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Potable Water Hygiene System

A Novel Approach for Drinking Water Installations

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Potable Water Hygiene System

Definitions

This presentation is about clean building water systems (domestic and process water) and focusses on

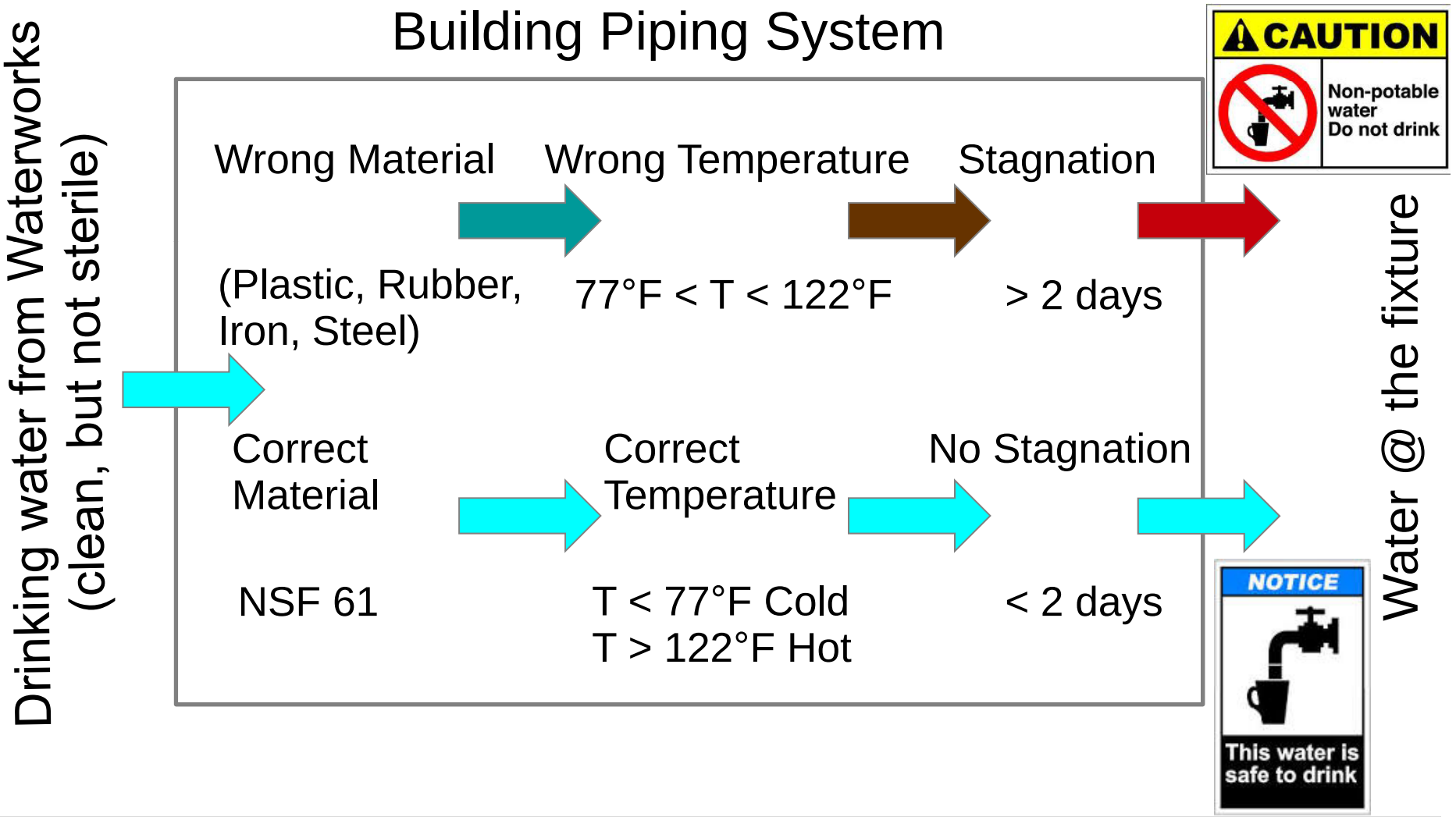
- the piping system in a building
  - and not on the fixtures, faucets, shower heads etc.
  - and also not on the water (quality) entering the building

„Clean“ or „Hygienic“ in this context means

- sufficiently low number of waterborne pathogens in the water (being not harmful to humans)
  - and not e.g. the amount of minerals, scale or metal ions

Potable Water Hygiene System

Motivation / Facts



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Legislation

- WHO Guidelines for drinking water quality
- European Drinking Water Directive EG 98/83/EC
- Germany
  - Infection Protection Act (IfSG)
  - Clean Drinking Water Act (TrinkwV) (rev. 2013)
  - Several Codes, Standards and Guidelines
- USA
  - Clean Water Act
  - ASHRAE 188 P and ASHRAE Guideline 12-2000
- Temperature < 68°F / 77°F for CWS and > 122°F / 131°F for HWS
- Avoid stagnation, dead legs etc.

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Solution

Provide cold (CWS) and hot (HWS) water and open every faucet and shower, flush every toilet and use every appliance on a regular basis to

- achieve correct temperatures
- avoid stagnation

⇨ no proliferation of waterborne pathogens

BUT: Is that always achievable in a building? NO

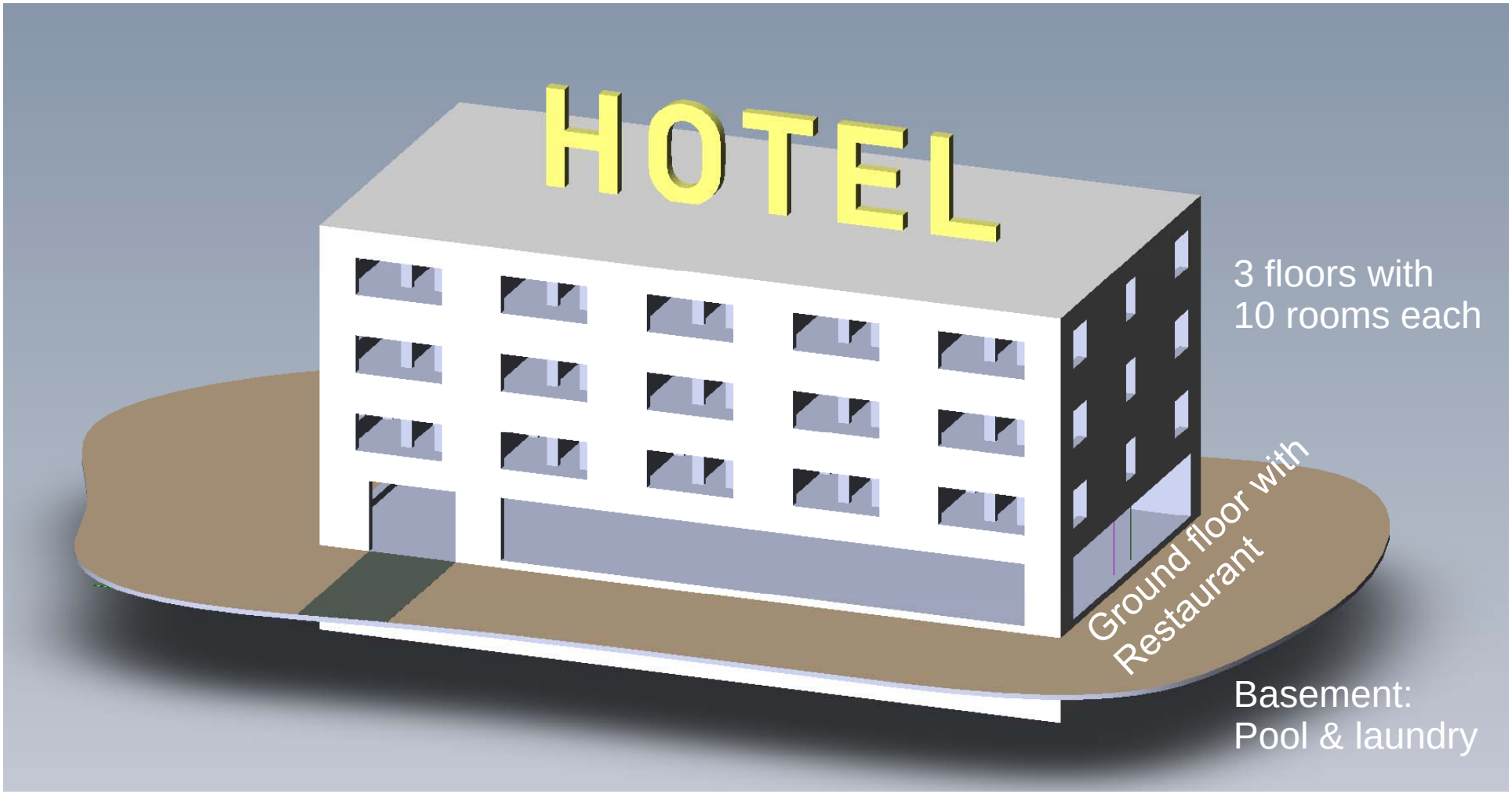
Potable Water Hygiene System Statement

- There is a new plumbing system available that
  - eliminates (or at least clearly minimizes) the risk of bacteria and other pathogens in building water piping systems …
  - … by just applying the right layout and design of the piping system and using some innovative valves and fittings

- No chemical (or any other type of) disinfection is needed but the proposed system also supports the distribution and efficiency of such method throughout the entire piping system

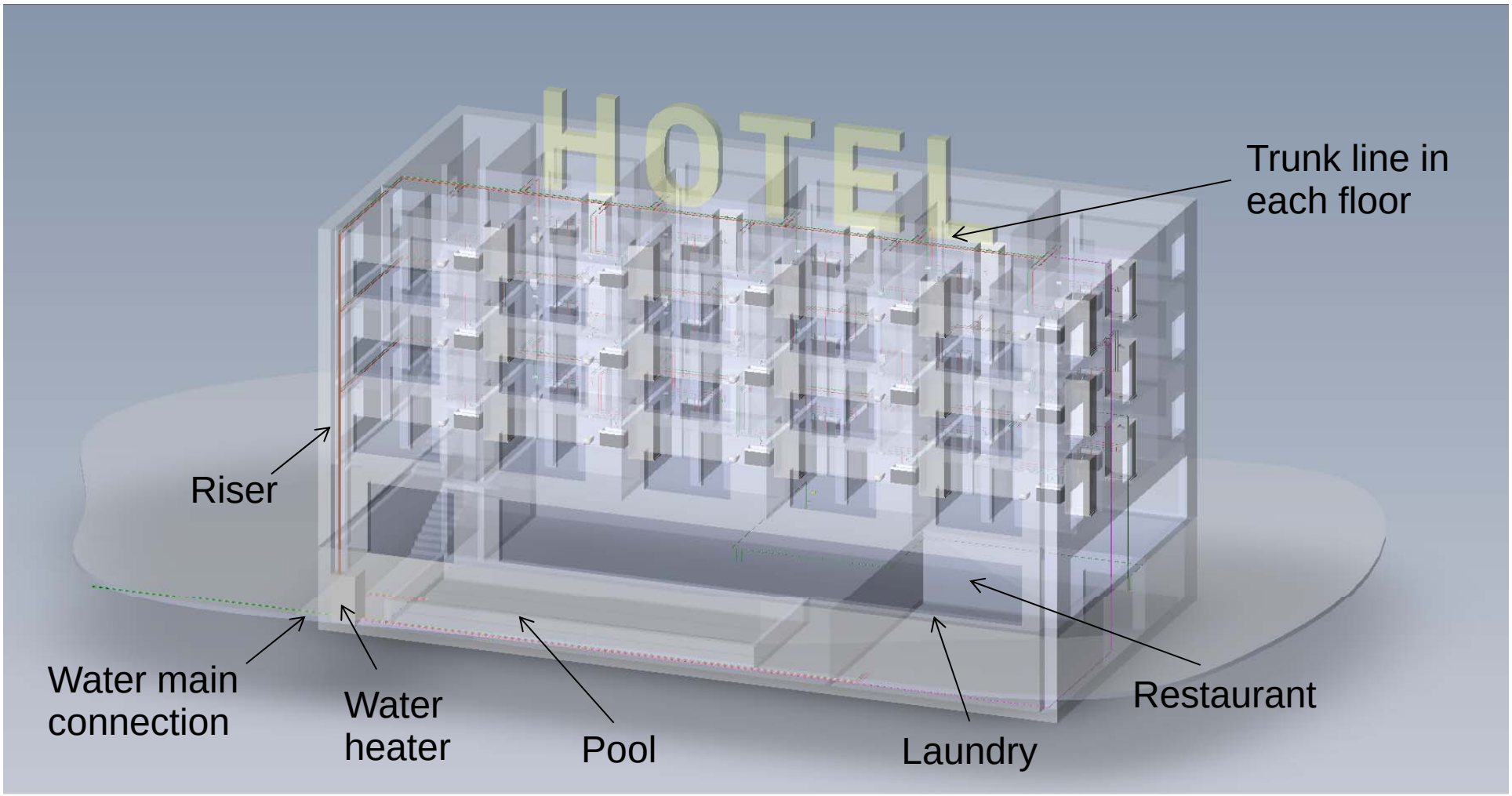
Potable Water Hygiene System

Sample Building



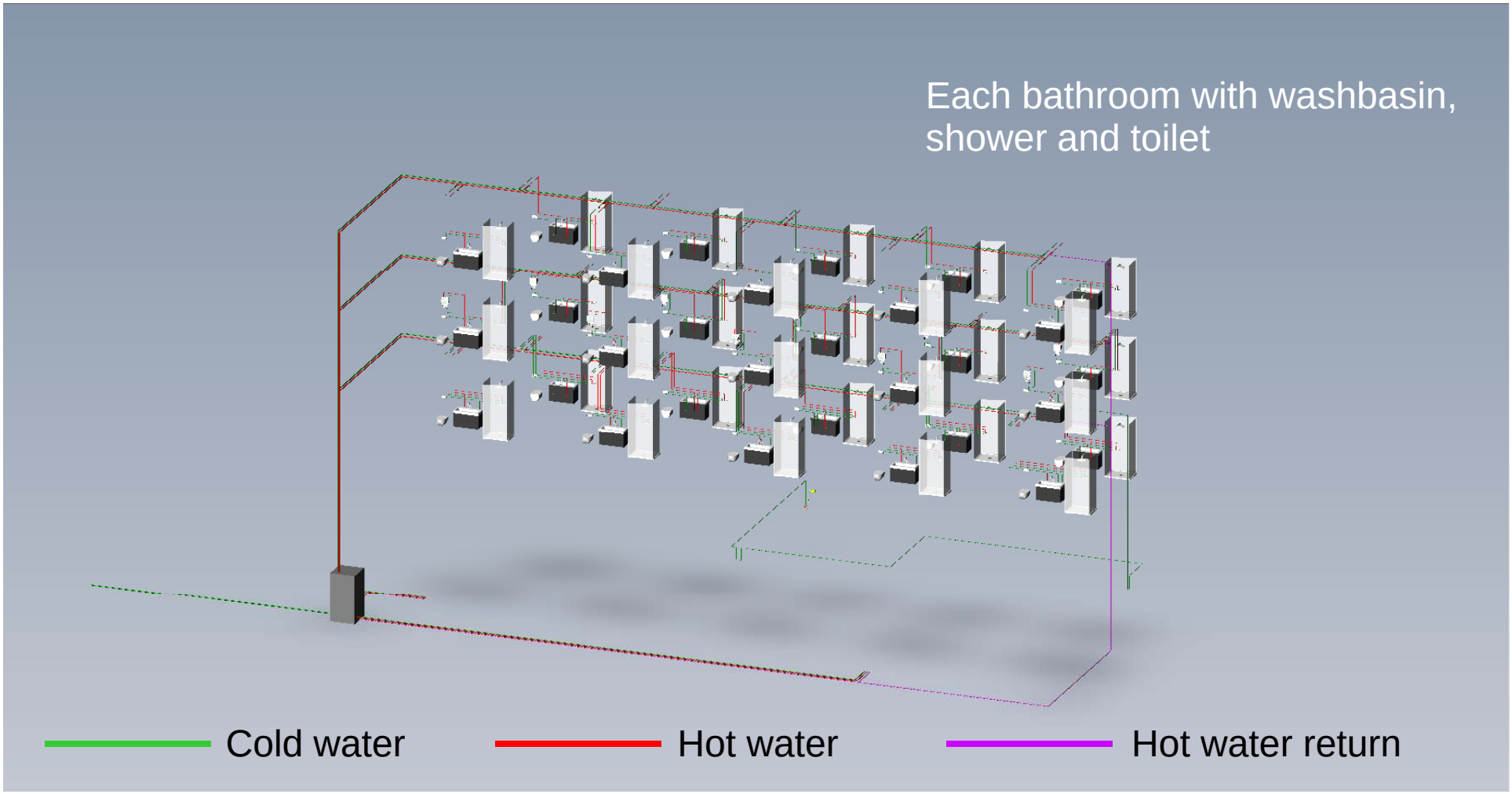
Potable Water Hygiene System

Sample Building



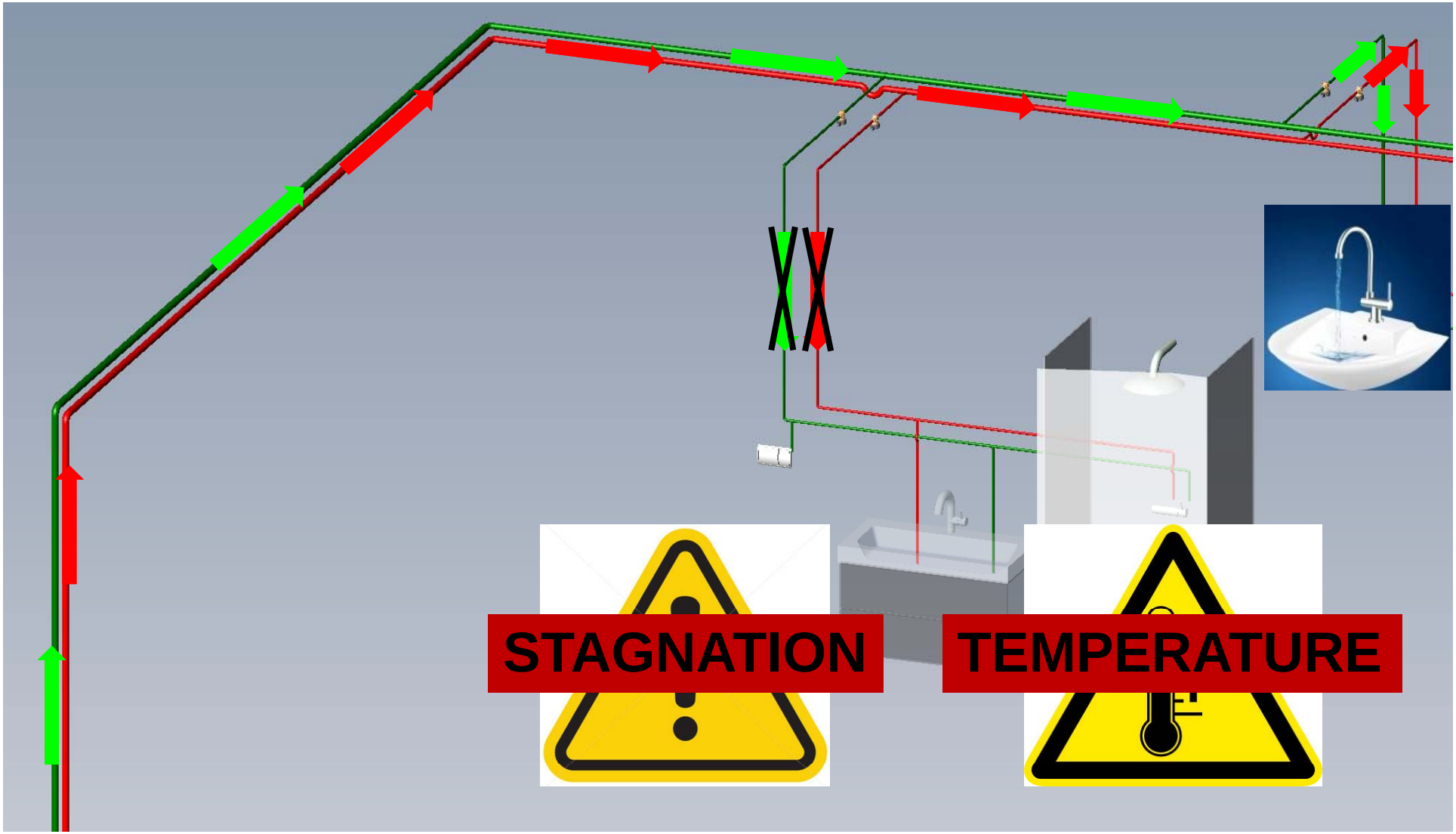
Potable Water Hygiene System

Sample Building



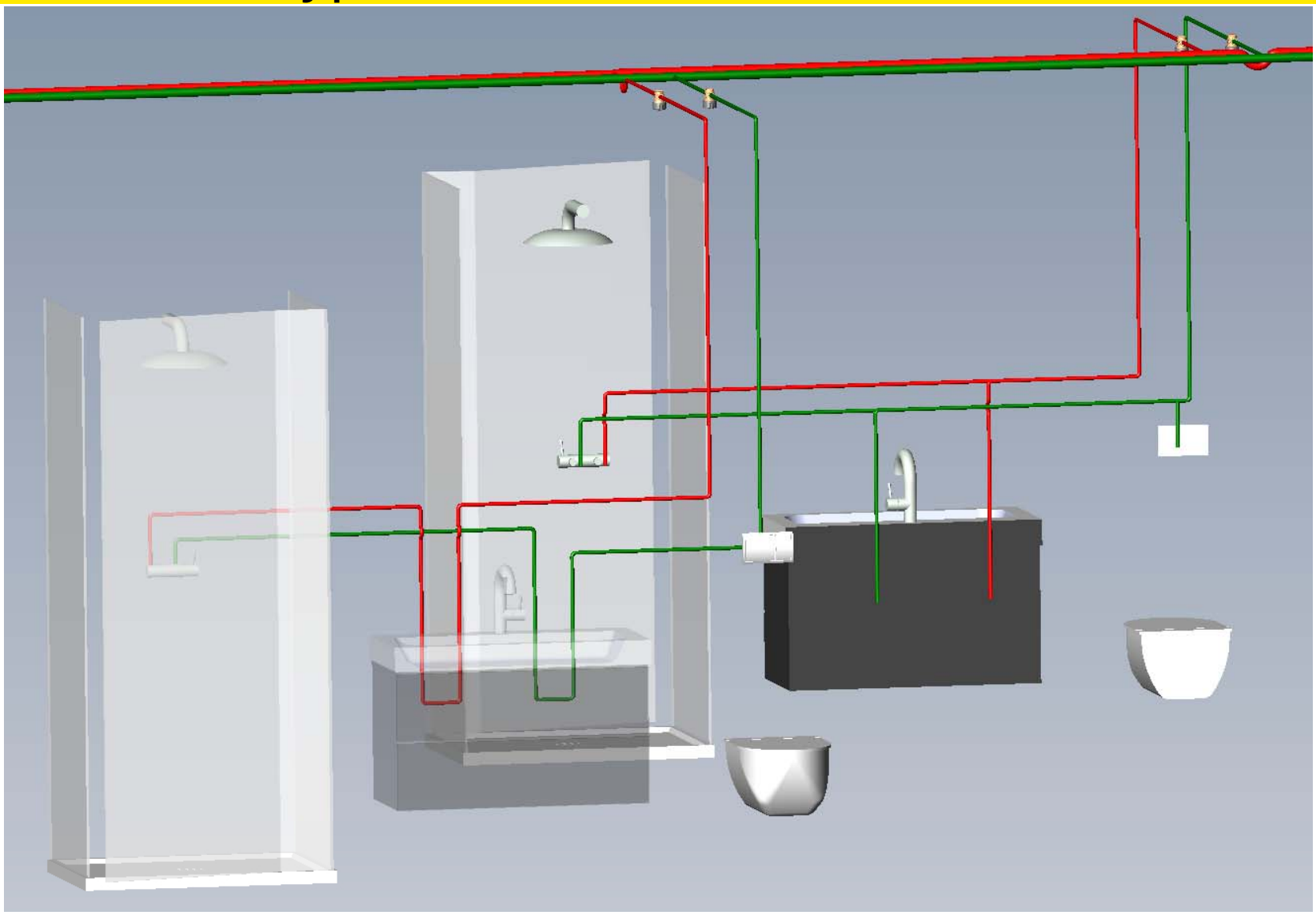
Potable Water Hygiene System

Conventional type 1



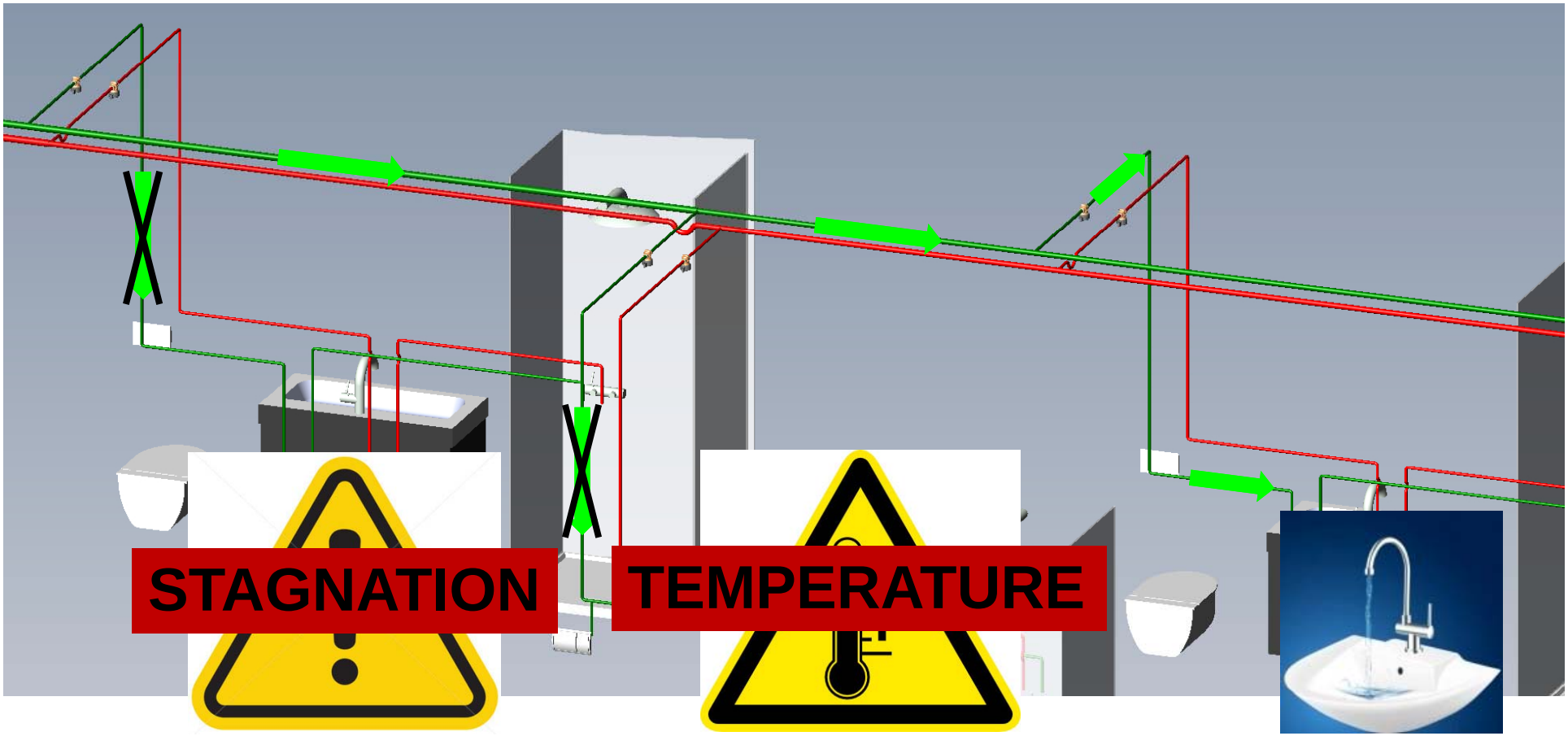
Potable Water Hygiene System

Conventional type 2



Potable Water Hygiene System

Conventional type 2



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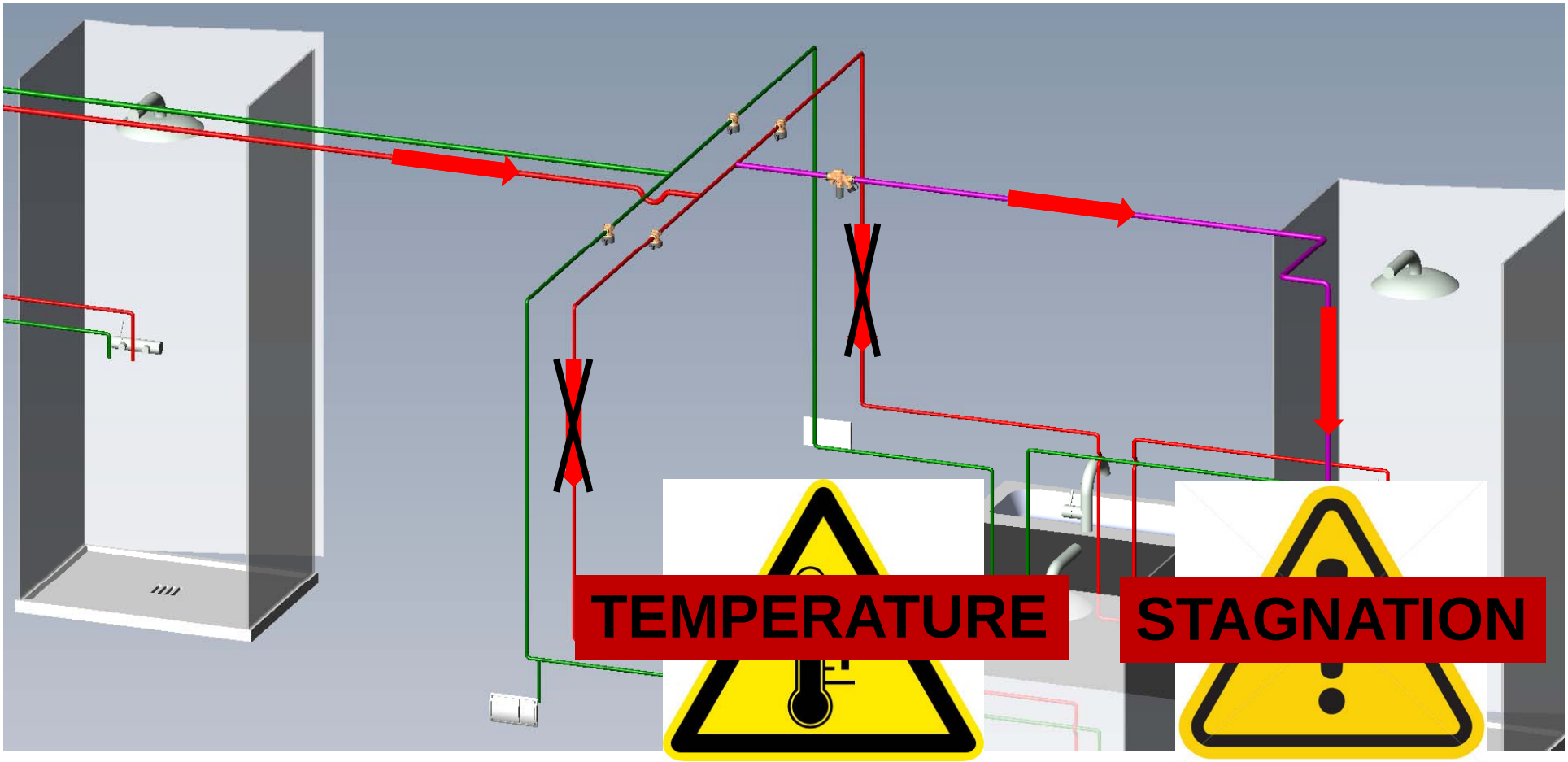
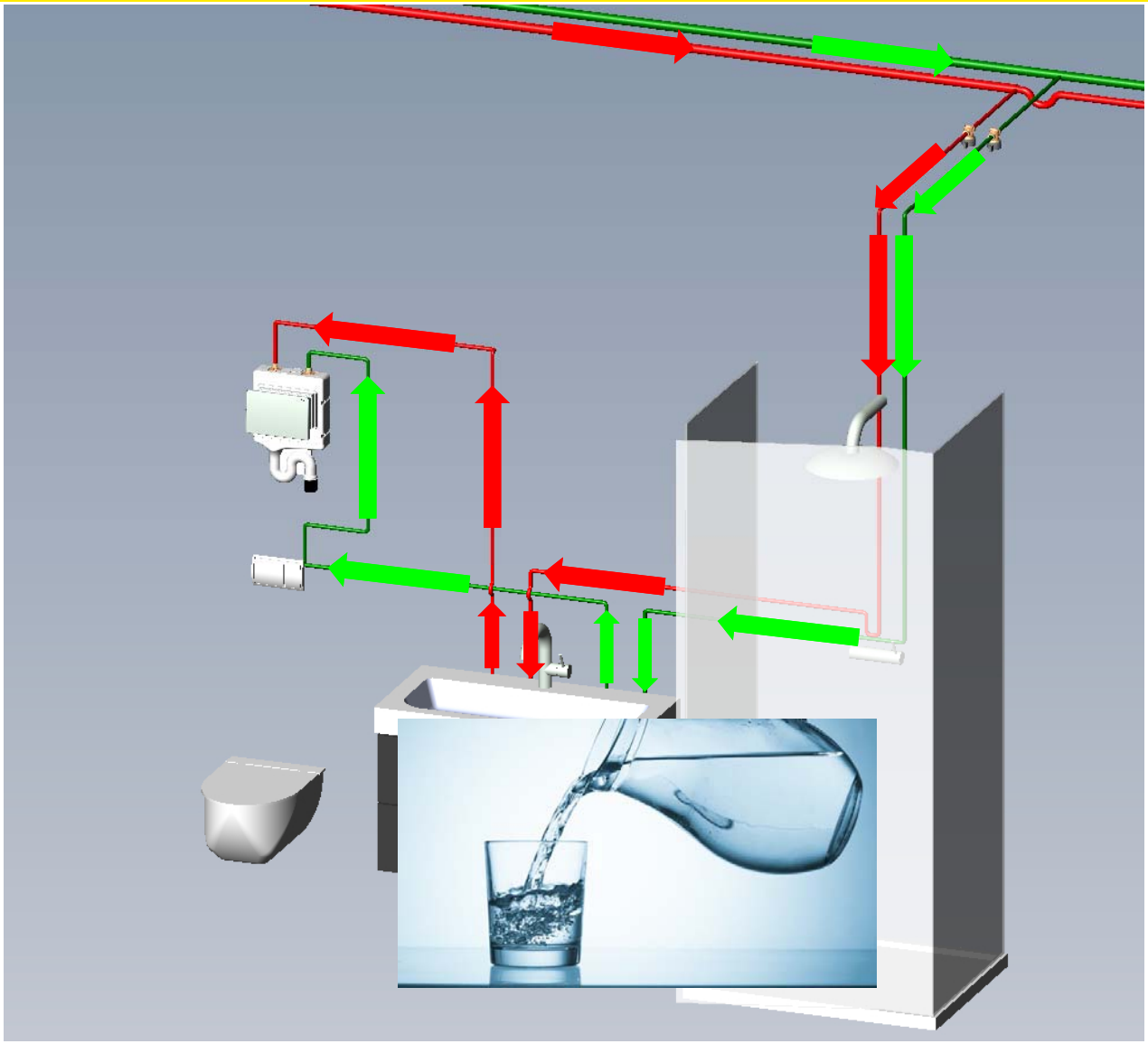
Conventional type 1+2



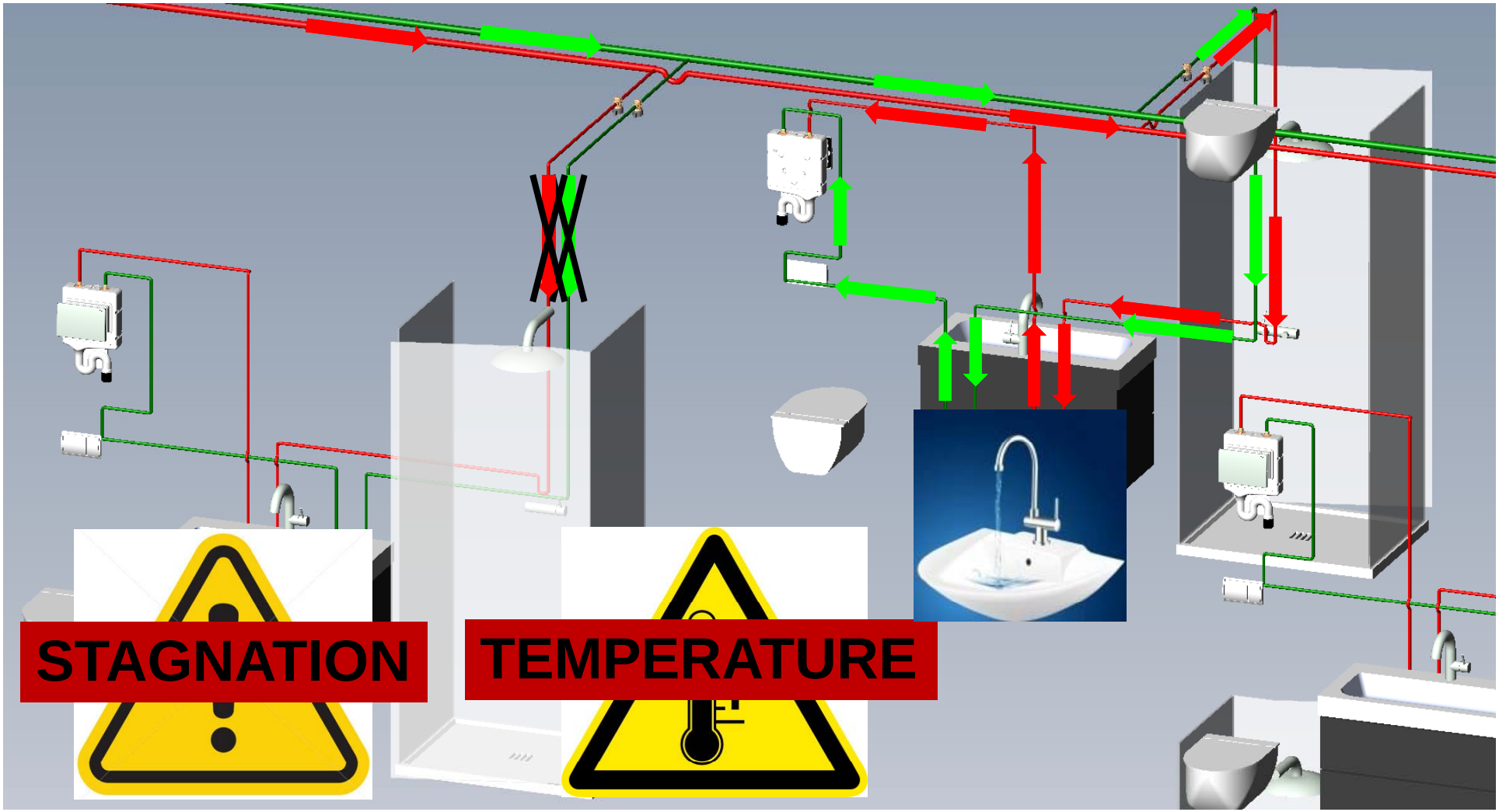
Potable Water Hygiene System

First improvement



Potable Water Hygiene System

First improvement



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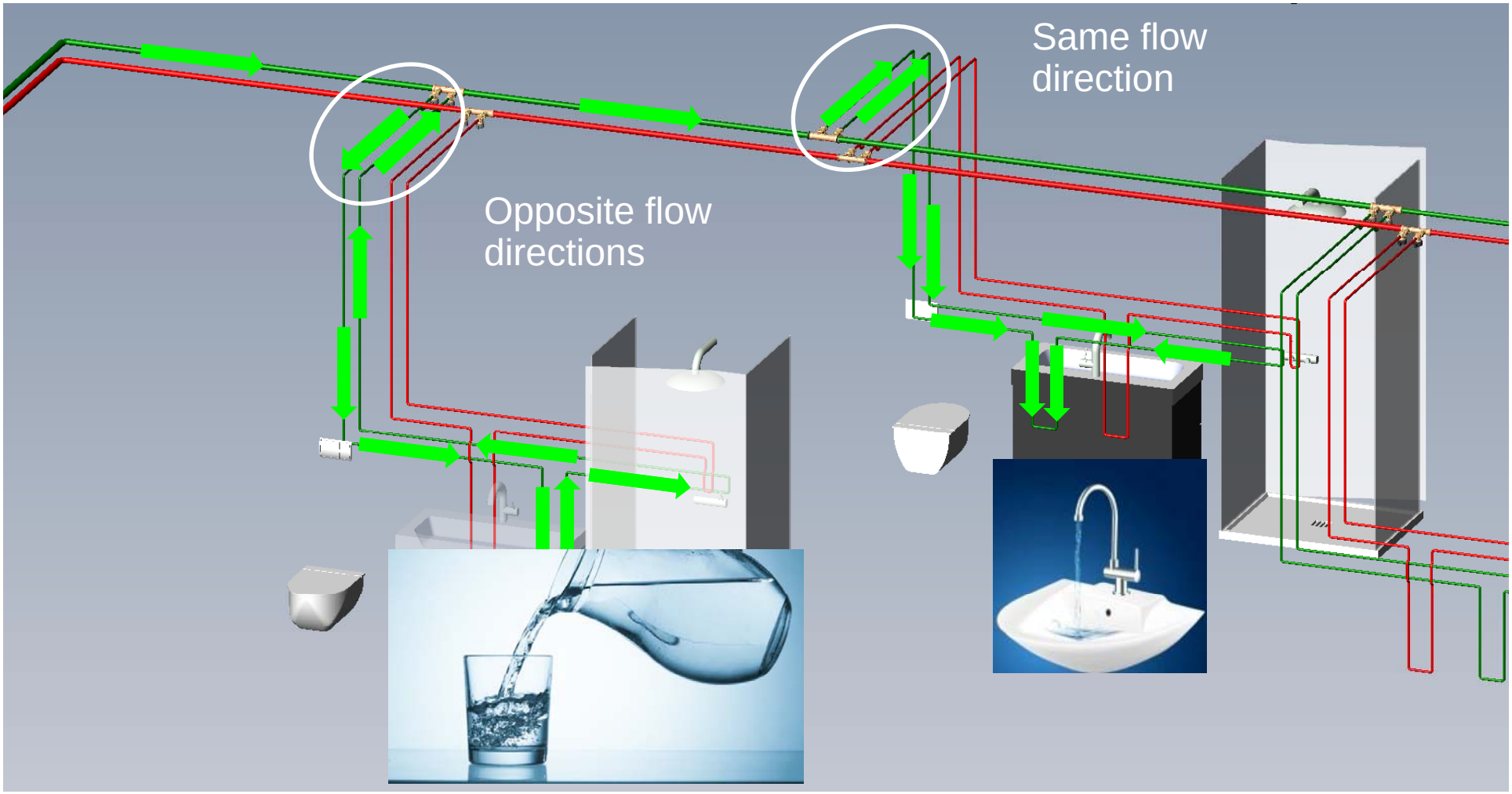
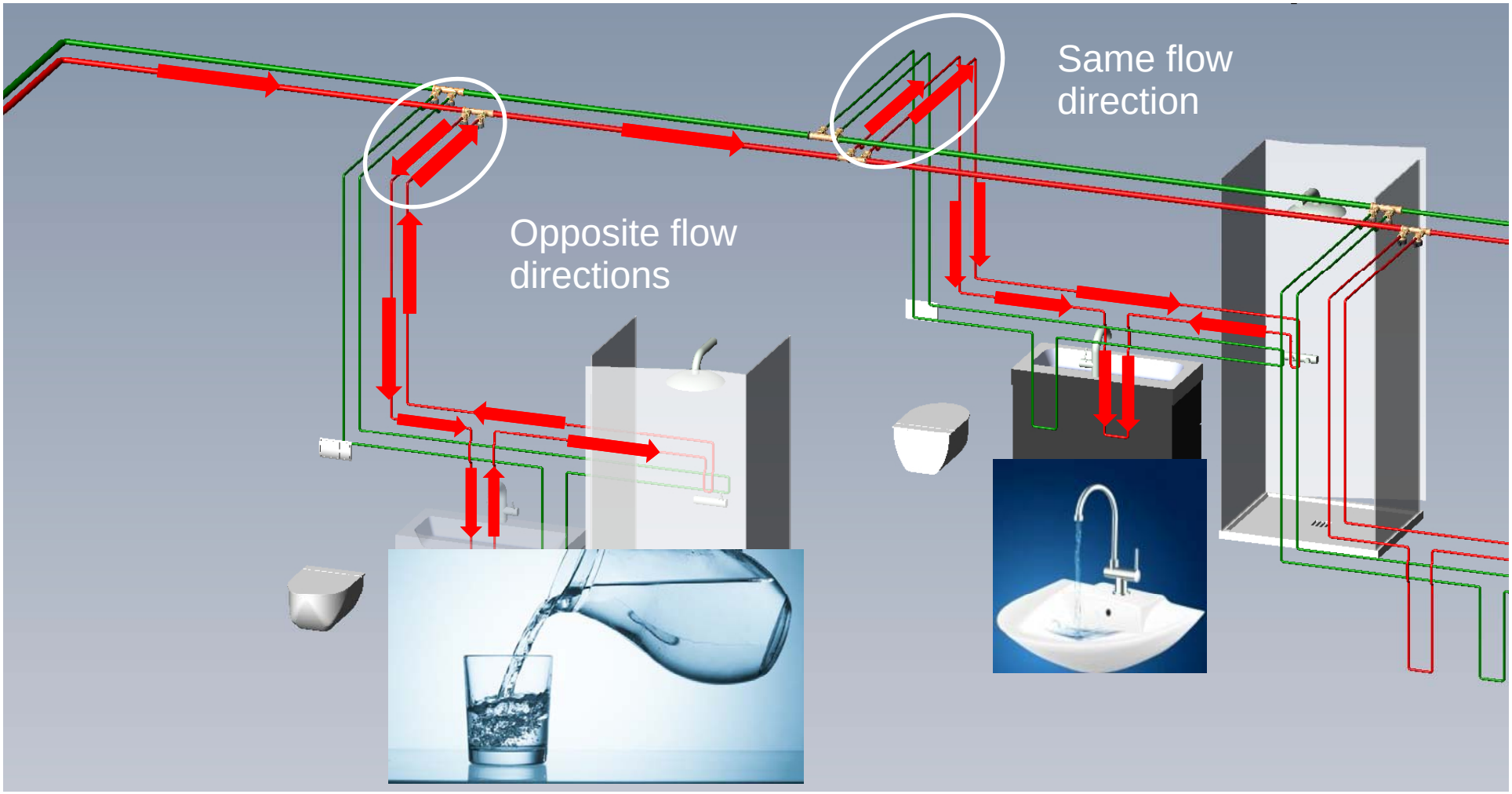
Emerging New Technology



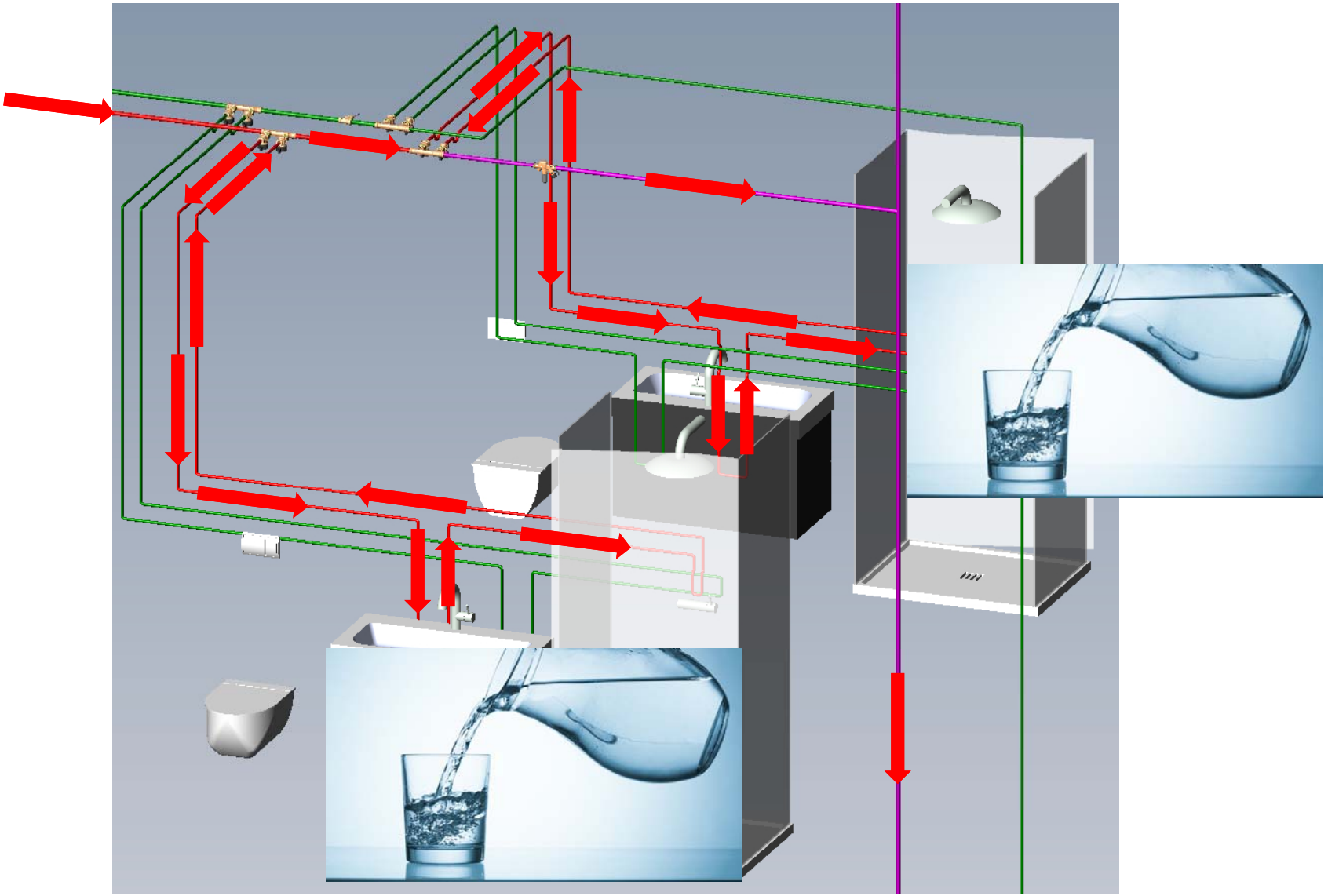
Potable Water Hygiene System

Emerging New Technology



Potable Water Hygiene System

Emerging New Technology



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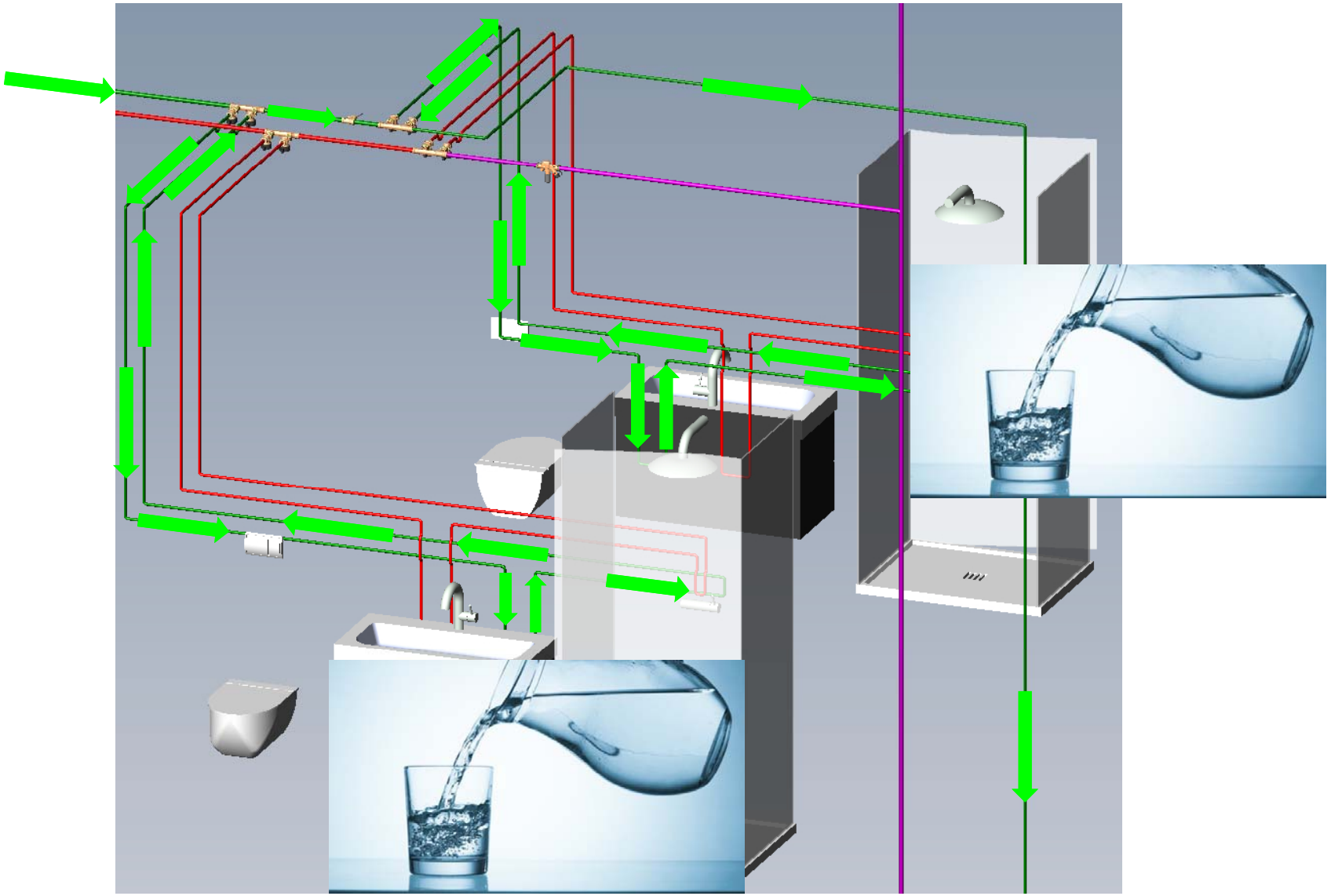

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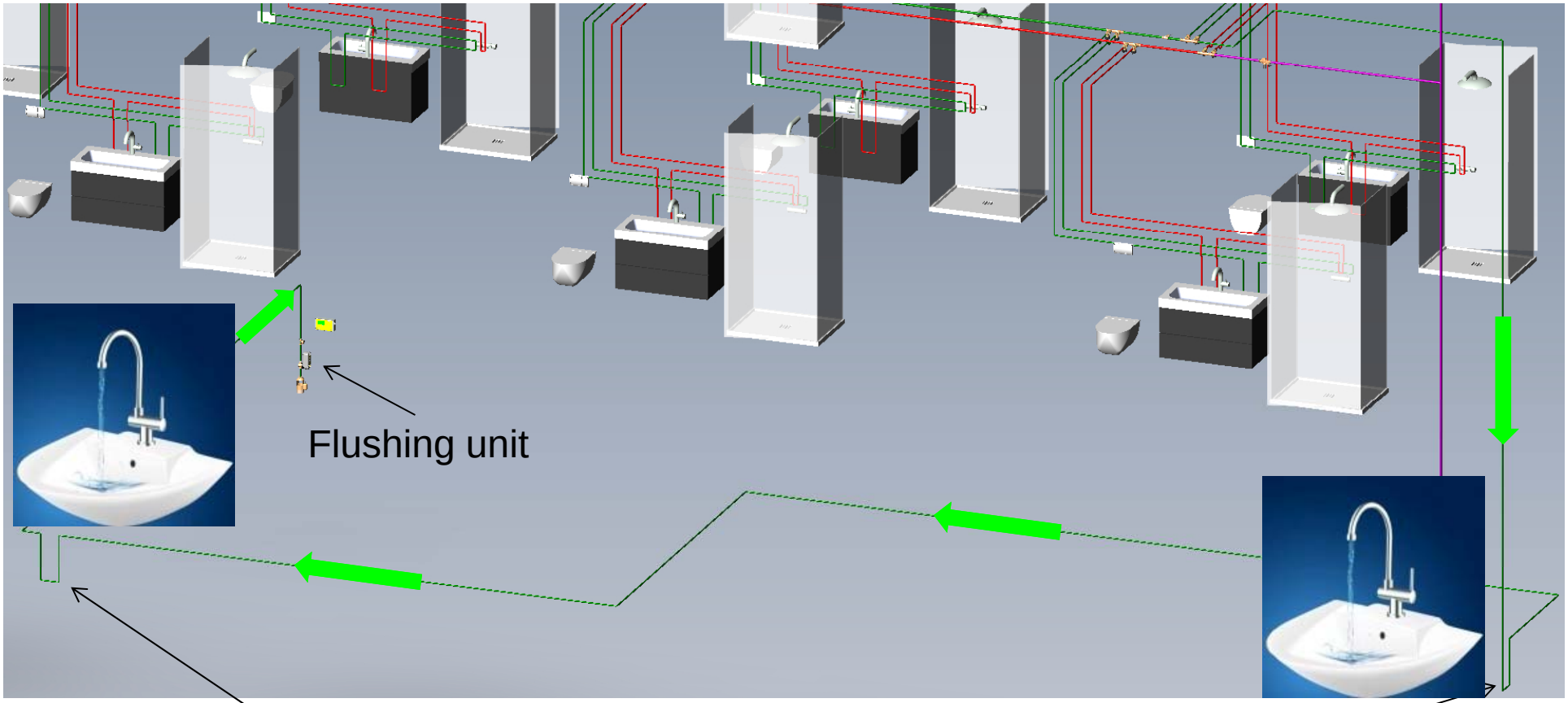
Emerging New Technology



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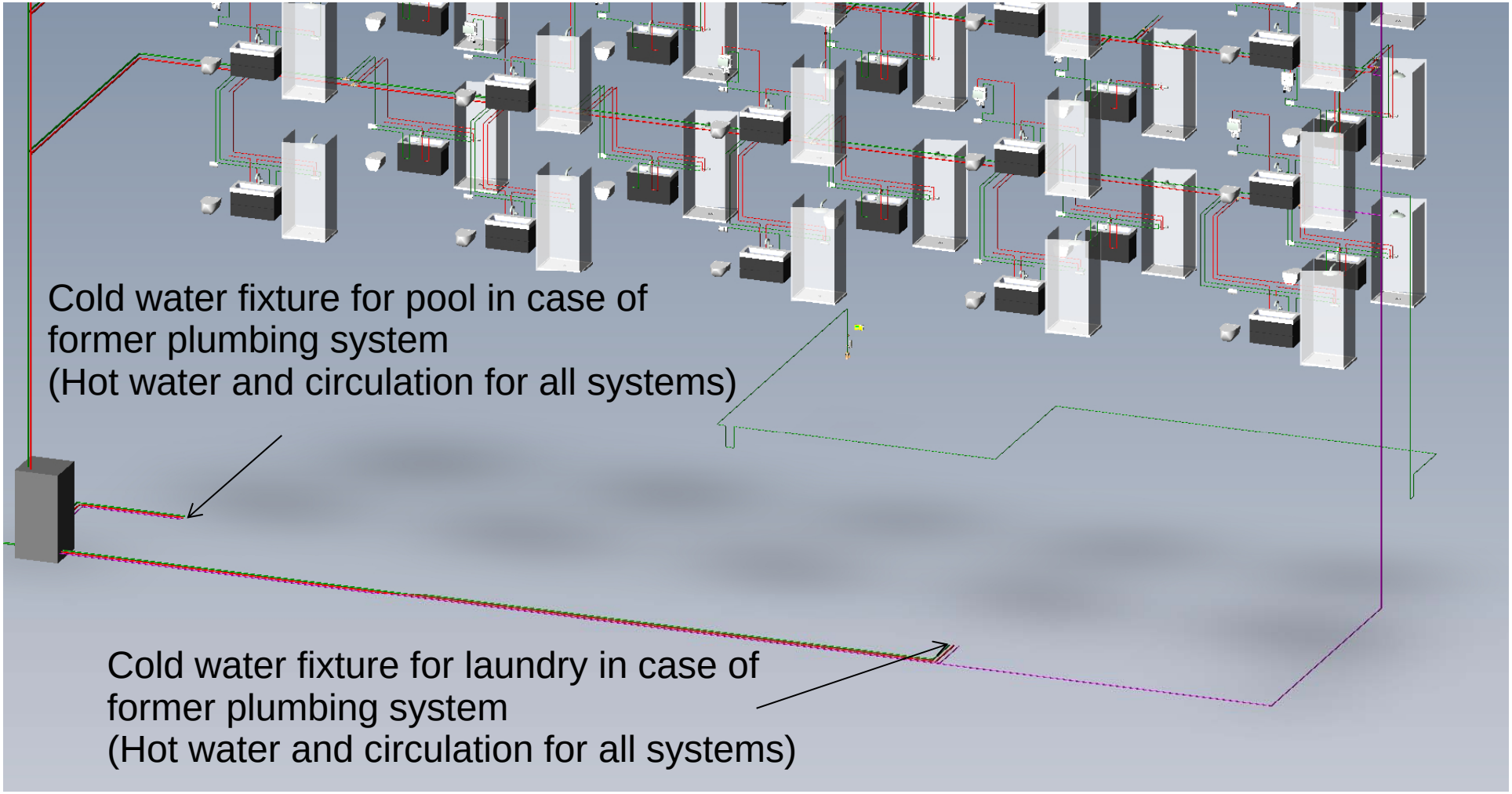
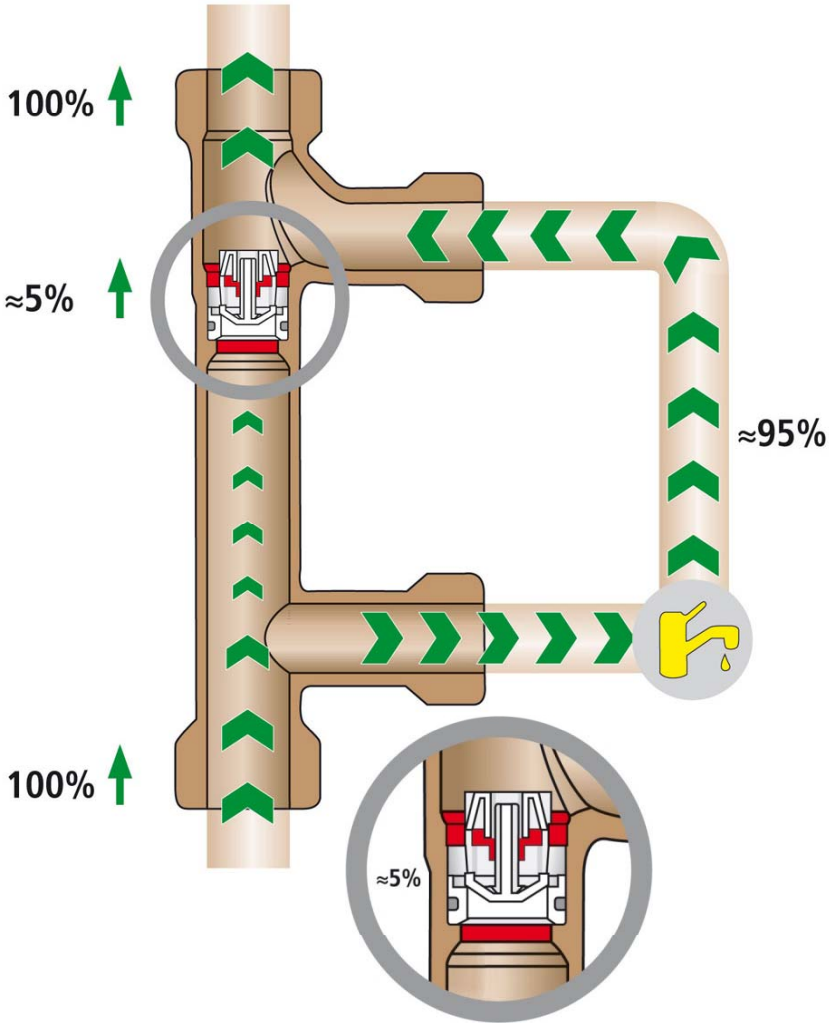
Comparison



Potable Water Hygiene System

Dynamic Flow Splitter

<u>Low</u> flow rate in the supply pipe



Potable Water Hygiene System

Options

- Control system with
  - Automated flushing valves
  - Sensors
    - Temperature: allows temperature dependend flushing
    - Volume Flow: allows flow controlled flushing
    - Float switch: avoids flooding in case of a blocked drain
  - Monitoring
    - Temperature, volume, time
    - Every incident (flushing, temperature, …)

Potable Water Hygiene System

Comparison

TODAY's Standard Situation	TOMORROW Potable Water Hygiene System
Stagnant Water • Dead legs, twigs (truncated pipes) • No use as intended of all taps	**Regular water exchange** • Loop rings with constant water flow substitute twigs • No need to open taps

Potable Water Hygiene System

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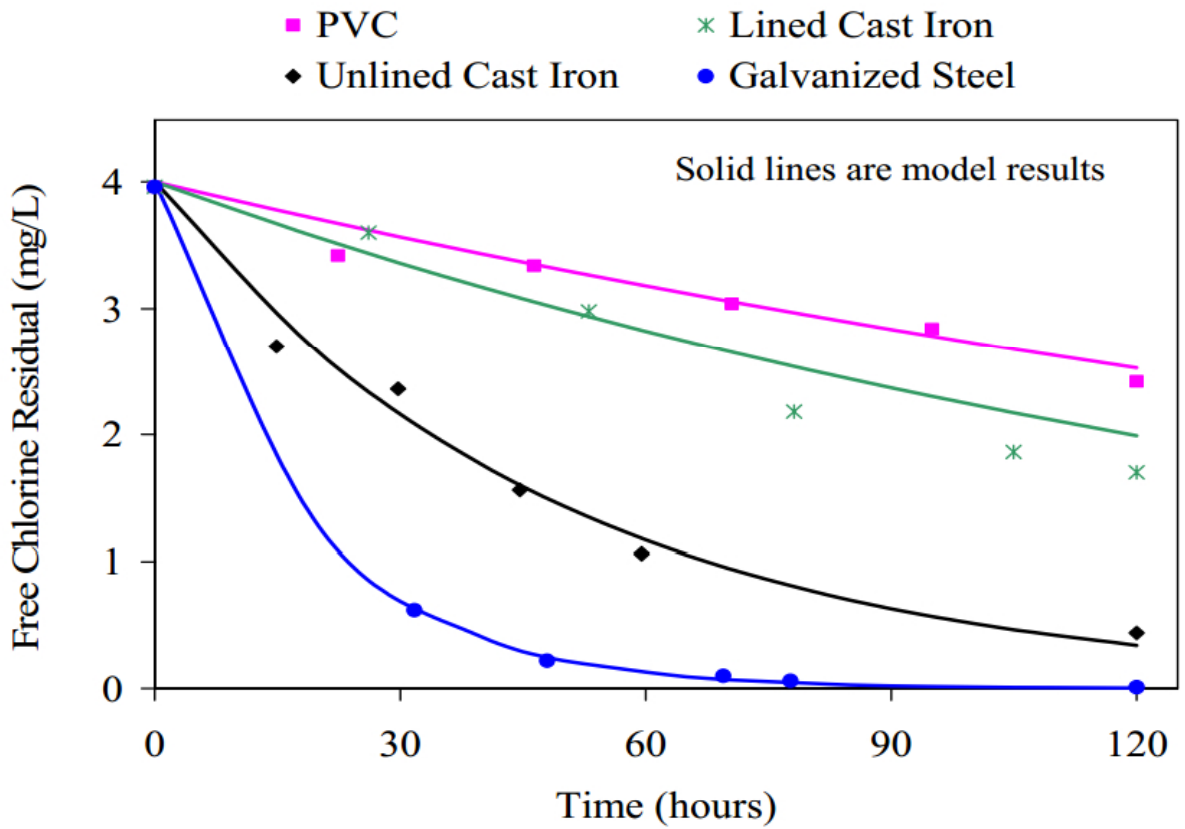
Stagnant Water • Dead legs, twigs (truncated pipes) • No use as intended of all taps	**Regular water exchange** • Loop rings with constant water flow substitute twigs • No need to open taps
Intermediate water temperature • Cold water too warm • Hot water too cold	**Correct water temperature** • Cold water below 68 (77) °F • Hot water above 131°F

Potable Water Hygiene System Comparison

Actual and Predicted Free Chlorine Residual



Source: http://research.cecs.ucf.edu/drinkingwater/Students/Arevalo/Modeling_chlorine_dissipation_in_DS_Jorge_Arevalo_ACE04.pdf

Potable Water Hygiene System

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Nutrients like biofilm exist
• Chemicals for disinfection do not reach every point
  • dilution and dissipation of e.g. Chlorine
  • higher concentration is needed
  • materials are stressed by chemicals
	Build up of biofilms is prevented
	• Constant water flow does not allow a build up of biofilms
	• Chemicals are effectively utilized by
	  • reaching each point in the system
	  • regular replacement of used chemicals

Potable Water Hygiene System

Comparison

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	  • reaching each point in the system
	  • regular replacement of used chemicals

Waterborne pathogens can easily proliferate and lead to serious and often fatal diseases	**Hot as well as Cold water is kept clean with the help of the proposed Potable Water Hygiene System**

Potable Water Hygiene System

Cost estimate (Hospital renovation)

w/o measures

	A
Risk Level	Very High
Invest	N/A
Costs per year	N/A
ROI (**months**) compared to B	N/A
ROI (**months**) compared to C	N/A
ROI (**months**) compared to D	N/A

Potable Water Hygiene System

Cost estimate (Hospital renovation)

	w/o measures	**manual flushing**	**chemical disinfection**
	A	B	C
Risk Level	Very High	Medium	Medium
Invest	N/A	0%	**100%**
Costs per year	N/A	141%	42%
ROI (**months**) compared to B	N/A	N/A	12.1
ROI (**months**) compared to C	N/A	N/A	N/A
ROI (**months**) compared to D	N/A	N/A	N/A

Potable Water Hygiene System

Cost estimate (Hospital renovation)

	w/o measures	**manual flushing**	**chemical disinfection**	**B+C**
	A	B	C	D
Risk Level	Very High	Medium	Medium	Low
Invest	N/A	0%	**100%**	100%
Costs per year	N/A	141%	42%	183%
ROI (**months**) compared to B	N/A	N/A	12.1	Always more expensive
ROI (**months**) compared to C	N/A	N/A	N/A	Always more expensive
ROI (**months**) compared to D	N/A	N/A	N/A	N/A

Potable Water Hygiene System

Cost estimate (Hospital renovation)

	w/o measures	**manual flushing**	**chemical disinfection**	**B+C**	**PWHS**
	A	B	C	D	E
Risk Level	Very High	Medium	Medium	Low	Very Low
Invest	N/A	0%	**100%**	100%	98%
Costs per year	N/A	141%	42%	183%	5%
ROI (**months**) compared to B	N/A	N/A	12.1	Always more expensive	**8.6**
ROI (**months**) compared to C	N/A	N/A	N/A	Always more expensive	Always less expensive
ROI (**months**) compared to D	N/A	N/A	N/A	N/A	Always less expensive

Potable Water Hygiene System

Cost estimate (Hospital renovation)

	w/o measures	manual flushing	chemical disinfection	B+C	PWHS	C+E
	A	B	C	D	E	F
Risk Level	Very High	Medium	Medium	Low	Very Low	Lowest possible
Invest	N/A	0%	**100%**	100%	98%	198%
Costs per year	N/A	141%	42%	183%	5%	47%
ROI (**months**) compared to B	N/A	N/A	12.1	Always more expensive	**8.6**	25.2
ROI (**months**) compared to C	N/A	N/A	N/A	Always more expensive	Always less expensive	Always more expensive
ROI (**months**) compared to D	N/A	N/A	N/A	N/A	Always less expensive	**8.6**

Potable Water Hygiene System

References

- Broadgreen Hospital, Liverpool / UK
  - Hospital with 2,000 beds
  - Southern annex equipped with the Potable Water Hygiene System
  - 6 flow splitters

Potable Water Hygiene System

References

- Royal Victoria Building, Western General Hospital, Edinburgh / UK
  - New building opened in 2012
  - 14 valves, 27 sensors
  - 300 flow splitters
- Antrim Area Hospital Belfast / UK
  - 5 valves
  - 10 sensors for control
  - 12 sensors for monitoring
  - 90 flow splitters

Potable Water Hygiene System

References

- Intercontinental Davos / Switzerland
  - 50 valves, 70 sensors, 615 flow splitters

Potable Water Hygiene System

References

- Nuclear Power Station Emsland Lingen / Germany
  - Building for maintenance staff, occupied for one month per year only
  - 87 flow splitters

Potable Water Hygiene System

References

- Crane vessels Balder + Thialf / The Netherlands

Balder

6300 tonnes lifting capacity

Staff: more than 330

Thialf

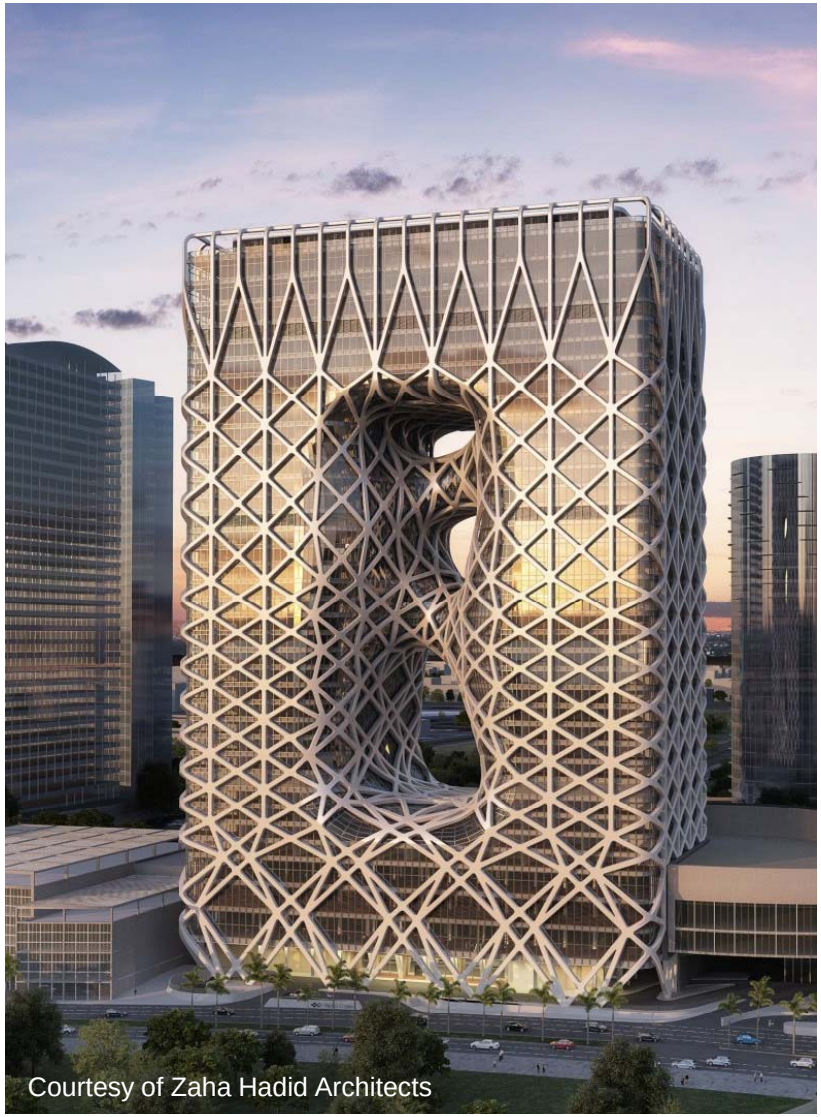
2 x 7100 tonnes lifting capacity

Staff: more than 730

Potable Water Hygiene System

References

- City of Dreams Hotel Tower Macau / China
  - 780 guest rooms
  - > 800 flow splitters
  - > 100 thermostatic balancing valves
  - Control system with > 100 sensors and > 20 valves



Potable Water Hygiene System

Conclusions

- The Potable Water Hygiene System has been shown in Europe to be an outstanding solution to keep potable water in buildings clean
- The Potable Water Hygiene System yields better results and can be operated at much lower costs compared to conventional systems
- It can be combined with conventionel disinfection methods by improving the efficiency of such systems

Contact

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