Australian Government
Department of Agriculture, Fisheries and Forestry

AUSTRALIAN Pork

Assessing the effects of APVMA-approved and other potential decontamination chemicals suitable for Emergency Animal Disease (EAD) events, on livestock truck and trailer infrastructure when used in routine cleaning procedures

Final Report
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Executive Summary

Livestock transport vehicles play a critical role in the pork industry supply chain but have been identified as a potential high-risk contributor to the spread of disease. Despite the importance of routine decontamination there is resistance by vehicle owners and drivers to routinely decontaminate vehicles with disinfectants after washing out due to the perceived corrosive or damaging nature of some chemicals. The potential for chemicals to affect the integrity, durability and aesthetic appearance of truck surfaces needs to be evaluated to allow decontamination protocols to be optimised without compromising the condition of the vehicle and therefore encourage the uptake of routine decontamination procedures.

This project aimed 1) to understand concerns of livestock transporters regarding the routine use of chemicals on trucks/trailers; 2) assess the impact of Australian Pesticides and Veterinary Medicines Authority (APVMA) approved decontamination chemicals on the integrity, durability and appearance on the surfaces of livestock transport vehicles; 3) identify alternative decontamination chemicals, currently not APVMA approved but that contain appropriate active constituents, and assess the impact on the integrity, durability and appearance on the surfaces of livestock transport vehicles and; 4) provide evidence to support registration requests for APVMA approval of additional decontamination chemicals for use on livestock transport vehicles during an Emergency Animal Disease response.

A survey of livestock transporters identified corrosion, fading and wear on livestock transport vehicles as the primary concerns associated with routine disinfectant use. The areas perceived to be most vulnerable to damage were steel (for example, the truck bed and frame) followed by chrome and painted surfaces and rubber components. Based on these findings four representative material types were selected for assessment including steel and aluminium truck/crate components, chrome hub caps and rubber seals.

A desktop review was undertaken to identify suitable decontamination chemicals (disinfectants) for evaluation. Six products were selected, comprising of three APVMA approved decontamination chemicals (Virkon S, Terminator and sodium hypochlorite) and three alternative decontamination chemicals (Quat, Ablesan AC 256 and Oxivir Five 16).

Disinfectant solutions were prepared and applied in accordance with label directions, including specified dilution rates, mixing procedures, contact times, and maximum retention times. Solutions were applied using a low-pressure hand sprayer, with surfaces maintained in a wet state for the required contact period. Surface durability and compatibility were assessed over 200 application cycles, with evaluations conducted at 0, 25, 50, 100, 150, and 200 applications. Assessments included photographs, weight change, corrosion assessment using optical surface recognition technology, visual evaluation of surface condition, and physical inspection for evidence of corrosion, colour change, pitting, and rust formation.

The project found that the effect of disinfectants varied between materials. Of the three AVPMA approved decontamination chemicals assessed Terminator showed the strongest overall surface compatibility and was considered suitable for routine disinfection of livestock transport vehicles. Virkon S also showed generally good surface compatibility and may be suitable for routine disinfection use. However, it should be noted that visual impacts were observed on aluminium surfaces where the disinfectant pooled. Sodium hypochlorite showed the greatest potential for degradation with the materials tested and is not recommended for frequent routine use where alternative products are

available. If it is to be used then consideration should be given to rinsing after the required contact time to minimise any potential adverse effects.

For the non AVPMA approved decontamination chemicals, Quat and Oxivir Five 16 demonstrated strong overall compatibility across the materials tested and are recommended for routine use on transport vehicles. They are also recommended for technical work to request registration for APVMA approval for additional decontamination chemicals for use on livestock transport vehicles. However, Ablesan AC 256 is not recommended for routine use as it showed visual deterioration particularly on chrome and aluminium surfaces.

In summary the findings show that routine decontamination of livestock transport vehicles can be achieved with minimal effects on infrastructure if disinfectants are appropriately selected and applied. These results also provide evidence to support decision making and registration requests to the APVMA for approval to include additional disinfectants for use in emergency animal disease situations.

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1. Background to Research

Livestock transport vehicles (those that deliver animals from farm to farm and from farm to processing facilities) have been identified by the pork industry as a potential high-risk contributor to the spread of disease. In the event of the incursion of an emergency animal disease (EAD) the limited efforts to routinely disinfect livestock transport vehicles after washing will exaggerate outward spread of disease in the period prior to detection, constrain EAD response activities, and increase the risk of further spread of an EAD to uninfected herds.

There is resistance by vehicle owners to routinely decontaminate vehicles with disinfectants after washing out due to the perceived corrosive or damaging nature of some chemicals. The potential for chemicals to affect the integrity, durability, longevity and aesthetic appearance of truck surfaces needs to be evaluated to allow decontamination protocols to be optimised and confidently applied without compromising the condition of the vehicle, and to therefore encourage the uptake of routine decontamination procedures.

This project aimed to provide an understanding of how decontamination chemicals may impact the structural and aesthetic integrity of livestock transport trucks/trailers and to provide valuable insight to ensure disinfection is not only effective in removing contamination but also sustainable in preserving the longevity and functionality of livestock vehicles. The project also sought to obtain evidence to support the industry in seeking APVMA approvals for additional chemicals to be permitted for decontamination against EAD's relevant to the pork industry (for example, African swine fever (ASF) and foot-and-mouth disease (FMD)) with minimal negative impacts on truck/trailer surfaces.

2. Objectives of the Research Project

The objectives of this project were to:

1. Understand concerns of livestock transporters regarding the routine use of chemicals on trucks/trailers;
2. Assess the impact of APVMA approved decontamination chemicals on the integrity, durability and appearance on the surfaces of livestock transport vehicles;
3. Identify alternative decontamination chemicals, currently not APVMA approved but that contain active constituents effective against ASF and/or FMD, and assess the impact on the integrity, durability and appearance on the surfaces of livestock transport vehicles and;
4. Provide evidence to support registration requests for APVMA approval of additional decontamination chemicals for use on livestock transport vehicles in relevant EAD events.

3. Research Methodology

3.1 Survey of livestock transporters

A survey was designed and distributed to the main companies and drivers delivering to Linley Valley Pork, sent to the members of the Livestock and Rural Transport Association of WA (LRTWA), the transporters delivering to V&V Walsh, the transporters delivering to Dardanup Butchering Company and to major SunPork Group transporters.

The survey asked seven questions addressing the current use of decontamination chemicals (disinfectants) and potential concerns regarding the routine use of disinfectants. These were:

1. What products do you use for your cleaning procedure?
    a. None/don't clean
    b. Water only
    c. Water and detergent
    d. Water and disinfectant
    e. Water, detergent and disinfectant
    f. Other
        i. Please specify

2. If you use disinfectants what product(s) do you use?
    a. Open ended answer.

3. If you use disinfectants how often do you use them?
    a. Daily
    b. Weekly
    c. Monthly
    d. Other
        i. Please specify

4. If you use disinfectants do you use them in accordance with their label directions?
    a. Yes
    b. No
    c. Not applicable

5. If you were to routinely use disinfectants (for example, if required in the event of an Emergency Animal Disease outbreak) do you think truck surfaces may be vulnerable to damage from routine exposure to these disinfectants?
    a. Yes
    b. No
    c. Maybe

6. If you answered yes or maybe to Question 5 what specific truck surfaces do you believe would be most vulnerable to damage from routine exposure to these chemicals? Rank in order of most vulnerable to damage (use the arrows to move; 1 = most vulnerable and 5 = least vulnerable).
    a. Steel (e.g. truck bed and frame)
    b. Chrome and painted surfaces (e.g. body panels)

c. Rubber seals (e.g. door and window seals)
d. Plastics (reservoirs, covers)
e. Tyres (e.g. rubber or composite materials)

7. What are your general concerns (if any) with using disinfectants?
    a. Corrosion
    b. Fading
    c. Wear
    d. Rust on metal
    e. Degradation of seals
    f. No concerns
    g. Other
        i. Please specify

3.2 Review and identification of current and potential decontamination chemicals

A desktop review was undertaken of chemicals and their active constituents specified in the APVMA permits (PER95958 and PER83649) to allow emergency use of registered and unregistered Agvet chemical products for use as disinfectants for both ASF and FMD (Table 4.2). Chemicals currently used in a food-producing abattoir were also reviewed. One further possible chemical was also identified from the literature that may be effective against ASF and FMD but is not listed in the APVMA permits or in a food-producing abattoir but is used in a hospital setting.

3.3 Assessing the impact of decontamination chemicals on livestock truck and trailer parts in an experimental setting

The survey in Section 3.1 was used to identify areas of concern for the transport drivers. Based on these findings the following representative materials were selected for further assessment through project trial activities:

1. Truck tray or crate surfaces – used steel and aluminium truck crate components (approximately 20-30 x 20-30 cm)
2. Truck chrome/painted surface – new chrome hub caps (8 inch in diameter)
3. Rubber seals – new door rubber seal strip generic for trucks (approximately 8 cm length).

The desktop review from Section 3.2 informed the selection of disinfectants for evaluation. The following products were selected for assessment:

i) Virkon S (494 g/kg potassium peroxomonosulfate triple salt, 132 g/kg sodium dodecyl benzene sulfonate, 15 g/kg sodium chloride) – APMVA approved for ASF and FMD
ii) Sodium hypochlorite 12.5% – APVMA approved for ASF and FMD and used in a food producing abattoir
iii) Terminator Broad Spectrum Disinfectant (150 g/L glutaraldehyde, 100 g/L quaternary ammonium) – APMVA approved for ASF and FMD
iv) Quat (20-40% quat mixture - quaternary ammonium compound, benzalkonium chloride - Benzalkonium chloride (20-40%)) – used in a food producing abattoir, effective against ASF (Beato et al. 2022; Frost et al. 2023) and possibly FMD (depending on circumstances)

v) Ablesan AC 256 (<8% w/w stabilised hydrogen peroxide, <1% benzalkonium chloride) - used in a food producing abattoir, effective against ASF (Beato et al. 2022, Frost et al. 2023) and FMD (Kumin et al 2018).

vi) Oxivir Five 16 (accelerated hydrogen peroxide) – used in a hospital setting, effective against ASF (Ramirez 2021) and FMD (Hole et al 2017).

Each disinfectant and surface combination was tested in five replicates.

Each disinfectant solution was prepared according to the label instructions of the relevant APVMA permit. All guidelines were followed for dilution ratios, mixing instructions and allowable solution storage times.

Solutions were applied using a low-pressure sprayer (Nylex 2L Chemical Resistant Hand Sprayer). The surfaces remained wet for at least the minimum specified contact time. From application 26 onwards, excess solution was wiped off to decrease the drying time after the required contact time had elapsed.

Assessments were conducted after 0, 25, 50, 100, 150 and 200 application cycles. At each interval, the following measurements were taken:

i) Photograph of the sample

ii) Weight – with percentage change calculated relative to the initial weight

iii) Corrosion assessment – scored from 0 to 100 using the Optical Surface Recognition app (Engineering Director Inc, 2020). Corrosion was evaluated within a defined template area (dimensions were 15 x 20 cm)

iv) Visual assessment of texture/appearance, colour, gloss or structural integrity using a 3-point scale (1 = no change and 3 = significant change)

v) Physical assessment evidence of i) onset of corrosion; ii) colour change (the silver metal changed to a light orange or darker colour; iii) pitting (formation of small surface divots); and iv) rust formation (presence of red, flaky material on the surface or edges).

Rubber seal samples were excluded from corrosion assessments.

Repeated measures analysis of variance (Genstat 24th edition) was used to assess the change in weight over time and the corrosion score obtained from the optical surface recognition. Disinfectant was the treatment factor with each truck component assessed separately.

4. Results

4.1 Survey of livestock transporters

Twenty-four livestock transporters from Western Australia and the SunPork Group responded to the survey. The survey was anonymous but it is assumed that the responses are a representative sample of all livestock transporters.

The majority of transporters only used water to wash down (62.5%) followed by water and detergent (29.2%) and water and disinfectant (8.33%) after transporting livestock (Figure 4.1). Of those that used disinfectants one used them weekly, one monthly and others used as required (for example if transporting breeding/stud stock, prior to transporting dairy export cattle or after transporting infected stock). All of those who used disinfectants (Terminator and Hibitane) used them in accordance with the label details.

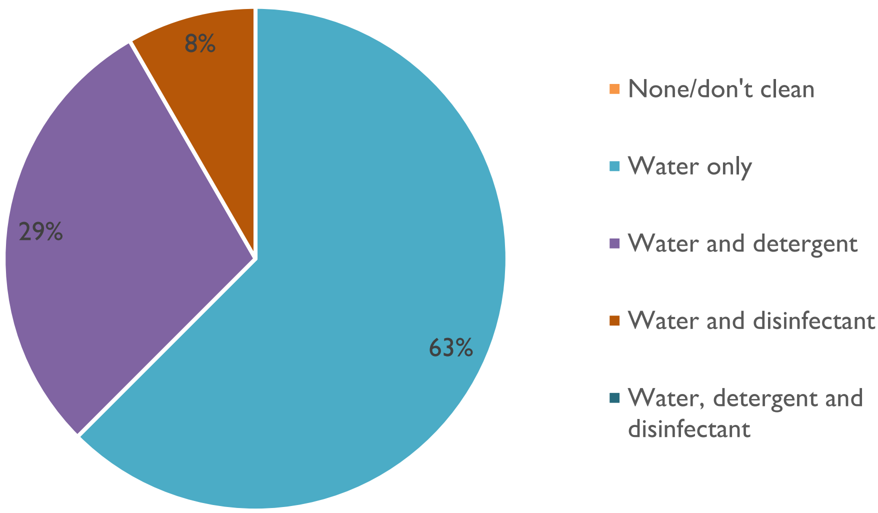


Figure 4.1 Proportion of transporters using water, detergent, disinfectants or a combination to clean trucks after transporting livestock.

Transporters were asked if they were to routinely use disinfectants (for example if required in the event of an Emergency Animal Disease outbreak) - Do you think truck surfaces may be vulnerable to damage from routine exposure to the disinfectants? Of the transporters surveyed 38% responded yes, 46% maybe while 17% of transporters surveyed were not concerned about the routine use of disinfectants on truck surfaces.

Transporters were asked what specific truck surface they believed would be most vulnerable to damage from routine exposure to disinfectants (Table 4.1). Steel surfaces (for example, truck bed and frame) were thought to be the most vulnerable by 47.1% of respondents, followed by chrome and painted surfaces (for example, body panels), rubber seals (for example, door and window panels), plastics (for example, reservoirs and covers) and tyres (for example, rubber or composite materials). Tyres and plastics were considered to be least vulnerable to damage.

Table 4.1 Perceived truck surface vulnerability (%) to damage from routine use of disinfection as identified by the transporters.

Rank	Options	Most vulnerable	2	3	4	Least vulnerable
1	Steel (e.g. truck bed and frame)	47.1	29.4	5.9	11.8	5.9
2	Chrome and painted surfaces (e.g. body panels)	35.3	35.3	5.9	5.9	17.6
3	Rubber seals (e.g. door and window panels)	17.6	23.5	52.9	5.9	0
4	Plastics (reservoirs, covers)	0	5.9	23.5	70.6	0
5	Tyres (e.g. rubber or composite materials)	0	5.9	11.8	5.9	76.5

Transporters were asked what general concerns they had with using disinfectants (Figure 4.2). The main areas of concern were corrosion, rust on metal and fading. The concerns in the other area related to potential human health risks and time and costs.

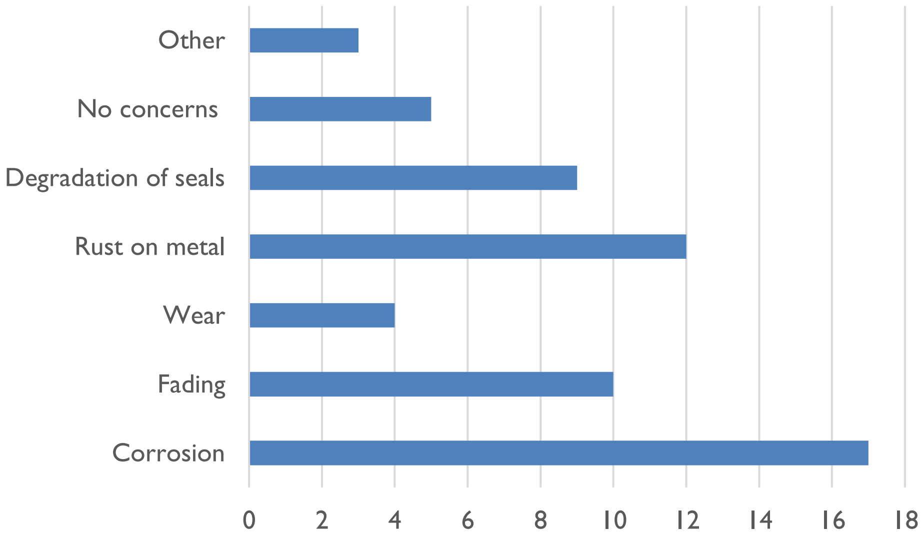


Figure 4.2 Number of respondents with general concerns with routine use of disinfectants.

4.2 Review and identification of current and potential decontamination chemicals

Chemicals were selected for further assessment based on their ease of application, potential environmental impact, label cautions and possible corrosive effects. The following chemicals were selected for further evaluation in Section 3.3 and 4.3 based on the desktop review:

vii) Virkon S (494 g/kg potassium peroxomonosulfate triple salt, 132 g/kg sodium dodecyl benzene sulfonate, 15 g/kg sodium chloride) or equivalent – APMVA approved for ASF and FMD

viii) Sodium hypochlorite 12.5% – APVMA approved for ASF and FMD and used in a food producing abattoir

ix) Terminator Broad Spectrum Disinfectant (150 g/L glutaraldehyde, 100 g/L quaternary ammonium) or equivalent – APMVA approved for ASF and FMD

x) Quat (20-40% quat mixture - quaternary ammonium compound, benzalkonium chloride - Benzalkonium chloride (20-40%)) or equivalent – used in a food producing abattoir, effective against ASF and possibly FMD (depending on circumstances)

xi) Ablesan AC 256 (<8% w/w stabilised hydrogen peroxide, <1% benzalkonium chloride) - used in a food producing abattoir, effective against FMD

xii) Oxivir Five 16 (accelerated hydrogen peroxide) – used in a hospital setting, effective against ASF and FMD.

Table 4.2 Review of APMVA approved and potential decontamination chemicals.

Chemical	Active Ingredient (s)	Effective against ASF	Effective against FMD	Cautions	Rinsing required	Application	Ecological information	Recommend testing
Listed in APVMA Permit Number 95958 (ASF) or Permit Number 83649 (FMD)								
Virkon S *Plus other similar registered products containing the same active ingredients*	494 g/kg potassium peroxomonosulfate triple salt, 132 g/kg sodium dodecyl benzene sulfonate, 15 g/kg sodium chloride	Yes	Yes	Strongly acidic, corrosive Do not immerse metal objects in Virkon S Adhere to specified contact times It is mildly corrosive to many metals.	Only if prolonged contact or on potable/feeder surfaces	Cloth, mop, mechanical spray, sponge or foam	Toxic to fish and algae at high levels	Yes
Virkon Aquatic *Plus other similar registered products containing the same active ingredients*	497 g/kg potassium peroxomonosulfate , 15 g/kg sodium chloride	Yes	Yes	Strongly acidic, corrosive No. Only if prolonged contact or on potable/feeder surfaces	Only if prolonged contact or on potable/feeder surfaces	Cloth, mop, mechanical spray or sponge	Toxic to fish and algae at high levels	No, prefer Virkon S
Gen Ag Chlor Dairy Sanitiser *Plus other similar registered products containing the same active ingredients*	125 g/L chlorine present as sodium hypochlorite	Yes	Yes	Toxic for eyes and skin - wear protection clothing, mask and gloves. Corrosive for many metals	No	Spray (not high pressure)	No known ecotoxicological effects when at diluted rates	Yes – currently used in some misting systems

Rua-Klenza RKL 400 low foam dairy detergent *Plus other similar registered products containing the same active ingredients*	400 g/L sodium hydroxide	Yes	Yes	Corrosive. Do not use with aluminium or zinc coated (galvanised) materials	No	Spray	Minimal once neutralised and released to the environment in small quantities	No
Terminator Broad Spectrum Disinfectant *Plus other similar registered products containing the same active ingredients*	150 g/L glutaraldehyde, 100 g/L quaternary ammonium	Yes	Yes	Non-corrosive (although in safety direction it says it is corrosive)	No	Spray, foam	In water, glutaraldehyde undergoes moderate biodegradation to produce glutamic acid. Benzalkonium chloride is not known to bioaccumulate	Yes
Hy-chlor Aquatic Premium Calcium Hypochlorite *Plus other similar registered products containing the*	700 g/kg available chlorine present as calcium hypochlorite	Yes	Not listed	Highly reactive Corrosive for many metals	No	Spray	Toxic to alae, zooplankton (likely when concentrated)	No

same active ingredients								
Virocid Broad Spectrum Disinfectant *Plus other similar registered products containing the same active ingredients*	107 g/L gluteraldehyde, 78 g/L didecyldimethylammoniumchloride, 170 g/L alkyldimethybenzilammoniumchloride	Yes	Yes	Corrosive	No	Spray, fogged, foamed	Environment friendly, no known ecotoxicological effects when diluted	Yes
F10SC Veterinary Disinfectant *Plus other similar registered products containing the same active ingredients*	54 g/L benzalknoium chloride, 4 g/L poly (hexamethylene biguanide) hydrochloride	Yes	Not listed	Non-irritating, non-corrosive	No	Spray or wipe	Toxic to aquatic life and may cause long-term adverse effects in the aquatic environment Product is readily biodegradable	No as only effective for ASF
Citric acid	Citric acid	No	Yes	Corrosive	No	Spray	When diluted, this chemical released directly or indirectly into the environment is not expected to have a significant impact	No
Sodium carbonate,	sodium carbonate	Yes	Yes	Corrosive to plastics and some metals like	No	Spray	No information available	No

anhydrous powder				aluminium, lead, zinc and zinc brasses				
Sodium carbonate, washing soda crystals	sodium carbonate	Yes	Yes	Corrosive to plastics and some metals like aluminium, lead, zinc and zinc brasses	No	Spray	No information available	No
Currently used in a food producing abattoir								
Quat	20-40% quat mixture - quaternary ammonium compound, benzalkonium chloride - Benzalkonium chloride (20-40%)[1,2]	Yes	Maybe (depends on setting)	Class 8 Corrosive - as per criteria for the Australian Code for the Transport of Dangerous Goods by Road & Rail	No	Spray, foam	Non-hazardous for aquatic both acute and long-term, no information on eco toxicity	Yes
Sodium Hypochlorite 12.5%	12% sodium hypochlorite	Yes	Yes	SDS - corrosive to metals	No	Spray	Acute hazard to Aquatic environment, chronic (long term) hazard to aquatic environment, no information on eco toxicity	Yes (equivalent to Gen Ag Chlor) – use as on site already
Ablesan AC 256	<8% w/w stabilised hydrogen peroxide, <1% benzalkonium chloride[1,2,3]	Yes	Yes	None specified	No	Apply via sprayer, cloth, swab or fogger and complete wet the surface, leave to dry	Acute aquatic hazard - non-hazardous; long-term aquatic hazard - non-hazardous; eco toxicity - no	Yes

							information available	
Currently used in a hospital-based or veterinary setting								
Oxivir	Accelerated Hydrogen Peroxide[4,5]	Yes	Yes	Non corrosive, non bleaching Disinfects hard surfaces without creating destructive microcracks that harbour pathogens	No	Spray, foam(?)	AHP biodegrades to oxygen and water	Potential as effective for ASF and FMD

[1]Beato et al, 2022; [2]Frost et al, 2023; [3]Kumin et al 2018; Ramirez, 2021; [4]Hole et al, 2017

4.3 Assessing the impact of decontamination chemicals on livestock truck and trailer parts in an experimental setting

4.3.1 *Visual appearance*

Tables 4.3, 4.4, 4.5 and 4.6 show representative examples of the change in appearance as the number of applications increases for rubber strips, chrome hub caps, aluminium crate parts and steel crate parts sprayed with different disinfectants. The full replicates are given in Appendix A.

There does not appear to be any visual effect of rubber strips sprayed up to 200 times with the six different disinfectants.

Chrome hubcaps sprayed with Virkon S, Terminator, Quat and Oxivir up to 200 times do not appear to be visually affected. However, those sprayed with sodium hypochlorite and Ablesan AC have been impacted from 50 and 25 sprays, respectively.

Aluminium crate components have been visually impacted after being sprayed from 25 applications with Virkon S, sodium hypochlorite and Ablesan AC. The aluminium surfaces have mainly been impacted where the disinfectant pools. On flat surfaces and after excess disinfectant was removed there did not appear to be further visual impacts. There was no visual effect of spraying Terminator, Quat and Oxivir on aluminium surfaces.

Steel crate components have been visually impacted by all the disinfectants to some extent. Virkon S, Terminator, Quat and Oxivir were less affected compared to sodium hypochlorite and Ablesan AC.

While not officially tested as part of the project the underside of some of the aluminium components were painted. These were also exposed to the disinfectants overtime. There did not appear to be any visual change to the painted surfaces irrespective of the disinfectant (Figure 4.3).

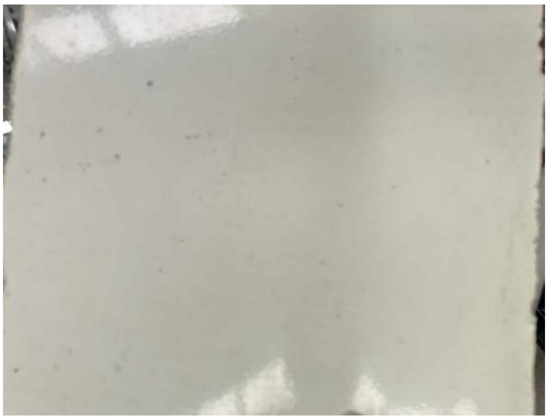


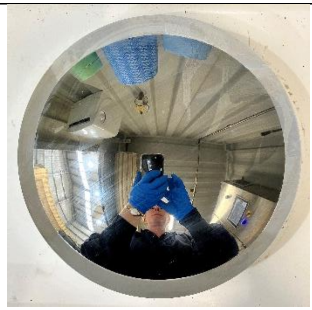
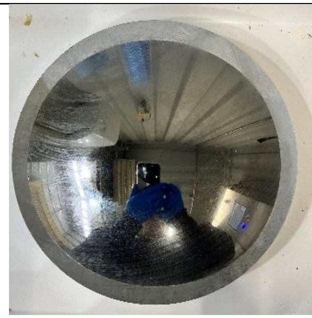
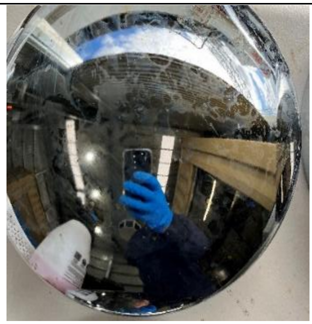
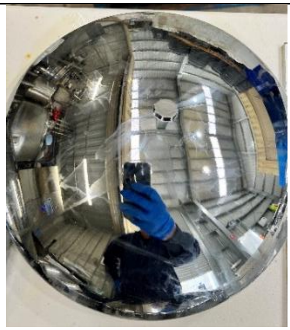
Figure 4.3 Example of aluminium painted surface exposed to a disinfectant repeatedly to disinfectant.

Table 4.3 Effect of six disinfectants on the visual appearance of rubber after 0, 25, 50, 100, 150 and 200 applications.

0 applications	**25 applications**	**50 applications**	**100 applications**	**150 applications**	**200 applications**
Virkon					
					
Sodium hydrochloride					
					
Terminator					
					

Quat					
					
Ablesan AC 256					
					
Oxivir Five 16					
					

Table 4.4 Effect of six disinfectants on the visual appearance of chrome hub caps after 0, 25, 50, 100, 150 and 200 applications.

0 applications	**25 applications**	**50 applications**	**100 applications**	**150 applications**	**200 applications**
Virkon					
					
Sodium hypochlorite					
					
Terminator					
					

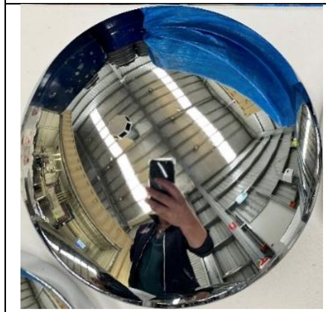
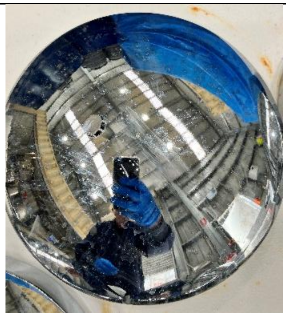
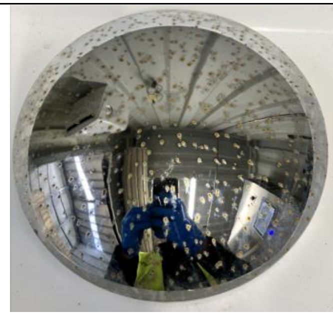
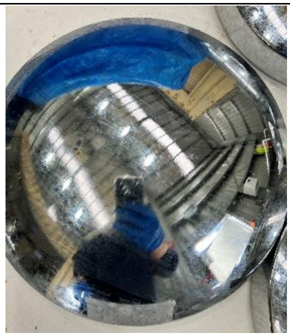
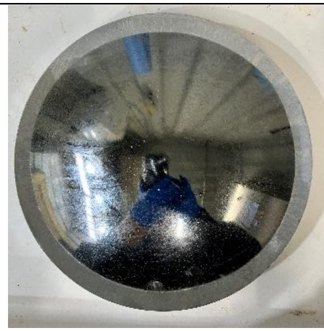
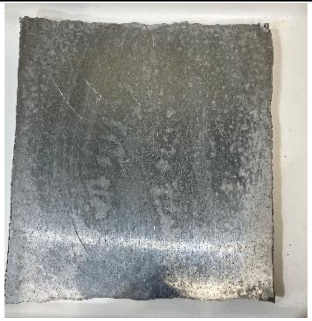
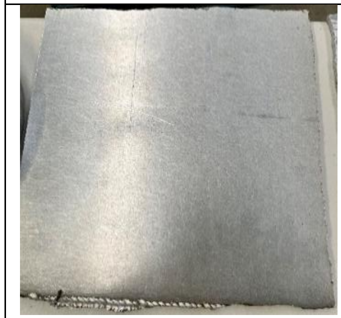
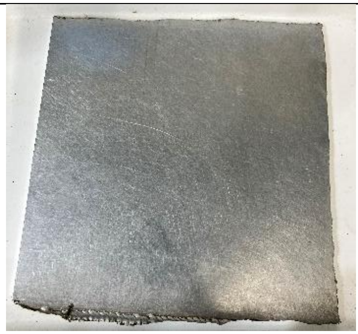
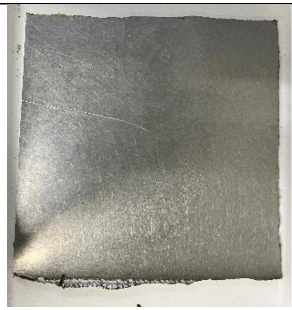
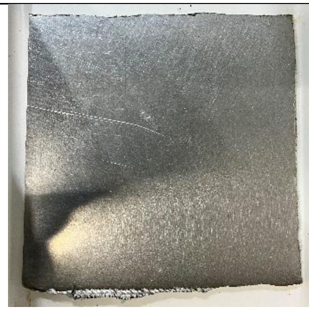
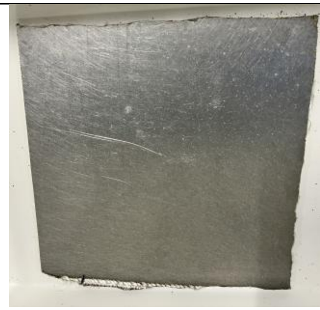
Quat					
					
Ablesan AC 256					
					
Oxivir Five 16					
					

Table 4.5 Effect of six disinfectants on the visual appearance of aluminium crate components after 0, 25, 50, 100, 150 and 200 applications.

0 applications	**25 applications**	**50 applications**	**100 applications**	**150 applications**	**200 applications**
Virkon					
					
Sodium hypochlorite					
					
Terminator					
					

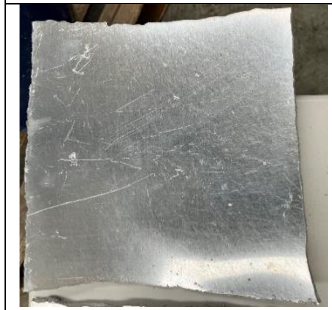
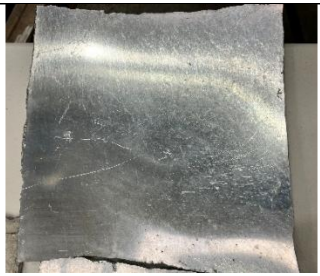
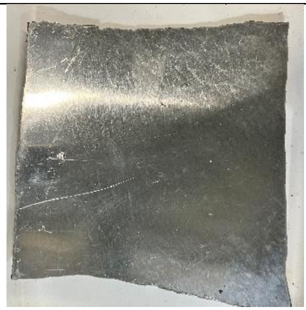
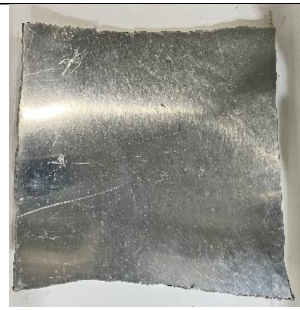
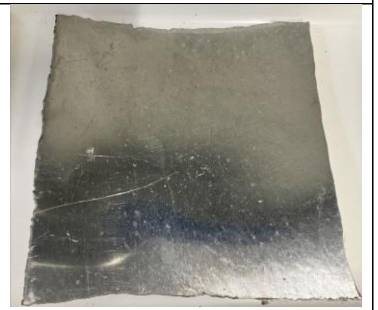
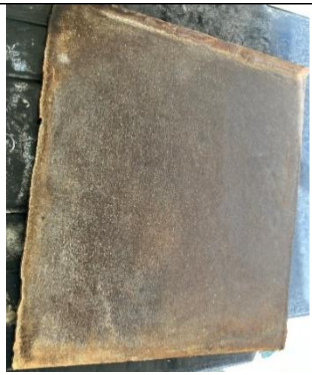
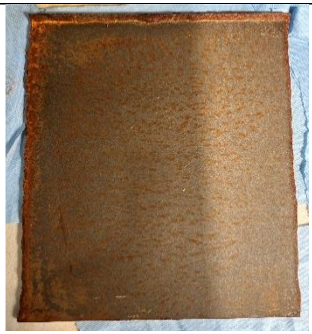
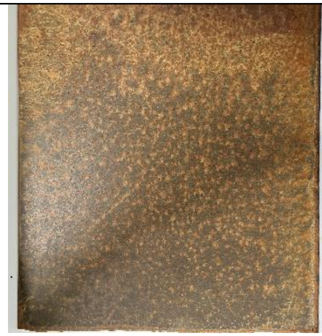
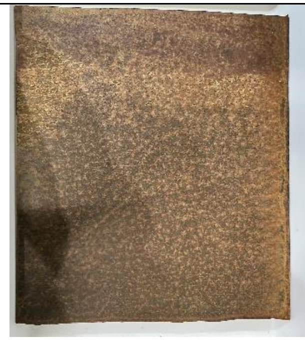
Quat					
					
Ablesan AC 256					
					
Oxivir Five 16					
					

Table 4.6 Effect of six disinfectants on the visual appearance of steel crate components after 0, 25, 50, 100, 150 and 200 applications.

0 applications	**25 applications**	**50 applications**	**100 applications**	**150 applications**	**200 applications**
Virkon					
					
Sodium hypochlorite					
					
Terminator					
					

Quat					
					
Ablesan AC 256					
					
Oxivir Five 16					
					

4.3.2 Visual assessment

Each truck component was assessed for the effect of disinfectant on the texture, colour, gloss and structural damage after 25, 50, 100, 150 and 200 applications on a scale of 1 to 3 where 1 was no change, 2 moderate change and 3 significant change (Tables 4.7, 4.8. and 4.9).

There was no effect on texture, colour, gloss or structure on the rubber strips from any disinfectant at any time point (all disinfectants scored 1 after all applications).

There was no impact of Virkon S, Terminator, Quat, or Oxivir on the texture of chrome hubcaps after 200 applications. Sodium hypochlorite moderately impacted the texture after 25, 50 and 100 applications and resulted in significant change after 150 applications. Ablesan AC moderately impacted the texture after 150 applications.

There was no impact of Virkon S, Terminator, Quat, or Oxivir on the colour of chrome hubcaps after 200 applications. Sodium hypochlorite moderately impacted the colour after 50 applications and resulted in significant change from 100 applications onwards. Ablesan AC moderately impacted the colour after 50 applications.

There was no impact of Terminator, Quat, or Oxivir on the gloss of chrome hubcaps after 200 applications. Virkon S and Ablesan AC moderately reduced gloss after 150 and 25 applications, respectively. Sodium hypochlorite moderately impacted the gloss after 25 applications and resulted in significant change from 100 applications onwards.

There was no structural damage after 200 applications for any disinfectant with the exception of sodium hypochlorite which had moderate structural damage after 150 applications.

Table 4.7 Effect of six disinfectants on the visual assessment of chrome hubcaps after 0, 25, 50, 100, 150 and 200 applications.

Chemical	**Number of applications**					
	0	**25**	**50**	**100**	**150**	**200**
Texture						
Virkon S	1	1	1	1	1	1
Sodium hypochlorite	1	2	2	2	3	3
Terminator	1	1	1	1	1	1
Quat	1	1	1	1	1	1
Ablesan AC	1	1	1	1	2	2
Oxivir	1	1	1	1	1	1
Colour						
Virkon S	1	1	1	1.2	1	1
Sodium hypochlorite	1	1	2	3	3	3
Terminator	1	1	1	1	1	1
Quat	1	1	1	1	1	1
Ablesan AC	1	1	1.8	2	2	2
Oxivir	1	1	1	1	1	1
Gloss						
Virkon S	1	1	1	1.4	2	2
Sodium hypochlorite	1	2	2	3	3	3
Terminator	1	1	1	1	1	1
Quat	1	1	1	1	1	1
Ablesan AC	1	2	2	2	2	2
Oxivir	1	1	1	1	1	1
Structural damage						

Virkon S	1	1	1	1	1	1
Sodium hypochlorite	1	1	1	1	2	2
Terminator	1	1	1	1	1	1
Quat	1	1	1	1	1	1
Ablesan AC	1	1	1	1	1	1
Oxivir	1	1	1	1	1	1

There was no to minimal impact of any disinfectant on the texture of aluminium after 200 applications.

There was no impact of Virkon S, Terminator, Quat, or Oxivir on the colour of aluminium after 200 applications. Virkon S and Sodium hypochlorite moderately impacted the colour from 50 applications onwards. Ablesan AC moderately impacted the colour from 25 applications onwards.

There was no impact of Terminator, Quat, or Oxivir on the gloss of aluminium after 200 applications. Virkon S, sodium hypochlorite and Ablesan AC moderately impacted the gloss from 25 applications onwards.

There was no structural damage after 200 applications for any disinfectant.

Table 4.8 Effect of six disinfectants on the visual assessment of aluminium crate components after 0, 25, 50, 100, 150 and 200 applications.

Chemical	Number of applications					
	0	**25**	**50**	**100**	**150**	**200**
Texture						
Virkon S	1	1	1	1	2	1
Sodium hypochlorite	1	1	1	1	1	1
Terminator	1	1	1	1	1	1
Quat	1	1	1	1	1	1
Ablesan AC	1	1.2	1	1	1	1
Oxivir	1	1.8	1	1	1	1
Colour						
Virkon S	1	1.4	2	1	2	2
Sodium hypochlorite	1	1.2	2	1.6	1.6	1.4
Terminator	1	1	1	1	1	1
Quat	1	1	1	1	1	1
Ablesan AC	1	2	2	2	2	1.2
Oxivir	1	1	1	1	2	1
Gloss						
Virkon S	1	1.8	2	1.6	2	2
Sodium hypochlorite	1	1.6	2	2	1	1.4
Terminator	1	1	1	1	1	1
Quat	1	1	1	1	1	1
Ablesan AC	1	2	2	2	2	2
Oxivir	1	1.8	1.4	2	2	2
Structural damage						
Virkon S	1	1	1	1	1	1
Sodium hypochlorite	1	1	1	1	1	1
Terminator	1	1	1	1	1	1
Quat	1	1	1	1	1	1
Ablesan AC	1	1	1	1	1	1
Oxivir	1	1	1	1	1	1

There was no impact of Virkon S, Terminator, Quat, Ablesan AC or Oxivir on the texture of steel after 200 applications. Sodium hypochlorite moderately impacted the texture after 25, 50, 100 and 150 applications and resulted in significant change after 200 applications.

There was no effect of Oxivir on the colour of steel until 150 applications when colour was moderately impacted. Virkon S, sodium hypochlorite, Terminator, Quat, and Ablesan AC moderately impacted the colour from 25 applications onwards.

Virkon S, Terminator, Quat, Ablesan AC and Oxivir moderately impacted the gloss of steel from 25 applications onwards. Sodium hypochlorite moderately impacted the gloss after 25 applications and resulted in significant change from 50 applications onwards.

There was no structural damage after 200 applications for any disinfectant.

Table 4.9 Effect of six disinfectants on the visual assessment of steel crate components after 0, 25, 50, 100, 150 and 200 applications.

Chemical	**Number of applications**					
	0	**25**	**50**	**100**	**150**	**200**
Texture						
Virkon S	1	1	1	1	1	1
Sodium hypochlorite	1	2	2	2	2	3
Terminator	1	1	1	1	1	1
Quat	1	1	1	1	1	2
Ablesan AC	1	1	1	1	2	1
Oxivir	1	1	1	1	1	1
Colour						
Virkon S	1	2	2	2	2	2
Sodium hypochlorite	1	2.2	3	2.6	2	2
Terminator	1	1.8	1	2	2	2
Quat	1	1.8	2	2	2	2
Ablesan AC	1	1.6	2.6	2	2	2
Oxivir	1	1	1	1	2	2
Gloss						
Virkon S	1	2	2	2	2	2
Sodium hypochlorite	1	2.2	3	2.6	3	3
Terminator	1	1.8	1	2	2	2
Quat	1	1.8	2	2	2	2
Ablesan AC	1	1.6	2.6	2	2	2
Oxivir	1	1.4	2	2	2	2
Structural damage						
Virkon S	1	1	1	1	1	1
Sodium hypochlorite	1	1	1	1	1	1
Terminator	1	1	1	1	1	1
Quat	1	1	1	1	1	1
Ablesan AC	1	1	1	1	1	1
Oxivir	1	1	1	1	1	1

4.3.3 Physical assessment

Each truck component was assessed for the effect of disinfectant on corrosion, colour change, rust and/or pitting after 25, 50, 100, 150 and 200 applications on a present or absent basis.

There was no impact of Terminator and Oxivir on the presence of corrosion on chrome hubcaps after 200 applications (Table 4.10). Twenty, forty and sixty percent of replicates, showed some effect of corrosion after 100, 150 and 200 applications of Virkon S respectively, however it is suspected that the corrosion was coming through from underneath the hubcap not from the application of Virkon S. All chrome hubcaps sprayed with sodium hypochlorite showed signs of corrosion from 25 applications onwards. Eighty and 100% sprayed with Ablesan AC showed signs of corrosion from 50 and 100 applications onwards, respectively.

Virkon S, Terminator, Quat and Oxivir had no impact on colour change, pitting or rust for any number of applications. Ablesan AC had no impact on colour change for any number of applications while one hundred percent of replicates sprayed with sodium hypochlorite showed colour change from 25 applications onwards. The majority of hubcaps showed pitting from 25 and 100 applications for sodium hypochlorite and Ablesan AC, respectively. The majority of hubcaps showed rust from 25 applications for both sodium hypochlorite and Ablesan AC.

Table 4.10 Effect of six disinfectants on the percentage of chrome hubcap replicates affected by corrosion, colour change, pitting or rust after 0, 25, 50, 100, 150 and 200 applications.

Chemical	**Number of applications**					
	0	**25**	**50**	**100**	**150**	**200**
Corrosion						
Virkon S	0	0	0	20	40	60
Sodium hypochlorite	0	100	100	100	100	100
Terminator	0	0	0	0	0	0
Quat	0	0	0	0	0	100
Ablesan AC	0	0	80	100	100	100
Oxivir	0	0	0	0	0	0
Colour change						
Virkon S	0	0	0	0	0	0
Sodium hypochlorite	0	100	100	100	100	100
Terminator	0	0	0	0	0	0
Quat	0	0	0	0	0	0
Ablesan AC	0	0	0	0	0	0
Oxivir	0	0	0	0	0	0
Pitting						
Virkon S	0	0	0	0	0	0
Sodium hypochlorite	0	80	100	100	100	100
Terminator	0	0	0	0	0	0
Quat	0	0	0	0	0	0
Ablesan AC	0	0	0	100	100	100
Oxivir	0	0	0	0	0	20
Rust						
Virkon S	0	0	0	0	0	0
Sodium hypochlorite	0	80	100	100	100	100
Terminator	0	0	0	0	0	0
Quat	0	0	0	0	0	0
Ablesan AC	0	100	100	100	100	100
Oxivir	0	0	0	0	0	20

There was no impact of Virkon S, sodium hypochlorite, Terminator, Quat, Ablesan AC and Oxivir on the presence of corrosion, colour change and rust on aluminium after 200 applications (Table 4.11).

Virkon S, Quat and Oxivir showed no evidence of pitting on aluminium after 200 applications while sodium hypochlorite was inconsistent. One hundred percent of aluminium components which were sprayed with Terminator showed pitting after 200 applications. The majority of aluminium components sprayed with Oxivir showed evidence of pitting from 100 applications onwards.

Table 4.11 Effect of six disinfectants on the percentage of aluminium crate replicates affected by corrosion, colour change, pitting or rust after 0, 25, 50, 100, 150 and 200 applications.

Chemical	**Number of applications**					
	0	**25**	**50**	**100**	**150**	**200**
Corrosion						
Virkon S	0	0	0	0	0	0
Sodium hypochlorite	0	0	0	0	0	0
Terminator	0	0	0	0	0	0
Quat	0	0	0	0	0	0
Ablesan AC	0	0	0	0	0	0
Oxivir	0	0	0	0	0	0
Colour change						
Virkon S	0	0	0	0	0	0
Sodium hypochlorite	0	0	0	0	0	0
Terminator	0	0	0	0	0	0
Quat	0	0	0	0	0	0
Ablesan AC	0	0	0	0	0	0
Oxivir	0	0	0	0	0	0
Pitting						
Virkon S	0	0	0	0	0	0
Sodium hypochlorite	0	20	0	0	0	20
Terminator	0	0	0	0	0	100
Quat	0	0	0	0	0	0
Ablesan AC	0	0	0	0	20	20
Oxivir	0	0	0	80	100	100
Rust						
Virkon S	0	0	0	0	0	0
Sodium hypochlorite	0	0	0	0	0	0
Terminator	0	0	0	0	0	0
Quat	0	0	0	0	0	0
Ablesan AC	0	0	0	0	0	0
Oxivir	0	0	0	0	0	0

A number of steel crate replicates had some degree of corrosion or colour change at the commencement of the project (Table 4.12). By application 25 the majority of those disinfected with sodium hypochlorite, Terminator, Quat and Ablesan AC showed some degree of corrosion and colour change. Oxivir showed no signs of corrosion from application 50 onwards.

Rust was present on all of the steel crate replicates sprayed with sodium hypochlorite from 100 applications onwards. There were minimal signs of pitting or rust for all other disinfectants.

Table 4.12 Effect of six disinfectants on the percentage of steel crate replicates affected by corrosion, colour change, pitting or rust after 0, 25, 50, 100, 150 and 200 applications.

Chemical	**Number of applications**					
	0	**25**	**50**	**100**	**150**	**200**
Corrosion						
Virkon S	0	80	20	0	0	20
Sodium hypochlorite	20	100	100	100	100	100
Terminator	20	100	100	100	100	100
Quat	40	100	100	100	100	100
Ablesan AC	60	100	100	100	100	100
Oxivir	60	20	0	0	0	0
Colour change						
Virkon S	60	100	100	100	100	100
Sodium hypochlorite	20	100	100	100	100	100
Terminator	40	100	100	100	100	100
Quat	40	100	100	100	100	100
Ablesan AC	60	100	100	100	100	100
Oxivir	60	80	80	100	100	100
Pitting						
Virkon S	0	0	0	0	0	0
Sodium hypochlorite	0	100	100	0	0	0
Terminator	0	0	0	0	0	20
Quat	0	0	0	0	0	0
Ablesan AC	0	0	0	0	0	0
Oxivir	0	0	0	0	0	0
Rust						
Virkon S	0	0	0	0	0	0
Sodium hypochlorite	0	0	0	100	100	100
Terminator	0	0	0	0	0	0
Quat	20	20	0	20	20	20
Ablesan AC	0	0	0	0	20	0
Oxivir	0	0	0	0	0	0

4.3.4 Weight change

There was a significant interaction between disinfectant and the number of applications for the change in the weight of rubber strips ($P<0.001$). Rubber strips increased in weight as the number of applications of disinfectant increased (Table 4.13) with those sprayed with Oxivir gaining more weight over time (4.78% at application 200 compared to application 0) and AbleSan gaining the least weight (0.69% at application 200 compared to application 0).

Table 4.13 Effect of six disinfectants on the percentage weight change of rubber strips compared to the initial weight and 25, 50, 100, 150 and 200 applications.

Disinfectant	**0-25**	**0-50**	**0-100**	**0-150**	**0-200**
Virkon S	0.71	1.81	2.63	3.84	3.84
Sodium hypochlorite	0.97	1.24	1.38	2.23	3.18
Terminator	0.24	2.64	1.17	1.21	2.18
Quat	0.25	0.99	0.94	1.00	1.98
Ablesan AC	0.89	0.69	0.88	0.46	0.69
Oxivir	0.99	1.91	3.02	3.17	4.78
SED[1] ($A^2 \times D^3$)			0.661		
P-value Application			<0.001		
P-value Disinfectant			0.005		

P-value (AxD)	<0.001

[1]Standard error of difference of mean; [2]Application; [3]Disinfectant

There was a significant interaction between disinfectant and the number of applications for the change in the weight of the chrome hubcaps (P<0.001). The chrome hubcaps increased in weight as the number of applications of disinfectant increased (Table 4.14) with those sprayed with Oxivir gaining more weight over time (1.37% at application 200 compared to application 0) and AbleSan gaining the least weight (0.21% at application 200 compared to application 0).

Table 4.14 Effect of six disinfectants on the weight change of chrome hubcaps compared to the initial weight and 25, 50, 100, 150 and 200 applications.

Disinfectant	0-25	0-50	0-100	0-150	0-200
Virkon S	0.18	0.49	0.73	1.04	1.04
Sodium hypochlorite	0.49	0.52	0.65	0.91	1.24
Terminator	0.14	0.79	0.39	0.41	0.65
Quat	0.23	0.51	0.51	0.51	0.75
Ablesan AC	0.20	0.16	0.23	0.12	0.21
Oxivir	0.35	0.55	0.88	0.91	1.37
SED[1] (A[2] x D[3])			0.340		
P-value Application			<0.001		
P-value Disinfectant			0.326		
P-value (AxD)			<0.001		

[1]Standard error of difference of mean; [2]Application; [3]Disinfectant

There was a significant interaction between disinfectant and the number of applications for the change in the weight of the aluminium crate parts (P=0.006). The aluminium crate parts increased in weight as the number of applications of disinfectant increased (Table 4.15) with those sprayed with sodium hypochlorite gaining more weight over time (0.54% at application 200 compared to application 0) and AbleSan, Virkon S, Quat and Oxivir gaining the least weight (-0.03 to 0.081% at application 200 compared to application 0).

Table 4.15 Effect of six disinfectants on the weight change of aluminium crate components compared to the initial weight and 25, 50, 100, 150 and 200 applications.

Disinfectant	0-25	0-50	0-100	0-150	0-200
Virkon S	0.02	0.04	0.10	0.06	0.07
Sodium hypochlorite	0.71	0.62	0.63	0.57	0.54
Terminator	0.29	0.28	0.27	0.25	0.23
Quat	0.04	0.10	0.13	0.11	0.03
Ablesan AC	-0.04	-0.03	0.02	-0.01	-0.03
Oxivir	0.18	0.04	0.12	0.05	0.08
SED[1] (A[2] x D[3])			0.284		
P-value Application			0.005		
P-value Disinfectant			0.280		
P-value (AxD)			0.006		

[1]Standard error of difference of mean; [2]Application; [3]Disinfectant

There was a significant interaction between disinfectant and the number of applications for the change in the weight of the steel crate parts (<0.001). The steel crate parts increased in weight as the number of applications of disinfectant increased (Table 4.16) with those sprayed with sodium hypochlorite and quat gaining more weight over time (1.00 and 0.92% respectively at application 200 compared to application 0) and Virkon S and Ablesan AC gaining the least weight (0.06 and 0.09%, respectively at application 200 compared to application 0).

Table 4.16 Effect of six disinfectants on the weight change of steel crate components compared to the initial weight and 25, 50, 100, 150 and 200 applications.

Disinfectant	0-25	0-50	0-100	0-150	0-200
Virkon S	0.008	0.03	0.04	0.08	0.06
Sodium hypochlorite	-0.01	0.18	0.48	0.72	1.00
Terminator	0.05	0.10	0.04	0.17	0.20
Quat	0.66	0.78	0.78	0.88	0.92
Ablesan AC	-0.04	-0.02	0.02	0.02	0.09
Oxivir	0.20	0.22	0.26	0.30	0.35
SED[1] (A[2] x D[3])			0.466		
P-value Application			<0.001		
P-value Disinfectant			0.516		
P-value (AxD)			<0.001		

[1]Standard error of difference of mean; [2]Application; [3]Disinfectant

4.3.5 Optical surface recognition

An assessment of corrosion was undertaken using an optical surface recognition digital app. The results for steel are not presented because while the digital app was effective at identifying the presence of corrosion when there was a small amount present, when there was significant colour change and/or corrosion as occurred with the steel components in this project, it was unable to detect the presence of corrosion.

There was a significant interaction between disinfectant and the number of applications for corrosion score obtained using optical surface recognition of chrome hubcaps ($P<0.001$, Table 4.17). The corrosion score of sodium hypochlorite and Ablesan AC increased over time while Virkon S, Terminator, Quat and Oxivir were not affected.

Table 4.17 Effect of six disinfectants on the optical surface recognition score of chrome hubcaps at 0, 25, 50, 100, 150 and 200 applications.

Disinfectant	0	25	50	100	150	200
Virkon S	0	0	0	1.8	5.4	4.4
Sodium hypochlorite	0	0.2	59	14.4	14.6	35.4
Terminator	0	0	0	0	0	0
Quat	0	0	0	0	0	3.6
Ablesan AC	0	0	26.1	25.6	1.6	79.2
Oxivir	0	0	0	0	0	0
SED[1] (A[2] x D[3])			6.35			
P-value A			<0.001			
P-value D			<0.001			
P-value (AxD)			<0.001			

[1]Standard error of difference of mean; [2]Application; [3]Disinfectant

There was a significant interaction between disinfectant and the number of applications for corrosion score obtained using optical surface recognition of chrome hubcaps ($P=0.033$, Table 4.18). The corrosion score of sodium hypochlorite and Ablesan AC increased over time while Virkon S, Terminator, Quat and Oxivir were not affected. Although there was an interaction between disinfectant and number of applications the corrosion score overall was very low.

Table 4.18 Effect of six disinfectants on the optical surface recognition score of aluminium crate components at 0, 25, 50, 100, 150 and 200 applications.

Disinfectant	**0**	**25**	**50**	**100**	**150**	**200**
Virkon S	0.4	0	0.8	0	0	0
Sodium hypochlorite	0	0.8	0	0	0.2	0.2
Terminator	0	0	0.4	0	0	0
Quat	0	0.4	0	0.4	0	0
Ablesan AC	0	0.4	0.2	0.4	0.2	2
Oxivir	0	0	0.2	0	0.2	0
SED[1] (A[2] x D[3])			0.383			
P-value A			0.204			
P-value D			0.076			
P-value (AxD)			0.033			

[1]Standard error of difference of mean; [2]Application; [3]Disinfectant

5. Discussion

An objective of the project was to understand the concerns of livestock transporters regarding the routine use of chemicals on trucks/trailers. To achieve this a survey of the livestock transporters in Western Australia in the pig, sheep and cattle industry (those delivering to Linley Valley Pork, Dardanup Butchering Company, V&V Walsh and distributed by the Livestock and Rural Transport Association of WA) and Queensland (major SunPork Group transporters) was undertaken. Twenty-four responses were received to the survey. The survey was anonymous but it is assumed that the responses were a representative sample of all the livestock transporters. The main areas of concern were related to corrosion, fading and wear on livestock transport vehicles. The areas thought to be most susceptible to damage were steel (for example, the truck bed and frame) followed by chrome and painted surfaces.

To evaluate the impact of APVMA approved decontamination chemicals on the integrity, durability and appearance of the surfaces of livestock transport vehicles a desktop review was undertaken. The review assessed APVMA approved decontamination chemicals for their potential effects on livestock transport trucks and trailers. This project also aimed to identify alternative decontamination chemicals that are not currently APVMA approved but that contain appropriate active constituents, and to evaluate their potential impacts on vehicle surfaces. Following the desktop review three APVMA approved decontamination chemicals (Virkon S, Terminator and sodium hypochlorite) and three alternative decontamination chemicals (Quat, AbleSan AC 256 and Oxivir) were selected for further evaluation.

The project assessed the effects of the six identified decontamination chemicals (disinfectants) on the integrity, durability and appearance of vehicle surfaces that had been identified as surfaces with the most concern from the survey. Based on the visual appearance, visual assessments, and physical assessments following 200 applications of disinfectants it is considered that all six disinfectants were suitable for use on rubber seals as there was no visual deterioration or physical changes. There was an increase in weight over time indicating that perhaps the rubber seals were absorbing the disinfectants, but this could be more of an artefact of the design of the project rather than an indicator of material degradation.

Virkon S, Terminator, Quat and Oxivir had minimal impacts on chrome surfaces after 200 applications based on the visual appearance, visual and physical assessment and the corrosion score. In comparison, sodium hypochlorite and Ablesan AC caused visible surface damage and corrosion after 50 and 25 applications respectively. These products should therefore be used with caution on chrome components. If their use is necessary, rinsing the surface after the required contact time is recommended to minimise the risk of damage.

Minimum visual and physical changes and low corrosion scores were observed for aluminium components treated with Terminator and Quat. Virkon S, sodium hypochlorite and Ablesan AC caused some visible changes and/or deterioration, particularly in areas where disinfectants pooled on the surface. If these disinfectants are used then consideration should be given to rinsing after the required contact time to minimise any potential adverse effects.

All of the disinfectants caused some degree of visual and physical impact on the steel surfaces. However, Virkon S, Terminator, Quat and Oxivir resulted in less impact than sodium hypochlorite and Ablesan AC. If sodium hypochlorite and Ablesan AC are used then it is suggested that the crate should be rinsed following the required contact time. It should also be noted that some of the test replicates showed existing signs of corrosion and the early signs of degradation before the project commenced which may have influenced the results. It is assumed that there would be range of conditions of crates and truck trays across the livestock industry and the existing condition of vehicle surfaces should be considered when selecting a disinfectant.

The project evaluated repeated applications of disinfectants with no intermediate washing or rinsing. Under normal operating conditions, livestock transport vehicles would typically be washed between loads and prior to subsequent disinfection. Consequently, the impacts observed in this project may represent a worst-case scenario. The interval between disinfection and vehicle use may also determine whether rinsing is required to prevent material degradation.

Other potential considerations of disinfectant application that may be considered include:

1. The disinfectants in this project were applied using a low-pressure sprayer. In practice, some disinfectants may be applied as a foam or fog. The method of application is not expected to affect the impact of the disinfectants on the materials assessed. However, application via foam may possibly reduce the likelihood of disinfectants pooling.
2. Maintaining the required surface contact time is necessary to ensure disinfectant efficacy. In the project, it was observed that when disinfectants were applied to warm surfaces they sometimes could dry before the specified contact time elapsed, requiring reapplication to keep the surface wet for the full contact time. This may be particularly relevant during warmer weather conditions. Therefore, consideration may need to be given to the method of application and environmental conditions (for example do foam applications remain on surfaces longer than sprayed solutions potentially increasing the wet contact time). Appropriate training and guidance should also be provided to ensure users are aware that the surface needs to remain wet for the entire contact period to achieve effective disinfection.

The final objective of the project was to provide evidence to support registration requests for APVMA approval of additional decontamination chemicals for use on livestock transport vehicles. Based on the results Quat and Oxivir were identified as the two most suitable disinfectants for consideration. Quat is currently approved for use in a food producing abattoir while Oxivir is used in hospital and veterinary settings. Although Oxivir is relatively expensive compared to the other disinfectants evaluated it demonstrated good compatibility for all materials. Neither of these products adversely affected rubber seals, had measurable impacts on chrome hubcap texture, colour or structural integrity, or resulted in visual deterioration of aluminium. Both products also had relatively limited effects on steel compared with other disinfectants assessed.

6. Implications & Recommendations

The recommendations are:

1. AVPMA approved decontamination chemicals
    a. Virkon S (active ingredients - 494 g/kg potassium peroxomonosulfate triple salt, 132 g/kg sodium dodecyl benzene sulfonate, 15 g/kg sodium chloride) – showed generally good material compatibility and may be suitable for routine disinfection use. However, it should be noted that visual impacts were observed on aluminium surfaces where the disinfectant pooled.
    b. Sodium hypochlorite 12.5% (active ingredient – sodium hypochlorite) – showed the greatest potential for material degradation with the materials tested and should be avoided for frequent routine disinfection where alternative products are available. If it is used then consideration should be given to rinsing after the required contact time to minimise any potential adverse effects.
    c. Terminator (active ingredients - 150 g/L glutaraldehyde, 100 g/L quaternary ammonium) – showed good material compatibility and is recommended for routine use on transport vehicles.
2. Non AVPMA approved decontamination chemicals
    a. Quat (active ingredients - 20-40% quat mixture - quaternary ammonium compound, benzalkonium chloride - Benzalkonium chloride (20-40%)) demonstrated strong overall compatibility across the materials tested and is recommended for routine use on transport vehicles.
    b. Ablesan AC 256 (active ingredients - <8% w/w stabilised hydrogen peroxide, <1% benzalkonium chloride) – not recommended for routine use as showed visual deterioration particularly on chrome and aluminium surfaces.
    c. Oxivir Five 16 (active ingredient - accelerated hydrogen peroxide) demonstrated strong overall compatibility across the materials tested and is recommended for routine use on transport vehicles.
3. Quat (or equivalent) and Oxivir Five 16 (or equivalent) are recommended for technical work to progress request for registration for APVMA approval as additional decontamination chemicals for use on livestock transport vehicles against ASF and/or FMD..
4. Particular attention should be given to areas where disinfectants are likely to accumulate and not quickly dry (after contact time requirements have been met). Aluminium and steel may be adversely affected by some disinfectants (for example Virkon S) if disinfectant remains pooled over an extended time.

7. Intellectual Property

No intellectual property was developed in this project.

8. Publications Arising

No publications arising to date.

9. References

Beato MS, D'Errico F, Iscaro C, Petrini S, Giammarioli M, and Feliziani F, 2022. Disinfectants against African Swine Fever: An Updated Review. Viruses, 14, 1384. https://doi.org/10.3390/v14071384.

Frost L, Tully M, Dixon L, Hicks HM, Bennett J, Stokes I, Marsella L, Gubbins S and Batten C, 2023. Evaluation of the efficacy of commercial disinfectants against African Swine Fever Virus. Pathogens, 12, 855. https://doi.org/10.3390/pathogens12070855.

Hole K, Ahmadpour F, Krishnan J, Stansfield C, Copps J and Nfon C, 2017. Efficacy of accelerated hydrogen peroxide disinfectant on foot-and-mouth disease virus, swine vesicular disease virus and Senecavirus A. Journal of Applied Microbiology 122 (3), 634-639.

Kumin D, Albert MG and Summermatter K, 2018. Comparison and validation of three fumigation methods to inactivate foot-and-mouth disease virus. Applied Biosafety: Journal of ABSA International 23(2), 70-76.

Ramirez JA, 2021. A new weapon for decontamination of surfaces and premises from African swine fever virus: accelerated hydrogen peroxide. 52nd Annual Meeting of the American Association of Swine Veterinarians (February 27 – March 2, 2021), 179-183.

10. Appendix A

Table A1 Effect of six disinfectants on the visual appearance of rubber after 0, 25, 50, 100, 150 and 200 applications.

0 applications	25 applications	50 applications	100 applications	150 applications	200 applications
Virkon S					
					
Sodium hydrochloride					
					
Terminator					

Quat

AbleSan AC

Oxivir Five

Table A2 Effect of six disinfectants on the visual appearance of chrome hub caps after 0, 25, 50, 100, 150 and 200 applications.

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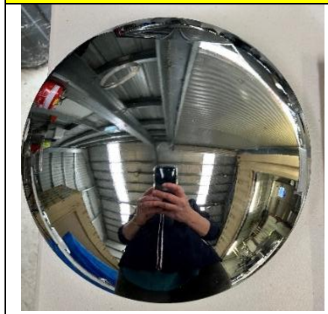
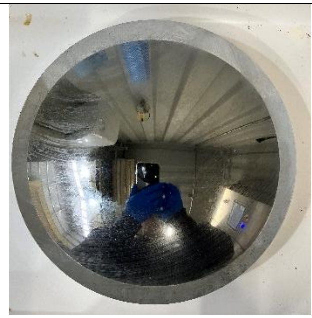
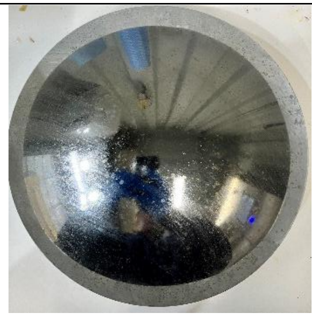
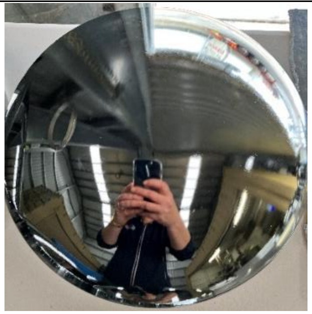
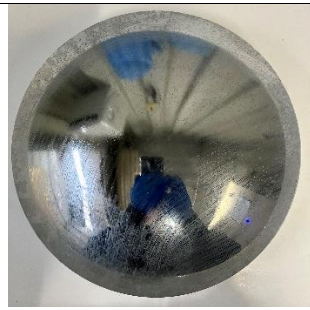
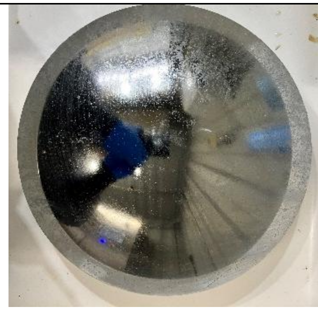
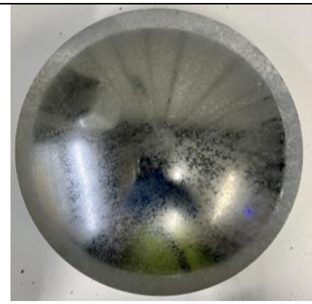
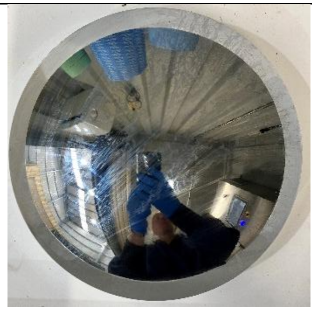
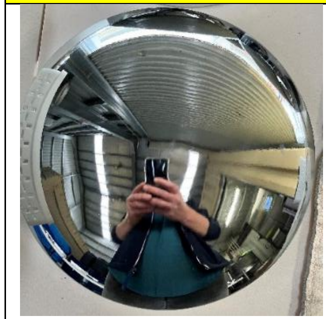
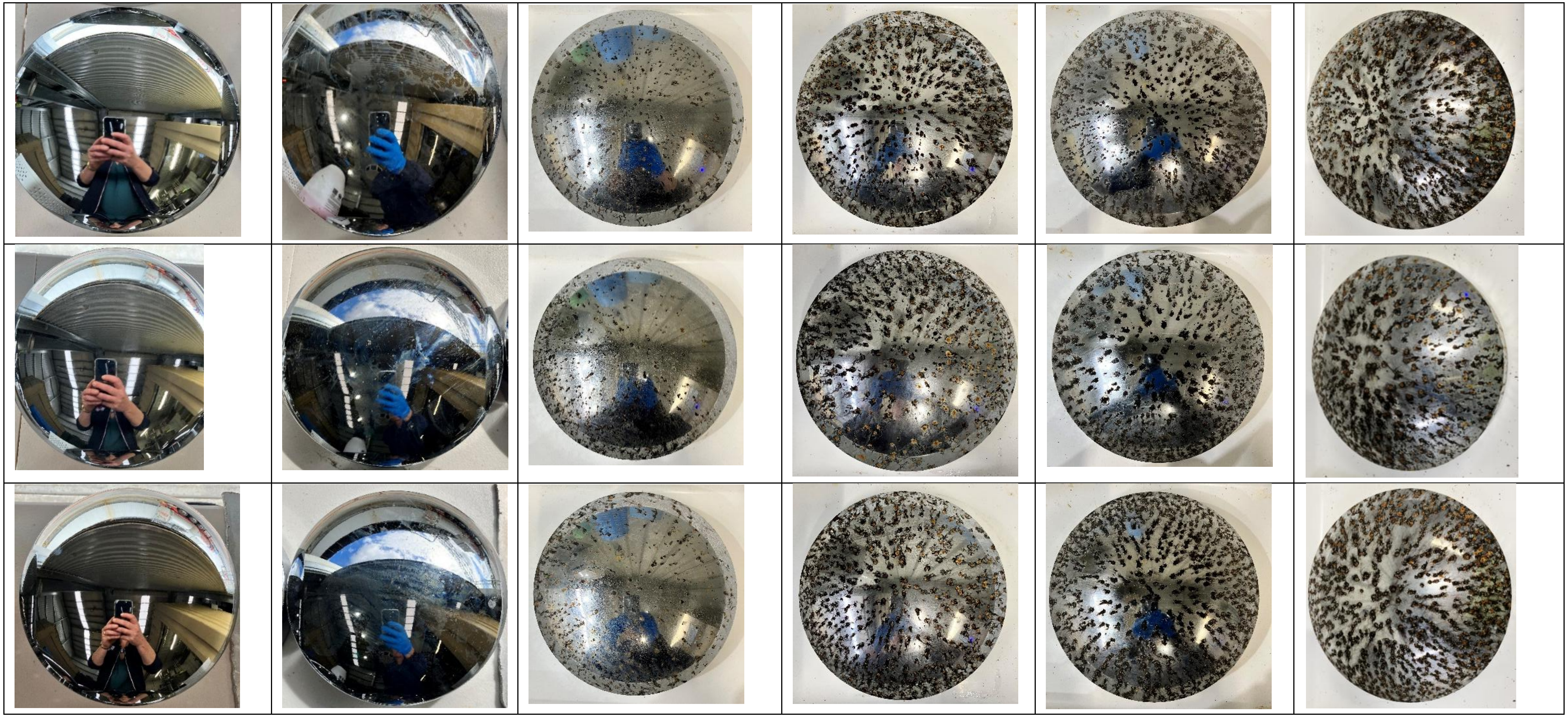
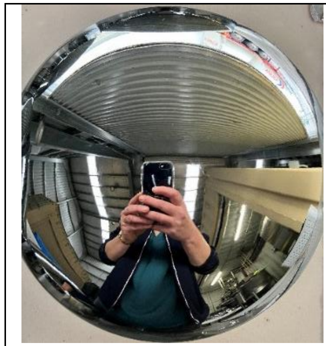
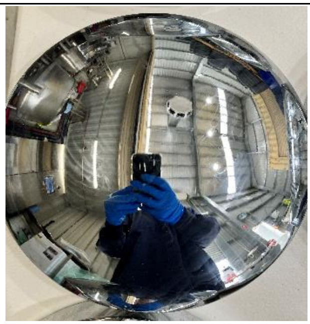
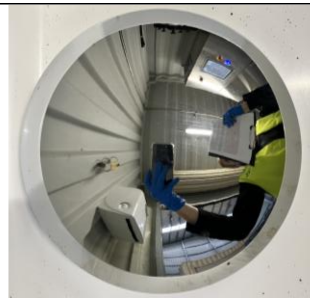
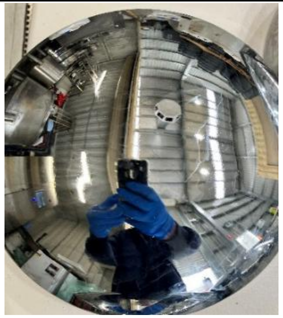
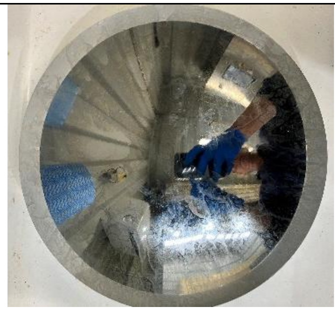
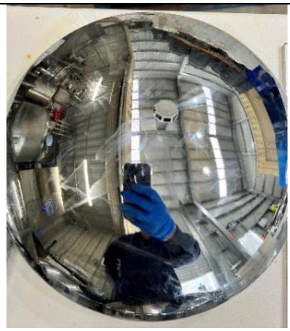
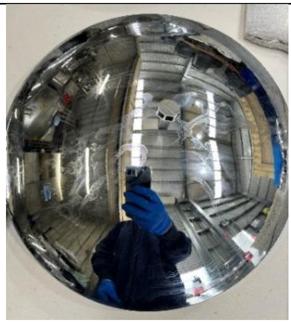
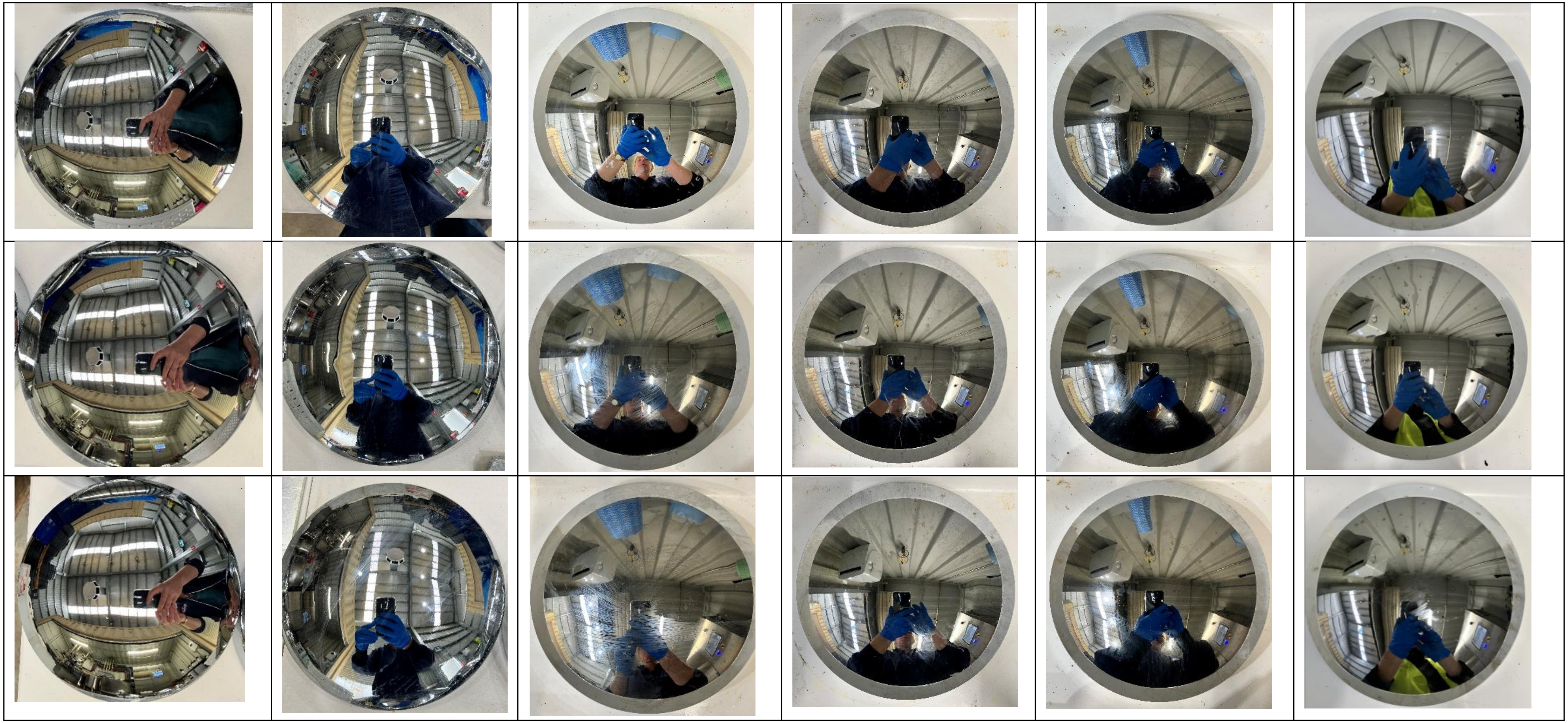
					
					
					

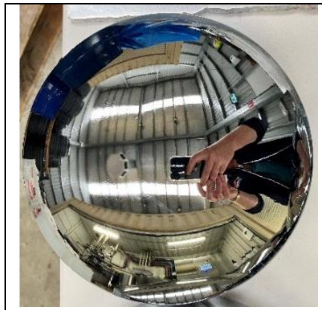
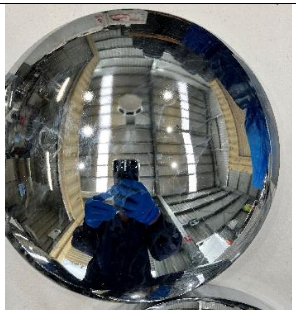
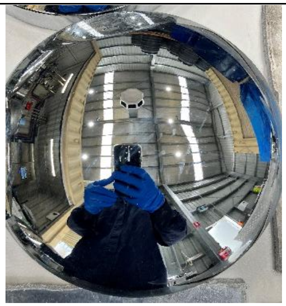
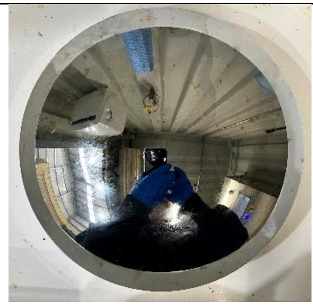
					
					
Sodium hypochlorite					
					



					
Terminator					
					
					

					
					
					
Quat					

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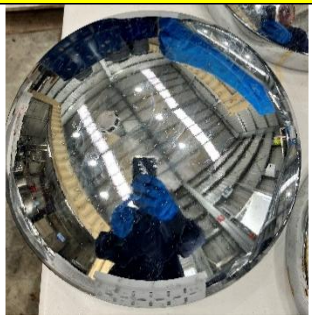
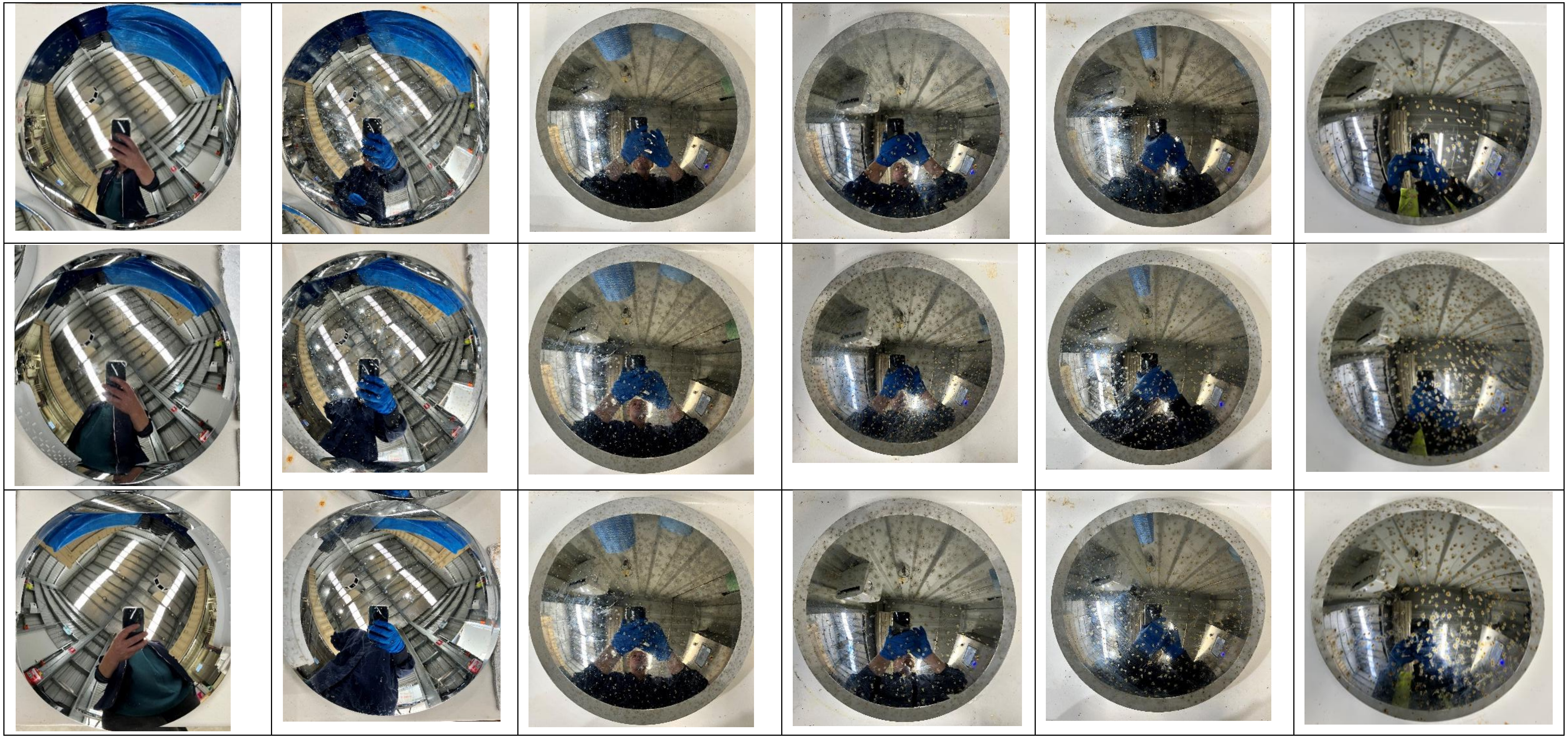
					



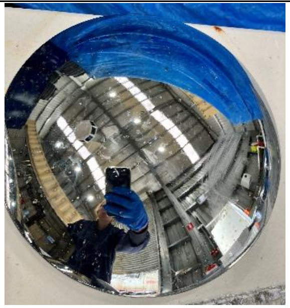
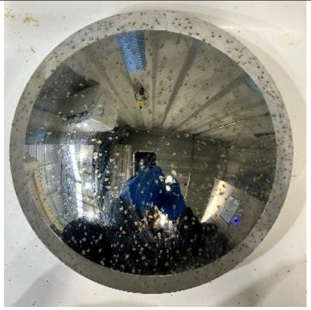
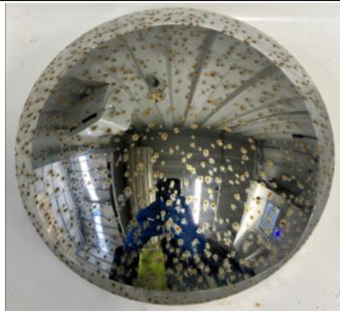
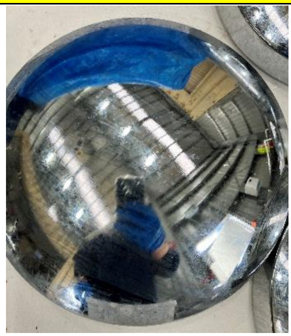
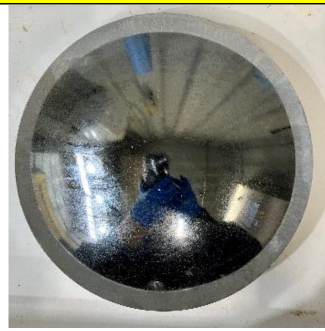
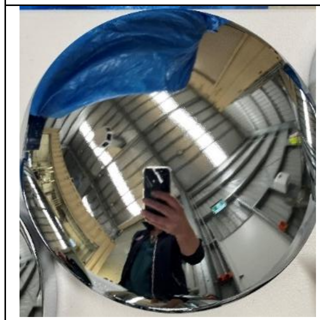
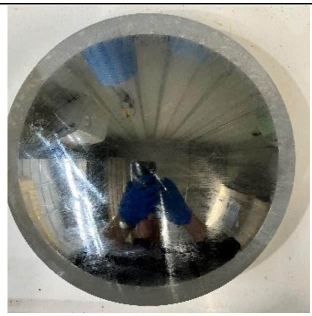
					
Oxivir Five					
					
					

Table A3 Effect of six disinfectants on the visual appearance of aluminium crate components after 0, 25, 50, 100, 150 and 200 applications.

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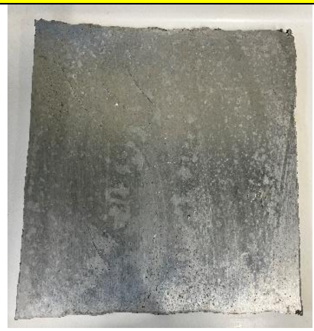
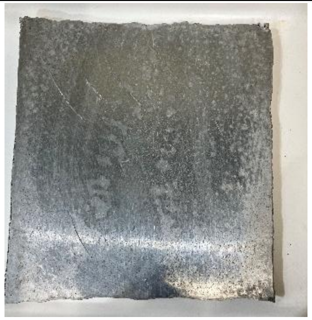
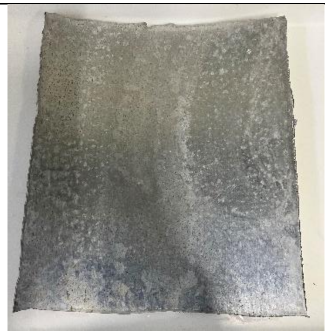
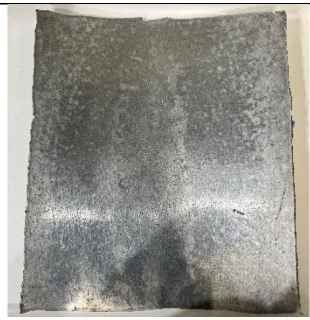
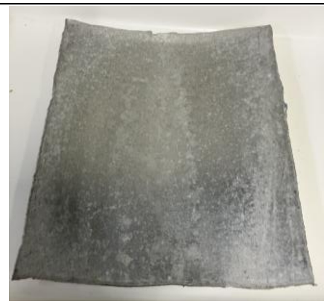
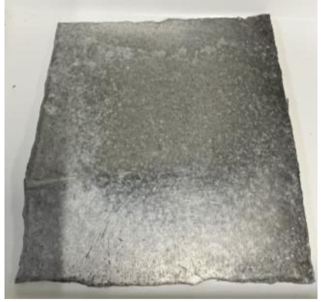
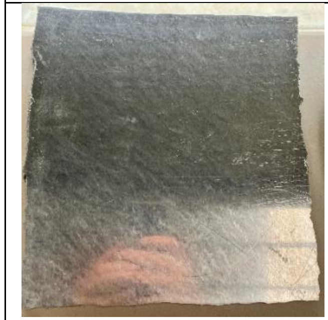
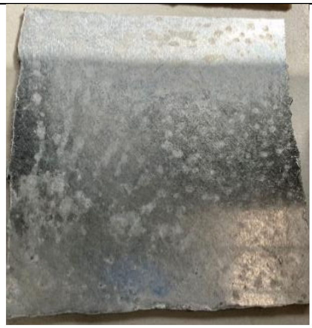
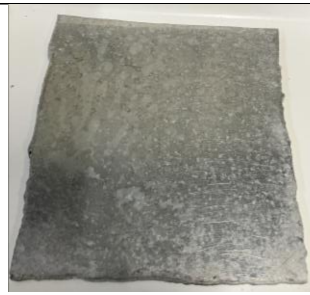
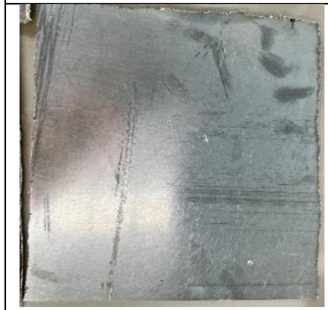
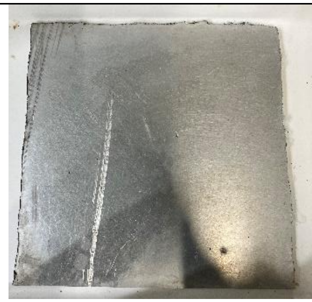
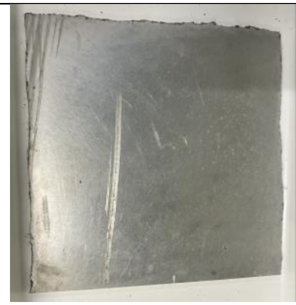
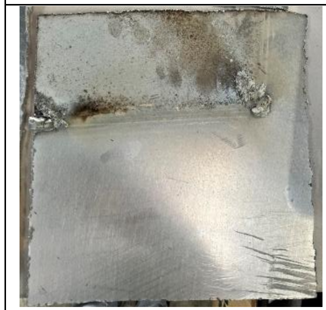
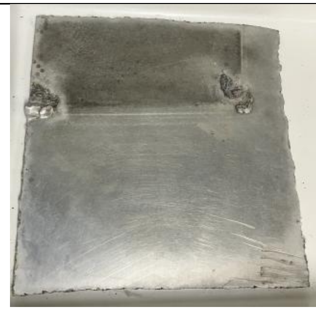
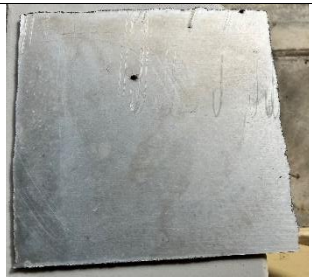
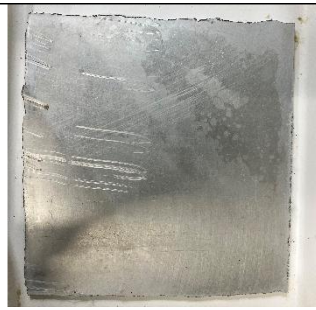
					
					
					

					
					
Sodium hypochlorite					
					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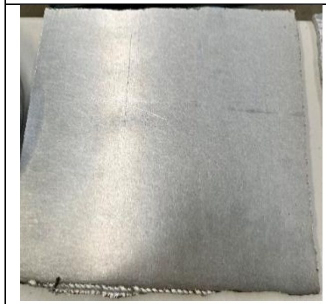		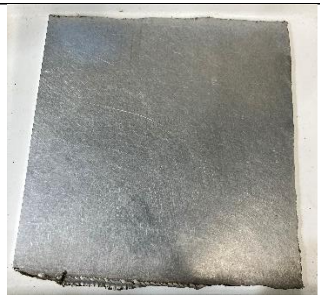	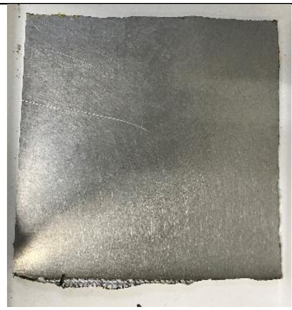	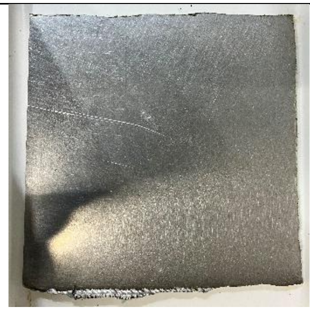	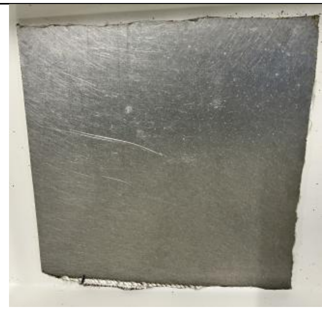

	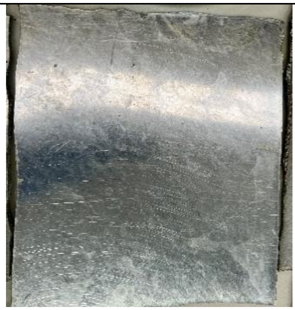				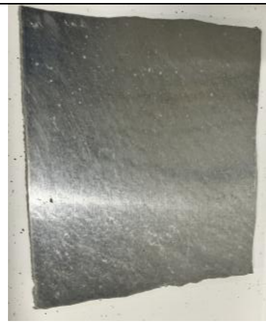
					
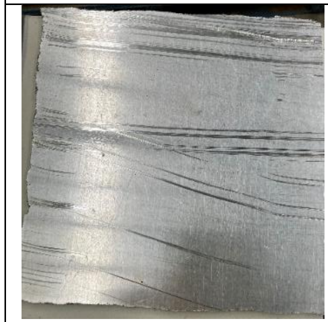	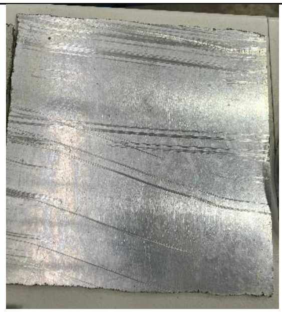	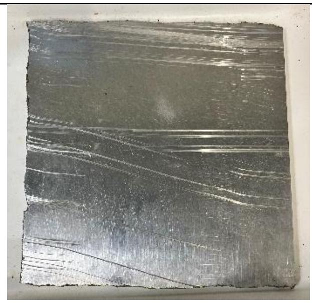	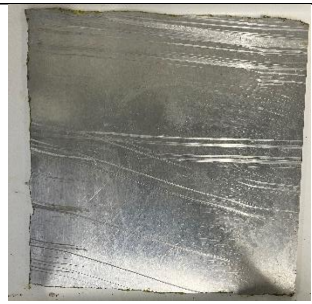	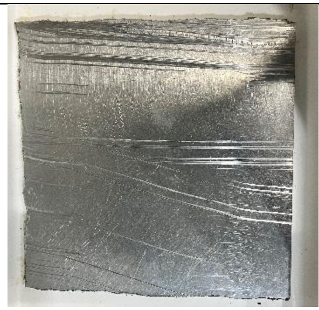	
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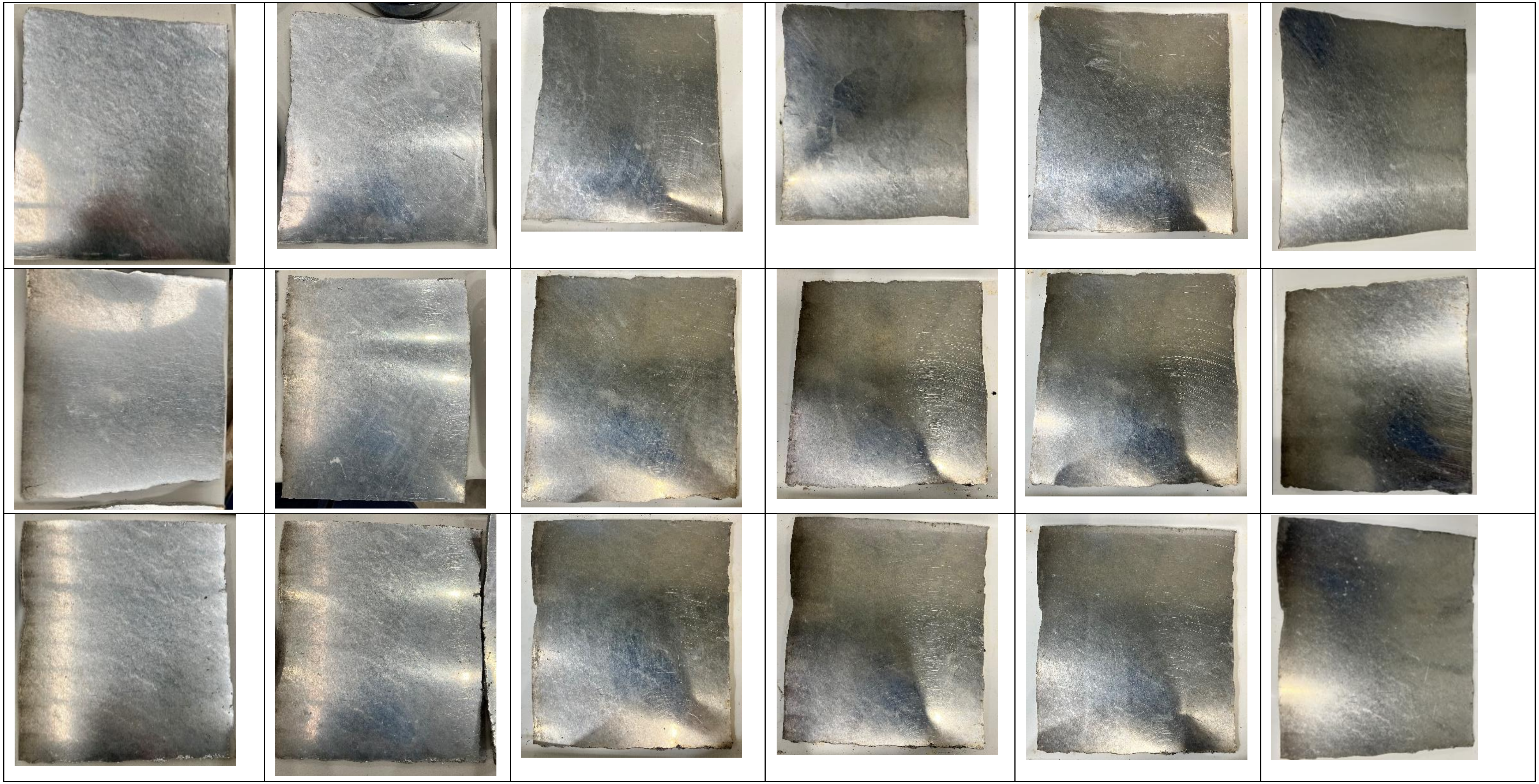

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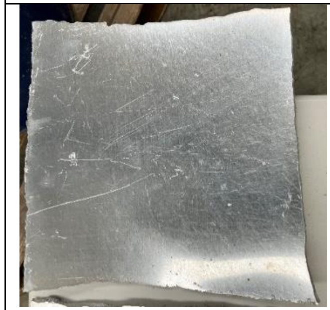
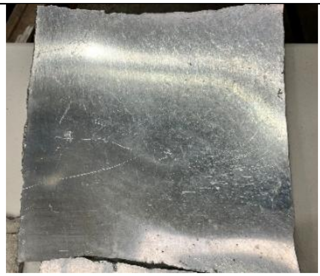
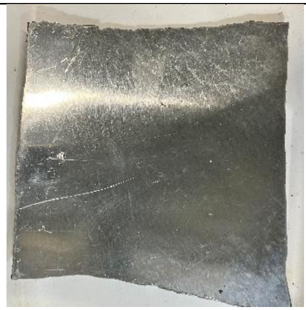
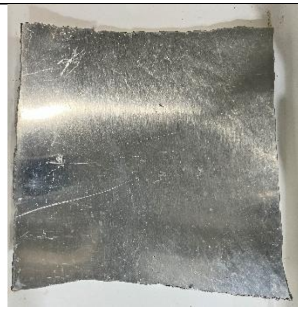
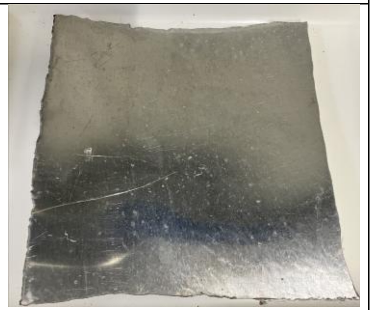
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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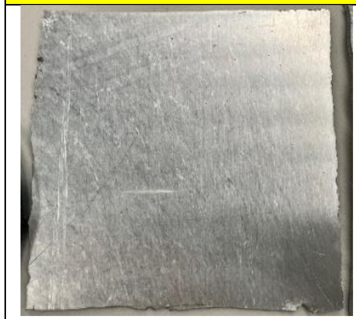
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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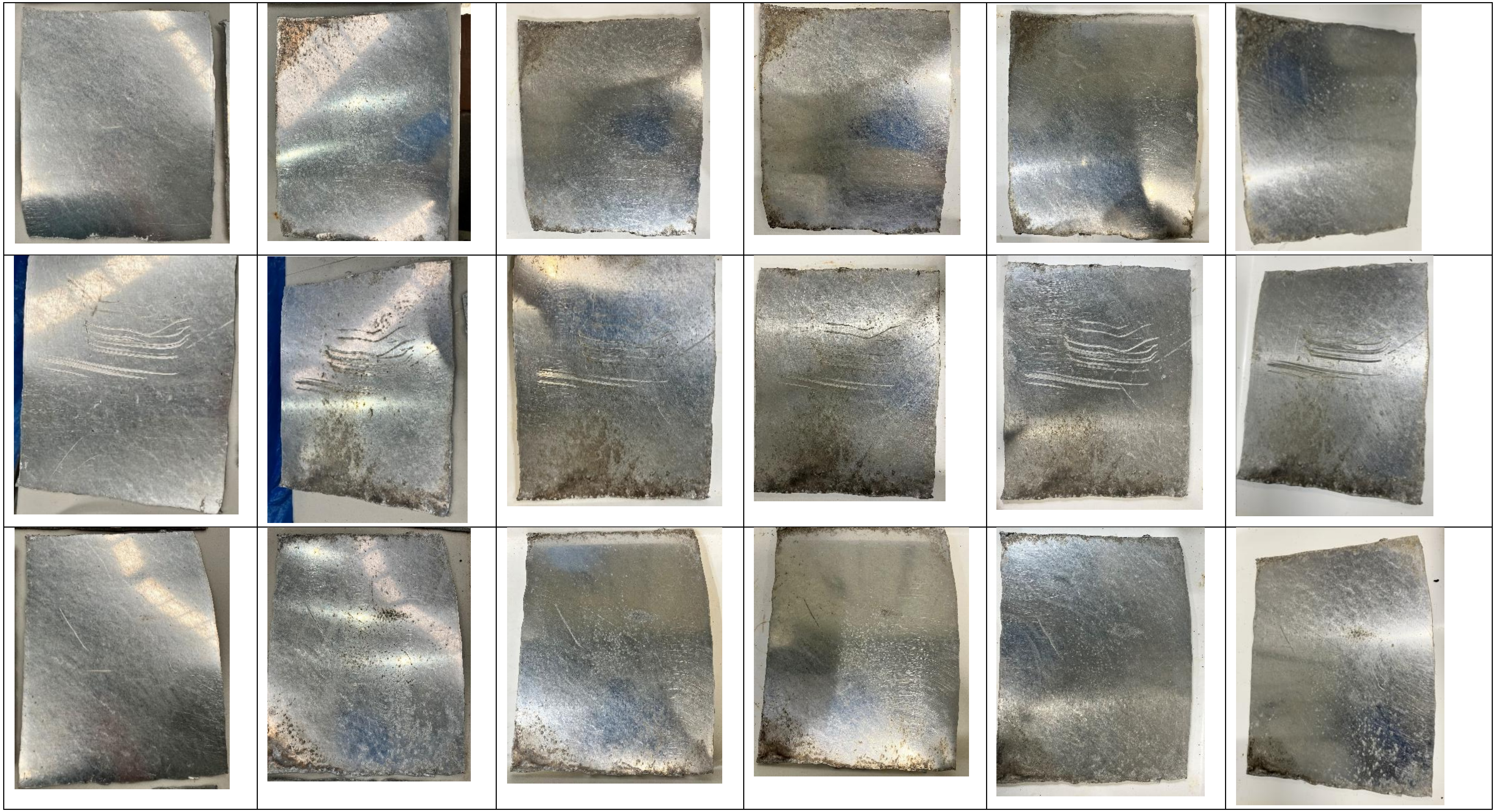
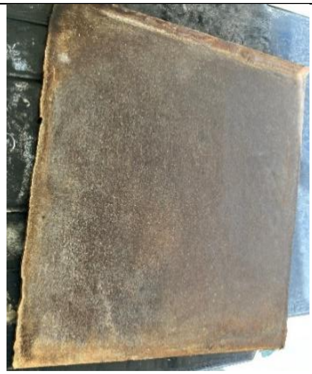


					
Oxivir Five					
					
					

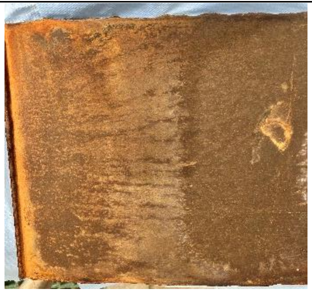
Table A4 Effect of six disinfectants on the visual appearance of steel crate components after 0, 25, 50, 100, 150 and 200 applications.

0 applications	**25 applications**	**50 applications**	**100 applications**	**150 applications**	**200 applications**
Virkon S					
					
					
					

					
					
Sodium hypochlorite					
					

					
Terminator					
					
					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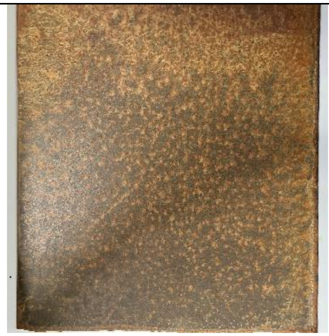
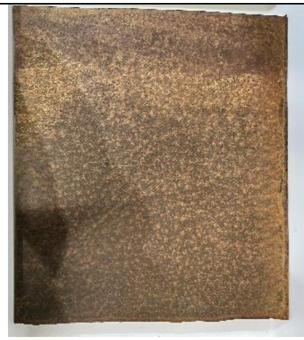
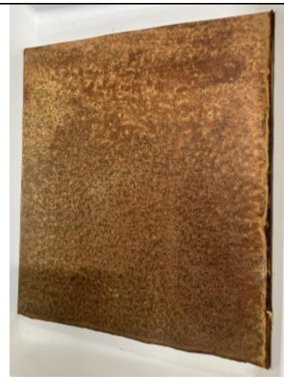
Ablesan AC					
					

					
Oxivir Five