



Project 3021: Quantifying indirect ingestion of recycled water: Improving the evidence base for water guidelines

WaterRA Research Symposium, Melbourne, July 2014

The Car Wash Pilot Study



Australian Guidelines for Water Recycling

- Current water treatment guidelines for non-potable water are based on “guesstimates” of how much is swallowed by accident during garden watering etc.
- No actual data exist for spray exposures
- This is important information to ensure that recycled water is “fit for purpose”
 - treated enough to make it safe to use
 - but not over-treated (wasting \$\$\$)

Project Concept

- **Aim:** to develop a method to **measure** how much water is swallowed using a non-toxic “tracer” chemical (cyanuric acid, CYA)
- This chemical is used to ‘stabilise’ chlorine in outdoor swimming pools and is approved by WHO to disinfect drinking water
- Measurement of CYA in 24 hour urine has been used to estimate water ingestion during swimming

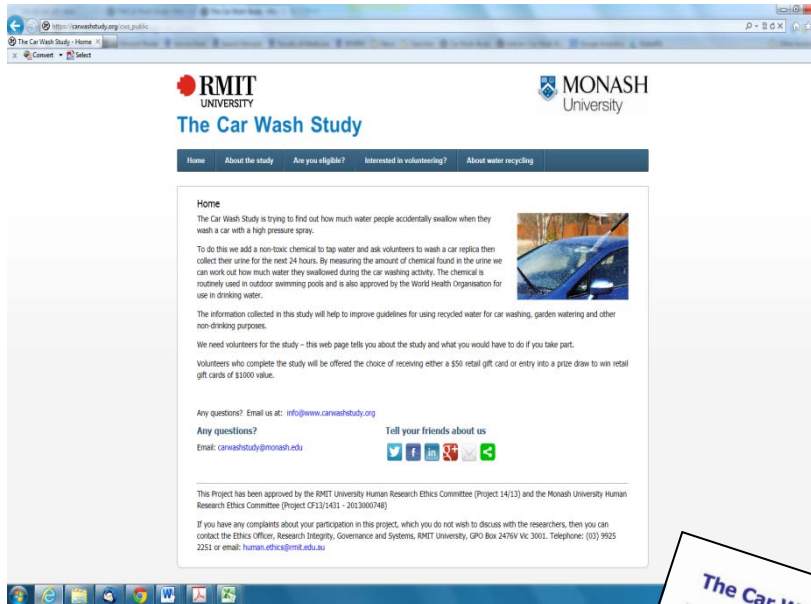
Method Development

- Accidental ingestion from spray exposures likely to be much less than for swimming
- Stage 1 study
 - developed more sensitive assay method (GC/MS)
 - showed high concentrations of CYA did not cause adverse taste, odour, skin feel or mouth feel
 - checked 24 hour excretion – not 100% as reported, 85% average excretion

Car Wash Pilot Study

- We should be able to detect ingestion of very small water volumes (0.1 mL or less)
- Pilot study needed to test:
 - Design of experimental rig
 - Can we recruit people to do the study?
 - Will they collect and bring back their urine?
 - What is limit of analytical throughput?
 - Can we actually detect water ingestion?
 - What percentage of people ingest quantifiable amounts?

Car Wash Pilot Study



- Advertising at RMIT and Monash
- Posters
- Flyers
- Email adverts
- Lectures/tutorials
- Web page



The Car Wash Study



Would you like to:

- see how research is done?
- help make water recycling guidelines better?
- donate your urine for the benefit of science?
- be reimbursed \$50 for your time?

Visit the Car Wash Study website for more info:

www.carwashstudy.org

This project is approved by the RMIT Human Research Ethics Committee (Project 14/13) and the Monash University Human Research Ethics Committee (Project CF13/1431 - 2013000748).



Car Wash Pilot Study

- Eligibility screening and verbal consent
- Random allocation:

Wash a car replica for 10 minutes with tap water containing CYA (n=25)

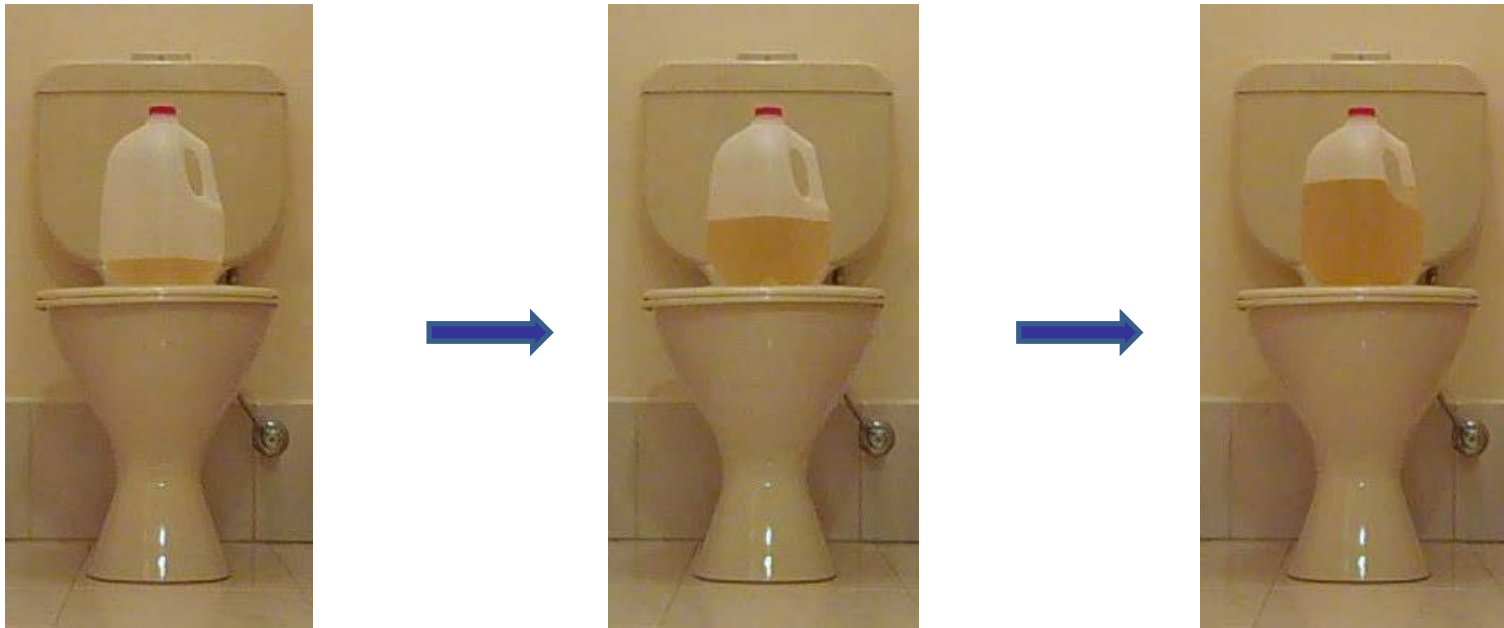


Drink a known dose of CYA (n=12)



Car Wash Pilot Study

- Then – collect all urine for 24 hours



- Return urine and collect gift card



Car Wash Pilot Study

- Clean up urine and water samples using SPE, then GC/MS analysis for CYA in urine extract
- Calculate total CYA mass in 24 hour urine
 - calculate volume of water ingested for car wash tests
 - calculate percentage of ingested dose excreted for known dose tests

Car Wash Pilot Study

Known dose tests for 12 participants

- Average excretion 86.3% (range 35 – 103%)
- Similar to previous study of 15 participants
– average 85.4% (range 43 – 105%)

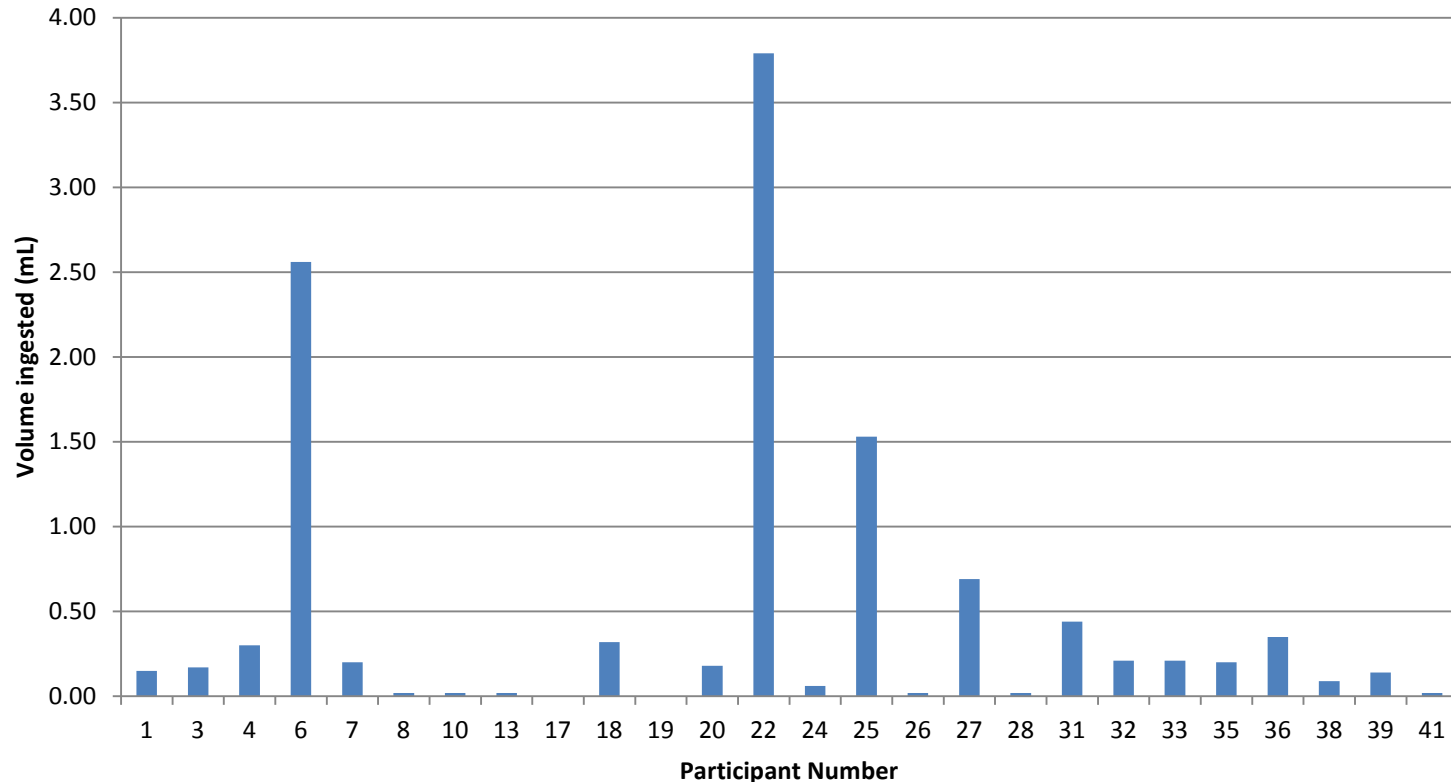
Car Wash Pilot Study



RMIT staff member doing car wash practice run

Car Wash Pilot Study

Ingested volume for car wash tests (26 participants)



2 participants – CYA not detected in urine (<0.01 mg/L)
6 participants – CYA trace detected (0.01 – 0.05 mg/L)
18 participants – CYA quantifiable amount detected (>0.05 mg/L)

Car Wash Pilot Study

Outcomes

- Recruitment successful, compliance good
- Lab facilities worked well
- Need to increase analytical capacity or stage exposure experiments to balance
- Now have methodology to measure water ingestion /inhalation
- Can generate data for QMRA

Car Wash Pilot Study

Limitations of using these data

- Laboratory setting – ambient conditions fairly constant
- Little variation in water pressure, spray setting
- Only one car type used
- Mainly male participants (23/26)
- But compared to no data at all 😊

Implications for AGWR?

Dual reticulation housing developments

- Exposure assumptions (670 mL/year) have deliberate over estimates (high cross-connection rate, home-grown salad vegetables eaten without washing)
- Add high pressure spray exposure from:
 - washing car x weekly x 10 min
 - washing paving x monthly x 30 min
 - washing windows x 4 times /year x 30 min
- These exposures have very small effect
 - extra 13.1 mL /year, < 0.01 log₁₀ change in pathogen removal requirements

Implications for AGWR?

Occupational exposures

- Assuming 4 hours per day using high pressure spray = 749 mL/year (5 days/week, 48 weeks/year)
- Physical exertion causes increased breathing rate, deeper breathing → exposure will be higher
- Log_{10} removals may need to be higher than for dual reticulation use
- Or use of personal protective equipment (face mask) may be required

Potential applications of this methodology

- Can generate empirical data on exposure volumes for QMRA
- Ability to investigate and compare:
 - specific scenarios of interest
 - interventions to reduce exposure
 - proposed new applications for non-potable waters
- More certainty for regulators and industry about exposures and potential health risks

Acknowledgements

Funding

- Coliban Region Water Corporation
- Melbourne Water Corporation
- South Australian Water Corporation
- Sydney Water Corporation
- Water Research Australia

Research Team

- **RMIT** Felicity Roddick, Oliver Jones, Thang Nguyen, Cameron Crombie, Prita Puspita, Yufei Wang
- **Monash** Martha Sinclair, Joanne O'Toole, Karin Leder, Rory Wolfe, Pam Hayes