Strengthening biosafety linkages and collaborations between Australia & New Zealand"

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Newsletter

Environmental Challenges

Earlier this year I was fortunate enough to be able to take my family on a holiday to the northern hemisphere which really put into perspective for me just how lucky we are in Australia and New Zealand working in such temperate climates.

Sure we have our climatic and environmental challenges for those of us in Australia that is generally unpredictable weather patterns, storm surges and some hot days and for our colleagues in New Zealand the extreme challenges of tectonic instability and the challenges of designing structures suitable to cope with earthquake resistance. However, nothing like the extreme climatic conditions some of our counterparts around the world need to factor in as part of normal day to day operational life which would make designing, working in and operating containment laboratories just so much more challenging.

The engineer in me kept looking at all of the challenges like redundancy, thermal expansion and contraction, anti-freezing strategies and melting snow and snow control in general. To have all of these additional design elements and operational elements placed over the top of day to day operation must have some amazing constraints. The countries we visited have adapted very well to the environmental conditions, one of which routinely has temperatures sub zero and has one of the highest concentration s of Tesla cars in the world – who hasn't struggled to start a car – let alone run a car on a cold day!

This really illustrated two key points 1) how government policy and investment can have such an amazing impact on market forces and 2) If there is a desire to make something work, the technological challenges (no matter how insurmountable) can be solved, both aspects of which are critical to our industry. Hopefully you will have noticed that we have held our inaugural webinar which was a great success - one that we are hoping to replicate again with the following two webinars which are planned for later this year.

Please remember that subscriptions are due and also remember to keep your diary free for the annual conference in New Zealand which is already shaping up to be a bumper conference.

Stephen Coulter
Editor

In this issue

10 Common issues found in PC2 laboratory refurbishments

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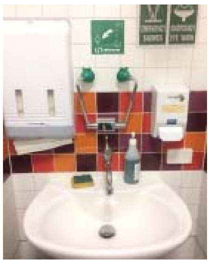
The following are examples of common issues found in PC2 laboratory refurbishments with corresponding solutions. By being aware of these issues in the planning and design phase of the lab refurbishment project, you could prevent unnecessary building delays and extra costs associated with rectification to ensure that the refurbished laboratory complies with PC2 containment and safety requirements.

1. Absorbent grout around tiles in wet areas in the lab

Tiles should be used with caution around wet areas in the lab (e.g. around hand basins or lab sinks as they are usually installed with absorbent grout.

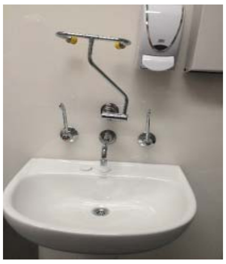



Splashbacks with absorbent tile grout


Non-absorbent tile grout Splashback with no tile grout

2. Size and position of eyewash units

Drop-down eyewash units not selected to fit size of hand wash basin or installed correctly



Incorrect installation should be installed off-centre to allow eyewash flushing water to drain into basin

Incorrect installation

Correct installation, however eyewash arm too long for basin

Correct installation and shorter length eyewash arm to allowwater to drain into basin

3. Eyewash unit plumbing – connection to drain/sewer

Eyewash units not plumbed to sewer


Water flows onto lab floor or only small volumes captured into containers


4. Sealing of service penetrations

Service penetrations into floors, walls, benches and ceilings are not always sealed eg around pipes/ducts/electrical fixtures.

Unsealed ceiling penetration

Unsealed wall penetration

Exposed electrical cables

Sealed floor penetration (using flange sealed to to floor

Electrical wiring enclosed within service duct

5. Fume cupboards, autoclaves etc

Fume cupboards and autoclaves are generally not enclosed on the top or have a bulk head installed to the ceiling - not easy to clean/decontaminate all mechanical surfaces inside units.

Fume cupboards with open top

Autoclave with open top

Fume cupboards bulkhead to ceiling

Autoclave enclosed to ceiling

6. Ventilation grills

Ventilation grills not ducted and open into ceiling void (e.g. return air grilles) - potential for contamination of ceiling space.

7. Under-bench Space

Under-bench exposed service pipes insulated with foam and foil - not able to withstand regular cleaning, easily damaged and absorbent.

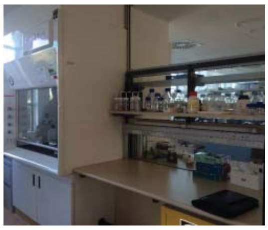
Under-bench pipes enclosed to prevent contamination and surfaces able to be cleaned/decontaminated

8. Lab Coats Spacing

Lab coats not separated by distance or barrier to prevent cross-contamination

9. Storage Shelves

Shelving too high for safe storage and access for cleaning.



10. Insect Screens

Invertebrate/insect screening not easy to remove for cleaning/decontamination (animal, plant and invertebrate facilities)

IN CASE YOU MISSED IT

OGTR issued its revised Criteria for Large Scale (25 litres of more) GMO microbiological facilities version 3.1 was published on the 28th of February 2018 and is available from the OGTR website
www.ogtr.gov.au

LABORATORY WATER

Stephen Coulter
Wood

Water used within laboratories is a critical service which often presents designers, users and facility managers with a number of challenges when trying to understand what is required for the operation of the facility.

All plumbing installed in Australia and New Zealand must comply with the Australian/New Zealand series AS/NZS 3500 and each state and territory will have specific requirements which will generally be over and above the requirements of AS3500. In the context of a laboratory, the hydraulic requirements of AS2982 and AS2243 must also be adopted. The final consideration is of course the operational requirements. These are the requirements that the user group stakeholders will have which allows them to use the laboratory spaces to achieve the outcome that they require.

1.0 Water Supply

Water supplied to a property
Most properties in Australia and New Zealand will be supplied with Potable water (drinking quality water). To ensure there is no damage or contamination to the water authorities' asset in the rare event of back flow at or near the property water meter, there will be a high hazard protection back flow valve which ensures that in the event the supply authority loses pressure there is no chance of reverse flow from the consumer's site (other alternatives to back flow protection could include a break tank). In some of the newer estates recycled water is supplied to the site which is typically used for toilet flushing, cooling tower supply and gardening. Recycled water is identified by being reticulated in lilac coloured pipework or standard pipework with lilac flow indication stickers
.

2.0 Types of Water

Treated water (potable water)
In the context of laboratories, treated water (Authority water) or drinking quality (potable water) is required to be reticulated to handwash basins, safety showers and eyewash units. Some designers provide additional back flow protection at the laboratory boundary for these potable water supplies. However, this is currently a mandatory requirement only at the higher physical containment levels of PC3 and PC4 or where a risk assessment deems that it is necessary.

Non-potable water.
Within laboratories, water reticulated to sinks and equipment is to be non-potable water in accordance with the requirements of AS29982 and AS2243.3. This means that the water supplies to these items of equipment must have additional back flow protection provided, to ensure that should there be a loss of pressure in the supply, there is no chance of the potable water supply being contaminated on the user's site. Some items of equipment present additional problems which need to be worked through using a risk assessment. Ice machines, for example, are technically a piece of equipment however the risk of contamination in a reverse flow event to the network is almost negligible. Similarly, for the generation of various types of purified water, either potable or non-potable water connections would probably be appropriate, given the further treatment the water undergoes in these processes.

Special care must be taken when considering the reticulation of non-potable hot water and how the conflicting requirements of independence and circulation will be addressed.

Some plumbers are concerned by how they certify or provide a plumbing industry certificate for potable and non potable water as, in essence, it is all potable water with two discrete networks.

Segregation within laboratory spaces.
Correctly configured potable and non potable water to laboratory spaces can be achieved at the entry to one or a cluster of laboratories. This will meet the intent of the standards to provide appropriate segregation between the laboratory space and the remainder of the building. For some sensitive or highly risky laboratory space, this type of segregation may be inadequate and additional segregation might be appropriate. Similarly, water services passing from one regulated boundary to another regulated boundary may require additional segregation. The requirement for additional segregation is based on a risk assessment taking into consideration the risk of the water networks exposure, the likelihood and the consequence.

Fire water
Fire water or fire services water is in most cases a separate tapping provided from the treated water supply which is used for the purposes of supplying fire services such as fire water storage tank top up, directly connected sprinklers, hydrants and hose reels. Fire connections to site are provided with a known pressure and flow rate. Where pressure and flow rate is inadequate for the site a fire water storage tank and pump station will be required as will other infrastructure as required by the local fire brigade to fill and boost the fire water system as required. Under the Australian and New Zealand code requirements, sprinkler water is separated from hydrant and hose reel water. Sprinkler water is continuously monitored for leakage and flow and runs as a pressurised system.

Purified water Type I, Type II and Type III
Purified water is developed by taking potable water and passing it through combinations of filtration (MF/UF/RO – topics for another day!) and or ion exchange, deionisation (or electrodeionisation) to produce a higher quality of water. The lower the number the higher the quality of water. The type of water is typically in accordance with the water qualities nominated in ASTM standard D1193 (excerpt given in Table 1). Small bench systems are readily available and work as discrete units. Larger generation, storage and distribution systems are quite complex and require specialist design and installation to ensure a good outcome for the owner.

Another key consideration, particularly for large users of water is what to do with the reject water from these systems which can be substantial. (I have just completed a hospital system which will produce over 1 million litres of reject water per annum). This water can be used in a similar way to recycled water. Purified water usage with laboratories is very common. However, taking into account the costs associated with the production of high quality water (in some cases well over $1/litre) it is important to only use the highest quality of water that is required. The higher the quality of water the harder it is to keep pure. High purity water for example degrades quickly when exposed to the atmosphere as it preferentially adsorbs carbon dioxide from the atmosphere which is typically identified by a rise in the conductivity level of the water.

Water for injection
Water for injection is the highest purity of water which can be produced using two key methods: either via two pass RO or through distillation of purified water. Due to the costs associated with production, it is generally only pharmaceutical manufacturers that are the main industry that make their own Water for Injection. Smaller users such as laboratories tend to buy this water into the business as prepackaged, pre-validated injection quality water

Pyrogen free water
Pyrogens are intra and extracellular microbiological entities that can be biologically alive or dead. In any pharmaceutical application and in some laboratory practices it is essential to remove both live and dead biological material from the water. Filtration to a certain level will remove viruses and bacteria and extra and intracellular material. Water that has been filtered to this level produces Pyrogen Free Water. Generally this process is undertaken at low temperature.

D1193 – 06

TABLE 1 Processes for Reagent Water Production

Type	Grade	Production Process[A,B,C,D]	µS/cm[E] (max)	MΩ·cm[F] (min)	pH[G]	TOC µg/L[H] (max)	Sodium µg/L[I] (max)	Chloride µg/L[J] (max)	Total Silica µg/L (max)	HBC[K] cfu/mL (max)	Endotoxin, EU/mL[L] (max)
I		Purify to 20 µS/cm by dist. or equiv., followed by mixed bed DI, 0.2 µm filtration[A]	0.0555	18		50	1	1	3		
I	A	Purify to 20 µS/cm by dist. or equiv., followed by mixed bed DI, 0.2 µm filtration[A]	0.0555	18		50	1	1	3	10/1000	0.03
I	B	Purify to 20 µS/cm by dist. or equiv., followed by mixed bed DI, 0.2 µm filtration[A]	0.0555	18		50	1	1	3	10/100	0.25
I	C	Purify to 20 µS/cm by dist. or equiv., followed by mixed bed DI, 0.2 µm filtration[A]	0.0555	18		50	1	1	3	100/10	
II		Distillation[B]	1.0	1.0		50	5	5	3		
II	A	Distillation[B]	1.0	1.0		50	5	5	3	10/1000	0.03
II	B	Distillation[B]	1.0	1.0		50	5	5	3	10/100	0.25
II	C	Distillation[B]	1.0	1.0		50	5	5	3	100/10	
III		Distillation, DI, EDI, and/or RO, followed by 0.45 µm filtration.[C]	0.25	4.0		200	10	10	500		
III	A	Distillation, DI, EDI, and/or RO, followed by 0.45 µm filtration.[C]	0.25	4.0		200	10	10	500	10/1000	0.03
III	B	Distillation, DI, EDI, and/or RO, followed by 0.45 µm filtration.[C]	0.25	4.0		200	10	10	500	10/100	0.25
III	C	Distillation, DI, EDI, and/or RO, followed by 0.45 µm filtration.[C]	0.25	4.0		200	10	10	500	1000/100	
IV		Distillation, DI, EDI, and/or RO.[D]	5.0	0.2	5.0 to 8.0		50	50			
IV	A	Distillation, DI, EDI, and/or RO.[D]	5.0	0.2	5.0 to 8.0		50	50		10/1000	0.03
IV	B	Distillation, DI, EDI, and/or RO.[D]	5.0	0.2	5.0 to 8.0		50	50		10/100	0.25
IV	C	Distillation, DI, EDI, and/or RO.[D]	5.0	0.2	5.0 to 8.0		50	50		100/10	

Water pre-treatment

To prevent filters and membranes blocking and becoming chemically damaged, potable water delivered to site is often pre-treated using a combination of coarse filtration – which might be a cartridge style filter or a sand bed filter followed by the removal of chlorine / chlorides via an active carbon filter. Water pre-treatment systems are extremely efficient and cost effective to run.

Softened water

Softened water is often used as treated water feeding boilers where it is essential to ensure that items that can precipitate out at high temperature such as calcium and magnesium which ultimately scale and foul the boiler elements are eliminated. While boiler feed water treatment is a highly specialised field of expertise, broadly it involves filtration followed by ionic exchange – through mixed ion bed resins followed by chemical treatment to remove additional elements such as colloidal silica and other items such as non-condensable gases.

18 Mega Ohm water.

18MOhm water is high purity water that is used in the microelectronics and semiconductor industry. 18MOhm water and water for injection are essentially the same with the exception that 18MOhm water can be produced without using distillation. The inverse relationship of MOhms is conductivity or microsiemens/cm2. 18MOhm = 0.05 microsiemens/cm2, one of the USP criteria used for measuring the quality of water for Injection.

3.0 Waste Water

Trade waste

Trade waste is waste water which typically sits outside the applicable water authorities' permitted discharge parameters for sewer. It is usually the facility owner's responsibility to treat the trade waste on site prior to discharge to sewer. In some instances the water authorities will require continuous monitoring of the trade waste and bill the applicant in accordance with the quality of water.

Sewer

Sewer is the untreated waste from any facility, typically it is from toilets, sinks, handwash basins and other services that do not introduce large quantities of chemicals or particulates which impact the water quality. With the exception of facilities seeking green-star credits most companies will not treat sewer water on site; in stead, a fee will be paid to the water authority (which is typically calculated on a percentage of the water supply to the site) for the collection and treatment of this waste.

Storm water

Storm water is surface or subsurface water that is collected during rain or flood events. There is no treatment of this water. It is collected and runs to the nearest discharge point which is typically a river, a lake or the open ocean. It is an offence to connect any other water discharges (with the exception, in some cases, of condensate from cooling coils) to the storm water system as it is untreated and can cause significant environmental damage.

Radioactive waste

In most states and territories, it is permissible to dispose of small volumes of low concentration ionising radiation into the Trade Waste system. There are strict release parameters that must be adopted including but not limited to, the release of prescribed isotopes with known half-lives, the monitoring and sampling of all radiological waste on the boundary prior to release, the provision of appropriate infrastructure including radiation flushing sinks and appropriate hand wash basins. Each water authority will have its own guidelines and requirements for the discharge of radiological waste streams. Each state and or territory is governed by its own authority which in most cases is the EPA.

Biological waste

Biological waste treatment is a complex issue that requires an in depth understanding of the codes and standards. Where possible, biological waste should not be sent to sewer or trade waste without the appropriate treatment which may include a combination of chemical and heat treatment. The purpose of the treatment is to render any viable organisms non viable and environmentally inert. The requirements for each regulator are different so it is vital that an understanding of how the facility will be used is clearly understood by the design team. The OGTR have recently revised their criteria for large scale waste treatment requirements of OGTR PC2 waste which requires a specific set of design criteria.

High temperature hot waste

Hot waste is waste that comes from a process which is heat generating. Typically this would include blow down vessels from boilers, autoclaves, equipment washers etc.

There are two key problems associated with hot waste. Firstly all water authorities impose limits on the boundary temperature discharge temperature which is designed to protect their assets (reticulation infrastructure) from any damage; the second relates to the physical ability of the drainage materials to withstand exposure to high temperatures for a long period of time. Hot waste must be held and cooled on site prior to discharge and piping material must be able to physically handle the temperature and the associated thermal expansion and contraction associated with the high temperature.

4.0 Waste Water Vent pipes

All plumbing drainage systems require appropriate venting. This is provided for several reasons: to ensure liquid traps aren't syphoned out, to ensure that waste odours are discharged in an appropriate location and to ensure there are no hydraulic air locks or system noises during discharge. For the lower levels of containment, the location and sizing of these vent lines is to be in accordance with the local plumbing regulations. For higher levels of containment facilities and for facilities dealing with large scale production, the regulators require that the vent pipework is appropriately vent filter protected and has the ability to be appropriately decontaminated. Generally, filter elements serving vent systems for biological waste will require a means of effective decontamination – be that by chemical treatment or by thermal decontamination – as required by most authorities. The implications of these requirements means correct placement of the filter outlets, correct materials of construction and adequate funds to ensure that correct infrastructure is available.

5.0 System Design and Sizing

System sizing
The metrics of water supply in domestic and commercial environments is well understood. Laboratory water sizing and set-out is more complicated and when it comes to the higher purity water requirements bigger and more redundancy is generally not better. High purity water deteriorates over time and all water generation plants have an optimum run time to ensure their highest efficiency. Correctly sizing a high purity water system is a specialist skill set that takes into account usage patterns and balances generation capacity (which is often better off being undersized) with an appropriate storage capacity.

Similarly, biological waste treatment systems need to be sized so that there is adequate redundancy while taking into account the most efficient run times for the waste treatment system which varies between chemical and thermal, batch operation and continuous operation.
Designers also need to take into account physical aspects such as movement of system components should elements require replacement or maintenance, and of course, structural adequacy of the building where the plant is to be located.

6.0 Summary

The type and amount of water supplied to laboratory spaces is a complex issue that needs to be understood on a basic level by all team members when planning a laboratory project because not understanding the basic requirements can be a costly exercise in terms of capital infrastructure if the plant is oversized, incorrectly installed or not fit for purpose. For lab designers it is critical that the user group have a clear understanding of target certification and a realistic expectation for how the space will be used both now and into the future so that a correctly configured and correctly sized water supply and water treatment facility can be provided.

ABSANZ & CSIRO Courses 2018

ABSANZ is very pleased to announce that the CSIRO will again be supporting the delivery of two training courses in September 2018.

Course 1: Biorisk Management in High Containment Laboratories (3 days)

Course 2: Practical Biocontainment Practices (2 days)

The core Biorisk Management Module is intended for students, experienced microbiologists and veterinarians who are interested in pursuing a career working with risk group 3 and risk group 4 pathogens.

The course provides an introduction to;

- National and international regulatory framework under which high containment facilities operate;
- Biocontainment principals, equipment and engineering systems;
- Biosafety principles and practices;
- Engineering and information technology systems and approaches which can be used to improve the biosafety and biosecurity of high containment laboratories.

Course Two, Practical Biocontainment Practices will cover the following subjects:

- Autoclave validation & monitoring considerations
- BSC and HEPA filter testing
- Room Pressure decay testing
- Autoclave validation & monitoring - the results
- Room Fumigation and validation
- RFID tracking and inventory of security sensitive biological agents

These very popular courses have a maximum of 8 participants and sold out quickly in 2017 - be quick and secure your place today!

For details and to register please visit

http://www.absanz.org.au/education-training/calendar/

IFBA Certifications

The IFBA's Professional Certification program has expanded its global footprint with certified individuals in over 50 countries worldwide. The number of individuals with their Professional Certification in Biorisk Management has now surpassed the 650 mark, representing a significant milestone for our growing international community of certified professionals. Many of these individuals have also earned additional certifications in Biosecurity, Biological Waste Management, Biosafety Cabinets and Biocontainment Facilities.

The success of the program can be partially attributed to a surge in recognition by employers and governments of the need for certifying the competency of individuals handling biological materials. On an individual level, certification has helped biosafety professionals differentiate themselves as achieving a high standard of excellence.

ABSANZ has 4 training modules available for purchase now! Make the most of your membership and access member discounts to the following courses!

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- Biosecurity
- Biosafety Cabinet Selection, Installation and Safe Use
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To learn more and to sign up now please visit
www.absanz.org.au/education-training/ifba-qualifications/

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ABSANZ welcomes new members at any time during the year - please note that our membership year has recently changed, and will now run 1 July to 30 June annually.

- New members joining between 1 March and 30 September annually pay 100% of the prescribed annual fee and remain financial until 30 June the following year, thereby receiving between 9 and 16 months membership.

- New members joining between 1 October and 28 February annually pay 50% of the prescribed fee and remain financial until the next 30 June, thereby receiving between 4 and 9 months membership.

Eligibility for the various categories of membership is set down in the organisation's constitution.

Join now to access all the benefits of membership.

Category of membership	Cost (2018/2019)
• Individual Membership	A$132.00 includes GST
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- E-Copy of the ABSANZ Newsletter covering significant changes and events affecting biosafety.
- Discounts on conference, training and workshops run by ABSANZ. Exclusive opporunities to provide conference and workshop materials at ABSANZ events.
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- Receive news of significant changes and events affecting biosafety.

Membership is for one year, beginning 1 February.

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- The annual subscription fee is non refundable and non transferrable, except in the case of Corporate Membership, where each can be transferred once per year.
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*For Corporate Membership, individual names and contact details must be supplied. The Member names can each be changed once during the membership year.

EDITORIAL COMMITTEE

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- Subramanyam Vemulpad - Macquarie University
- Neil Walls, Neil Walls Consulting
- Ian Booth, NDY
- Barry Wards MPI

Want a bigger role?

The Editorial Committee is a small group of dedicated industry savvy individuals who would really appreciate additional support from the ABSANZ members.

- If you have a desire to contribute articles or have a series of topics that you would like to see us research and publish information on, please let us know - we welcome all input.
- We would also welcome members who would be interested in becoming part of the editorial committee to not only share the duties but to provide a greater diversity in views and opinions on ABSANZ printed material.