, products compatibility, ...) Display safety and health signs Use of PPE by workers Verification of correct packaging and labeling when receiving products Storage, handling and dilution according with safety data sheets Written plan for cleaning premises and pool accessories Staff formation See Chapter "Safety and Good Practices"	Visual observation by the head of technicians (non planned audits) to verify: • Maintenance/updating of products' data safety sheets • Products storage and handling procedures • Adequacy/preservation of safety and health signs • Use of personnel protection equipment (PPE) by workers • Use of PPE by workers • Adequate filling of all the files • Compliance with periodicity of cleaning operations	nventory management file for products, indicating: Product reception, supplier, quantity, adequate packaging and labeling, safety data file, returns and causes, person in charge. Professional formation chart in which each worker acknowledges: • Having been informed about correct products use; • Having been informed about correct equipments use; • Having been informed of risks and prevention procedures; • Having received PPE (type and number discriminated Cleaning chart for register: • Products used and quantities • Cleaning process steps • Products concentrations used • Use standards • Cleaning periodicity and area • Person responsible Public display of the cleaning chart with time and person responsible

Process	Hazards	Preventive measures	Monitoring	Register
Safety and good practices	Accidents in tanks and adjacent areas Increased degradation of water quality	Respect the maximum bathers loading	Periodic manual counting by a designated technician Verify adequate register in SRL	Display in several locations the maximum number of bathers allowed in each tank Bathers affluence control file (hours of peak affluence and signature of person in charge) Register the number of bathers in the SRL (daily)
		Permanent vigilant to guaranty safety and verify the compliance of the internal regulation (mandatory prior shower, use of bathing caps, bathing slippers, ...) Internal regulation defining good practices and corrective measures	Visual observation by the vigilant, who will assure the compliance of the internal regulation by bathers and will dispose of autonomy to impose adequate measures	Accidents/events register (procedures adopted, time and signature of person in charge) Contents list of the first aid box (signature of the person in charge of verifying inventory and expiration dates)
Reviews and maintenance	Physical accidents Difficulties in achieving water treatment	Periodic review of all the equipments and structures of shower rooms, dressing rooms and toilets Review of HVAC equipment Calibration of measuring devices	Visual observation by the head of technicians Test equipments	Maintenance file (result of reviews, signature of the person in charge, corrective measure adopted) Calibration file (calibrated equipment, calibration date, entity responsible, deviation observed, signature of the person in charge)
Disinfestations	Diseases caused by rodents, insects and other vectors	Mosquito nets on windows; siphons on toilets and lavatories Eliminate damp and condensation on surfaces Cleaning and disinfection plan	Verifying the meeting of deadlines established by the company responsible for the tasks Visual confirmation of plagues Verifying the meeting of deadlines for the cleaning and disinfection plans Regular inspections of the structural and hygienic conditions of the premises	Surveillance and detection of plagues file (areas included, traps, results of inspections, signature of the person in charge) Disinfestations file (products used, periodicity and company in charge)

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