HALEWOOD

PAINT OPERATIONS

IPPC REPORT 2024

Permit Number A2/0703/6.4/1

Contents

Introduction

This report has been prepared to provide information in accordance with the Paint Operations IPPC Permit -

The Permit to operate a Part 'A2' installation has been issued by Knowsley Metropolitan Borough Council, under the Pollution Prevention & Control Act 1999 and the Environmental Permitting (England & Wales) Regulations 2010.

Permit Number is A2/0703/6.4/1

Address of the installation is –

Jaguar Land Rover Limited
Halewood Operations
Liverpool
L24 9BJ

Enquiries relating to this report should be sent to the above address and marked for the attention of:

[redacted],
Site Services Manager,

Report issued – February 2024.

Executive Summary

In 2024, Jaguar Land Rover Limited achieved ISO 14001:2015 certification, continuing their commitment to environmental management systems aimed at minimizing waste, energy consumption, and environmental risks. The Halewood site produced two models: Discovery Sport and Range Rover Evoque.

Throughout the year, Jaguar Land Rover slightly increased build schedules at Halewood compared to the previous year. Extensive works were carried out to prepare for the transition to all-electric vehicle production, set to begin in 2025.

Here are the major changes to the Paint Shop facility completed in 2024:

- **Pre-Treatment Heating System Replacement**: A new system was installed to eliminate reliance on the plant boiler house for high-pressure hot water (HPHW). Completed in summer 2024, this reduced gas usage for the main boiler house by 37%.
- **Pre-Treatment Dip Tank Partitioning**: The second 275 m³ pre-treatment dip tank was partitioned to 172 m³, reducing heating energy, water, and raw material usage.
- **Zone 3 & 6 Pump Replacement**: Pumps in these zones were upgraded to IE5 motors for increased efficiency.
- **New Enamel Incinerator**: A new incinerator was installed to replace the obsolete unit, which had become difficult to maintain due to discontinued components.

These changes reflect Jaguar Land Rover's ongoing efforts to enhance efficiency and sustainability in their manufacturing processes.

The Paint Shop participate in Halewood’s Carbon Management Plan. The aim is to deliver a 30% reduction in process energy use, which will contribute to a plant level net zero carbon status by 2030.

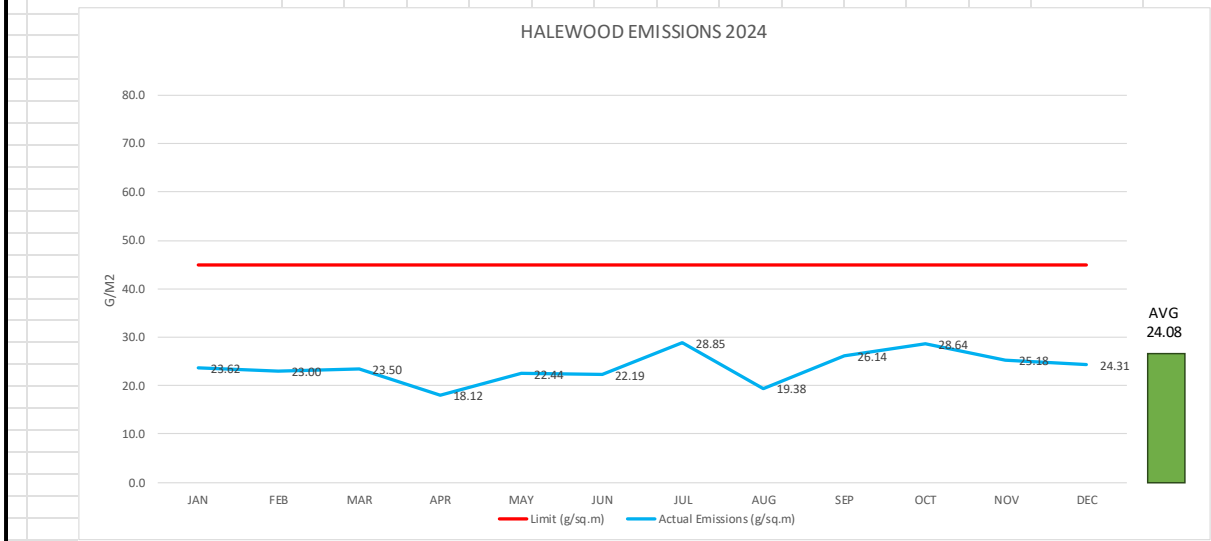
1. Mass Balance (VOC Emissions)

The table below shows the monthly Mass Balance performance for January to December 2024, based on the total area painted and solvent used.

Table 1 – Mass Balance Summary

HALEWOOD PAINT OPERATIONS - MASS BALANCE RESULTS 2024

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	**Total**
Total Units	5004	6663	5032	4311	6034	4567	4413	3741	7710	7383	2909	1963	59730
Total Area (m2)	553515	738057	558341	476568	665670	503326	486906	413543	861300	812435	322419	218895	6610975
Actual Emissions (Kg)	13072	16977	13121	8634	14941	11171	14045	8015	22510	23265	8118	5320	159190
Actual Emissions (g/sq.m)	23.62	23.00	23.50	18.12	22.44	22.19	28.85	19.38	26.14	28.64	25.18	24.31	24.08
Limit (g/sq.m)	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45
Percentage of emission limit used	**52.48%**	**51.12%**	**52.22%**	**40.26%**	**49.88%**	**52.48%**	**52.48%**	**52.48%**	**52.48%**	**52.48%**	**52.48%**	**52.48%**	



Notes –
Total Units – The number of vehicles produced in the month.
Total Area – The total surface area painted in the month in square metres.
Actual Emissions 1 – The total solvent emission in the month (VOCs).
Actual Emissions 2 – Actual emissions 1 divided by the total area.
Limit – Emission limit.

In 2024, the limit of 45 g/m^2 was applied, and the average annual total emission of VOCs was 24.08g/m^2, a slight decrease on the 26.11g/m^2 achieved in 2023. The decrease was due to an increase in build schedules at Halewood.

Total solvents used 184356 kg
Total reclaimed solvent 106521 kg
Removed from site for waste to energy 10377 kg

2. Continuous Monitoring (Air Emissions)

2.1 Introductory Notes

Emissions from the Thermal Oxidisers are continuously monitored for carbon monoxide and temperature. An average reading is recorded every 15 minutes. If the carbon

monoxide reading exceeds the specified limits, an alarm is triggered, and an alarm sheet is generated. Additionally, a 24-hour average of all the 15-minute readings is calculated, which must also remain below the specified limit. For more details on the alarms, refer to Tables 2 and 2a.

JLR Halewood paint team have enlisted the services of SLR consultants to assist in the creation of a solvent management plan for paint shop. All of the work to effectively manage solvent use on site is already being done and covered by processes and procedures owned by the paint shop department. The solvent management plan will bring all this work together and consolidate it in one place. This will be completed before the end of January 2026.

CO Concentration Limits

- 15-minute average 200mg/m^3
- 24-hour (daily mean) 100mg/m^3

2.2 Summary of Continuous Monitoring Alarms

Table 2 – Summary of 15 min alarms

Reference	Thermal Oxidiser	Date	Time	CO (mg/m³)	Cause
1	Primer RTO	31/1/24	14:00 – 14:15	200.9	Oven temperature low as RTO came out of by-pass
			14:15 – 14:30	206	
2	E-Coat RTO	15/2/24	09:45 – 10:00	205	Failed damper motor
			16:30 – 16:45	206	
			16:45 – 17:00	216	
			17:00 – 17:15	227	
			17:15 – 17:30	237	
			18:15 – 18:30	234	
			18:30 – 18:45	276	
			18:45 – 17:00	238	
			20:45 – 21:00	235	
3	Primer RTO	12/9/24	13:15 – 13:30	250	Sticking valve
			13:30 – 13:45	250	
			13:45 – 14:00	250	
			14:00 – 14:15	250	
			14:15 – 14:30	226	
4	Primer RTO	17/9/24	23.45 – 00:00	208	Sticking valve
			00:00 – 00:15	201	
5	Primer RTO	18/9/24	16:00 – 16:15	246	Sticking valve
			16:15 – 16:30	207	
			16:30 – 16:45	211	
6	Primer RTO	9/10/24	07:00 – 07:15	203	Sticking valve
			07:15 – 07:30	203	

NB 31/1/24 – Primer RTO in bypass, 1/5/24 Primer RTO in bypass, 5/9/24 E-Coat RTO in bypass

Table 2a – Summary of 24-hour alarms

Reference	Thermal Oxidiser	Date	Time	CO (mg/m³)	Cause
			No Alarms		

2.3 Monitoring System Notes & Initiatives

At JLR Halewood Paint Shop, PROTEA CO analysers and Yokogawa data collection units are used to monitor stack CO emissions released into the atmosphere. The data required by the IPPC permit is stored in four locations: the Yokogawa data collector, Yokogawa trend recorder, a central data acquisition PC, and a folder with hard copies of daily printed reports.

3. Energy

3.1 Energy Usage

Paint Operations energy data for 2024, shown in the table below –

Table 3a – Energy Usage (Information supplied by EQUANS)

Jaguar Paint 2024 IPPC Information			
Energy Source	**As Delivered (MWh) (Paint shop usage)**	**Primary Energy Consumption At Source (MWh) plant totals**	**Fraction of Total (%)**
Electricity (Public Supply)*	23,760.13	89,743.12	40.4
Firm Gas	64,240.68	71,994.98	32.4
Boiler House (Interruptible Gas & Gas Oil Standby) **	3,020.46	60,409.24	27.2
Total	91,021.27	222,147.34	100.0

*** Based on delivered figures multiplied by a generation loss correction factor of 2.6.**
****From January, 2007, standby fuel is Gas oil**

Notes:		
Electricity:		
Direct Electricity Use	(kWh pa)	21,687,503
Dedicated HP Paint Compressors	(kWh pa)	0
General & High Quality LP Compressed Air	(kWh pa)	2,072,631
Total	(kWh pa)	23,760,134
Primary Energy:Supplied Electriciy Ratio		3.78
Hence primary Energy Use	(kWh pa)	89,743,121
Firm Gas:		
Total Jaguar Firm Gas use	(kWh pa)	71,994,983
Estimated Use at Paint	(%)	89.2
Hence Paint Estimated Use	(kWh pa)	64,240,676
Interruptible Gas & Gas Oil & MFO:		
Total Jaguar Int Gas & MFO use	(kWh pa)	60,409,240
Estimated Use at Paint	(%)	5
Hence Paint Estimated Use	(kWh pa)	3,020,462
Information Compiled by:	S.Dutton	
Date:	20/01/2025	
Data Source:	JLR Halewood Monthly Energy Mega File/Power radar Paint Daily energy report	

Table 3b – Energy Comparison with Previous Years

	2020 (units)	2021 (units)	2022 (units)	2023 (units)	2024 (units)
Volume	85162	69701	61574	48986	59730
	2020 (MWh)	2021 (MWh)	2022(MWh)	2023(MWh)	2024(MWh)
Electricity	29109	26915	24096	19767	23760
Electricity per unit	**0.34**	**0.39**	**0.39**	**0.39**	**0.40**
Gas	57950	49045	42748	56027	64241
Gas per unit	**0.68**	**0.70**	**0.69**	**1.11**	**1.08**
Total	87059	75960	66844	75794	88001
Total per unit	**1.02**	**1.09**	**1.09**	**1.51**	**1.47**
Plant wide	2020 (KWh)	2021 (KWh)	2022(KWh)	2023(KWh)	2024(KWh)
HP Compressed air	0	0	0	0	0
LP Compressed air	1838257	1948564	900499	498278	498278
	21.59	**27.96**	**14.62**	**9.91**	**8.34**

3.2 Energy Initiatives

Despite increased build figures, energy efficiencies ensured that per-unit gas and electricity usage remained relatively unchanged in 2024 compared to 2023.

Throughout 2024, we had slightly increased gas and electric energy usage as the programmes team frequently ran night shifts to commission the latest all-electric EMA units (Electrified Modular Architecture) through all spray booths. This process required running all ARPs (Air Replacement Plant) and ovens due to safety interlocks with the paint application equipment, even though vehicles were not being produced. These commissioning events increased energy usage compared with day-to-day production and could only be completed on night shifts. The prototype pre-works are an essential part of any successful launch, unfortunately this needs to be done out of hours for varying reasons. Mainly security protocol as these vehicles are under embargo, also the size differences and new shapes of the vehicles need vital commissioning works to realign robots and ovens and ensure dimensional integrity and avoid collisions with current facility.

Additionally, the new Enamel Incinerator operates differently from the previous equipment, ramping up to temperature more slowly over a longer period. This gradual ramp-up is designed to optimize the lifespan of the equipment.

Looking forward to 2025,

- New Electrocoat RTO installation to be completed in 2026 the platform will be installed towards the end of 2025 and the RTO will be in 2026.

4. Waste

4.1 Waste Initiatives

Lean Manufacturing tools, such as Kaizen, are employed to minimize all forms of waste. Kaizen, meaning "change for the better" or "continual improvement," focuses on waste elimination, prioritizing waste avoidance by reducing non-essential raw materials used in the process. At the end of their useful life, materials are segregated and recycled where possible. For instance, purge solvents are reclaimed and distilled to produce a lower-grade solvent for cleaning purposes. Paint Operations also leads company-wide recycling programs for plastics, paper, etc. Efforts are concentrated on achieving JLR's internal waste targets: zero waste directly to landfill and no more than 0.45% from second tier to landfill. Additionally, all residual general waste that cannot be recycled undergoes waste-to-energy processes.

l In 2024, the Paint Shop significantly reduced waste per vehicle, cutting non-hazardous waste from 8.84 g to 3.6 kg and hazardous waste from 10.18 kg to 8.0 kg. This resulted in an overall waste reduction from 18.5 kg to 11.6 kg per vehicle. The year-on-year decrease is largely attributed to excessive waste generated in 2023 during a five-week shutdown, which was necessary for the transition to all-electric vehicle production (EMA).

During this period, major works included the removal of old ductwork insulation and oven interior sections. The downsizing of two zones by half required the disposal of hazardous pre-treatment materials from Zones 6 and 3. Additionally, the installation of two new clearcoat interior robots necessitated extensive cleaning of the robot zone prior to installation, as hot works regulations demanded thorough cleansing due to the flammable nature of materials in the facility. The waste bath material and any steelwork removed was classed as hazardous because of the components of the bath make up,

Zone 3 – Fatty alcohols (up to 60% of an additive) Potassium Hydroxide (up to 20% of an additive), Tripotassium Orthophosphate (up to 20% of an additive), Tetrapotassium Pyrophosphate (up to 10% of an additive).

Zone 6 – Potassium DiFluoride (up to 20% of an additive), Zinc (up to 20% of an additive) Manganese (up to 20% of an additive), Phosphoric Acid (up to 10% of an additive and 80% in another)

Other working groups are exploring alternative disposal routes for other waste streams to divert from landfill. Leadec also conducts regular waste bin audits across the site to check the segregation and recycling of all materials, promoting better awareness of staff behaviours.

4.2 Waste Data

The tables below show the waste streams from Paint Operations and quantities sent for disposal or recycling, for the calendar year January to December 2024.

Table 4 – Non-Hazardous Waste Data (Information supplied by Leadec & Nalco)

Description	Source	Quantity Generated (tonnes)	Storage Location and Container	Frequency of Collection	Contractor	Final Destination and Method Of Disposal	R & D Codes	EWC Codes
Non-Hazardous Waste								
General Waste	Packaging, biodegradable & domestic waste	54.4	Black bins at lineside transferred to 35 yd^3 skip at Recycle Centre	Daily	Leadec/Bagnall & Morris	Viridor Waste 2 Energy, Runcorn	R1	200301
Liquid Sealer	Shutdown	8.4		Annual	Leadec/Robert Hopkins	TFS - Waste 2 Energy (AEB, Holland)	R1	80410
Contrast Roof Polythene	Contrast Roof	27.3	1100 litre Taylor Bins	4 bins per shift	Leadec/New Horizon Plastics	New Horizon Plastics - Recycled intpo LDPE pellets for re-use in new applications	R3	150102
Insulation	Project Refurbishment	1.40	Skip	As required	Leadec/CCC	Waste to energy	R1	170604

Table 4a – Hazardous Waste Data (Information supplied by Leadec)

Description	Source	Quantity Generated (in tonnes, unless otherwise stated)	Storage Location and Container	Frequency of Collection	Contractor	Final Destination and Method Of Disposal	R & D Codes	EWC Codes
Hazardous Waste								
Effluent Plant Filter Cake Solid	Trade Effluent Plant	42.94	Filter cake discharged into 14 yd^3 skip and exchanged	Every 6 weeks	Leadec/Robert Hopkins	TFS - Waste 2 Energy (AEB, Holland)	R1	110109*
Effluent Plant Tankered Filter Cake Sludge	Trade Effluent Plant	20.54	Tankered	As required	Leadec/Future Industrial	15% to landfill	D9	110109*
Effluent Plant Liquid	Trade Effluent Plant	44.86	Tankered	As required	Leadec/Future Industrial	15% to landfill	D9	110109*
Paints and Thinners	Paintshop/Garage Repair- colour changes - redundant products	14.50	Stored in 205 ltr drums then transferred to the HWTS	As required	Leadec/Robert Hopkins	Solvent recovery at Tradebe, Morecambe	R2	080111*
Hydropurge	Purging paint spray lines at colour change	195.19	Paint Mix Bulk Tank 12,000 ltrs	Fortnightly	Leadec/Future Industrial/WasteCare	5% to landfill	D9	080119*
Sealers	Paintshop Hazardous Sealer	5.21	Stored in 205 ltr drums then transferred to the HWTS	As required	Leadec/Robert Hopkins	TFS - Waste 2 Energy (Albox-Espana)	R1	080409*
Solvent Rags/Cloths/Filters	Solvent wiping / cleaning / air filters	3.26	Red bins at lineside transferred to 14 yd^3 skip at Waste Transfer Station	As required	Leadec/Robert Hopkins	TFS - Waste 2 Energy (AEB, Holland)	R1	150202*
Plastic & Steel Containers	Chemical Handling	1.31	Transfer Station / West drum compound	As required	Leadec/Robert Hopkins	Plastics to Mallory Oils, Metals to EMR	R3 R4	150110*
Empty Paint Tins	Paintshop general areas	0.065	Transfer Station / West drum compound	As required	Leadec/Robert Hopkins	Recycling EMR	R4	150110*
Spent Purge Solvent	Purging paint spray lines at colour change in Primer and Clearcoat processes.	106.52	Paint Mix Bulk Tank 12,000 ltrs	As required	Gage Products	Solvent recovery at Augean, Avonmouth	R2	080111*
Phosphate	Zone 6	4.6	Stored in 205l drums and transferred to HWTS	As required	Leadec/Robert Hopkins	TFS - Waste 2 energy (AEB)	R1	110108*
PPE Parco Contaminated	M18	1.5	Stored in Wastesafes and transferred to HWTS	As required	Leadec/Robert Hopkins	TFS - Waste 2 energy (Renova)	R1	150202*
Contaminated Pipework		0.30	Stored in Wastesafes and transferred to HWTS	As required	Leadec/Robert Hopkins	Metal recycling - European metal recycling	R4	170904*
Paint Contaminated Pipework	Project Refurbishment	2.48	Skip	As required	Leadec/Future Industrial	O'Connells Metal Dealers	R4	170409*
Lead Acid Battery		0.032	Stored in HWTS	As required	Leadec/Ecobat	Ecobat, Derby	R4	160601*
Alkaline washings		5.0	Tanker	As required	Leadec/Future	Future	D9	110111*
Acid washings		8.08	Tanker	As required	Leadec/Future	Future	D9	110111*
Paint Sludge		15.75	Stored in 205l drums and transferred to HWTS	As required	Leadec/Robert Hopkins	ATM(Waste to energy)	R1	080113*
Brake Fluid		0.1	Stored in 205l drums and transferred to HWTS	As required	Leadec/Robert Hopkins	Recycling (MTB)	R3	160113*
Contaminated Metal	Project Refurbishment	3.2	Skip	As required	Leadec/Robert Hopkins	Metal recycling - European metal recycling	R3	170904*
Paint Activator PSA		0.25	Stored in 25l drums and transferred to HWTS	As required	Leadec/Robert Hopkins	Secoundry fuel (BIP/Veolia)	R3	160305*
Shot Blast	Project Refurbishment	0.8	Stored in 205l drums and transferred to HWTS	As required	Leadec/Robert Hopkins	ATM(Waste to energy)	R1	120116*
Bonderite M-AC AL2000		0.552	Stored in 25l drums and transferred to HWTS	As required	Leadec/Robert Hopkins	ATM(Waste to energy)	R1	160303*
Bonderite 958		2.0	Stored in IBC	As required		ATM(Waste to energy)	R1	160305*
Pfinder 759		0.1	Stored in drums and transferred to HWTS	As required	Leadec/Robert Hopkins	ATM(Waste to energy)	R1	160305*
Pfinder 13/18		0.2	Stored in drums and transferred to HWTS	As required	Leadec/Robert Hopkins	ATM(Waste to energy)	R1	120112*

5. Water

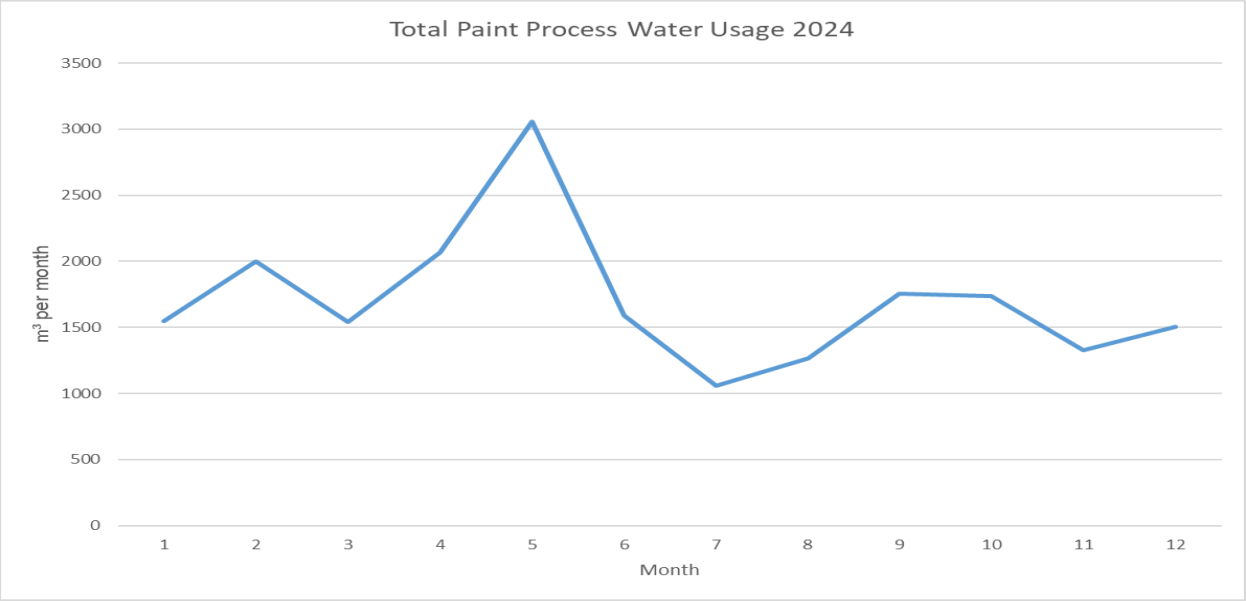
5.1 Water Data

Two principal sources of water used within the Paint Operations processes –

- Process Water (incoming potable water from the utility provider)
- Demineralised Water (higher quality water from our internal plant)

Process water is used for the first cleaning stages in the Pre-treatment process. The graph below shows the monthly usage of process water in cubic metres, for 2024

Graph 5a – Process Water Usage



Demineralised (or "Demin") water is higher quality water used in many processes, including the final cleaning stages of the Pre-treatment, as well as polishing and repair procedures. Demineralised water is also used to achieve the relative humidity set points in all the spray booths to improve paint quality.

The graph below represents the total demineralised water monthly usage in cubic metres, for 2024:

Graph 5b – Demineralised Water Usage

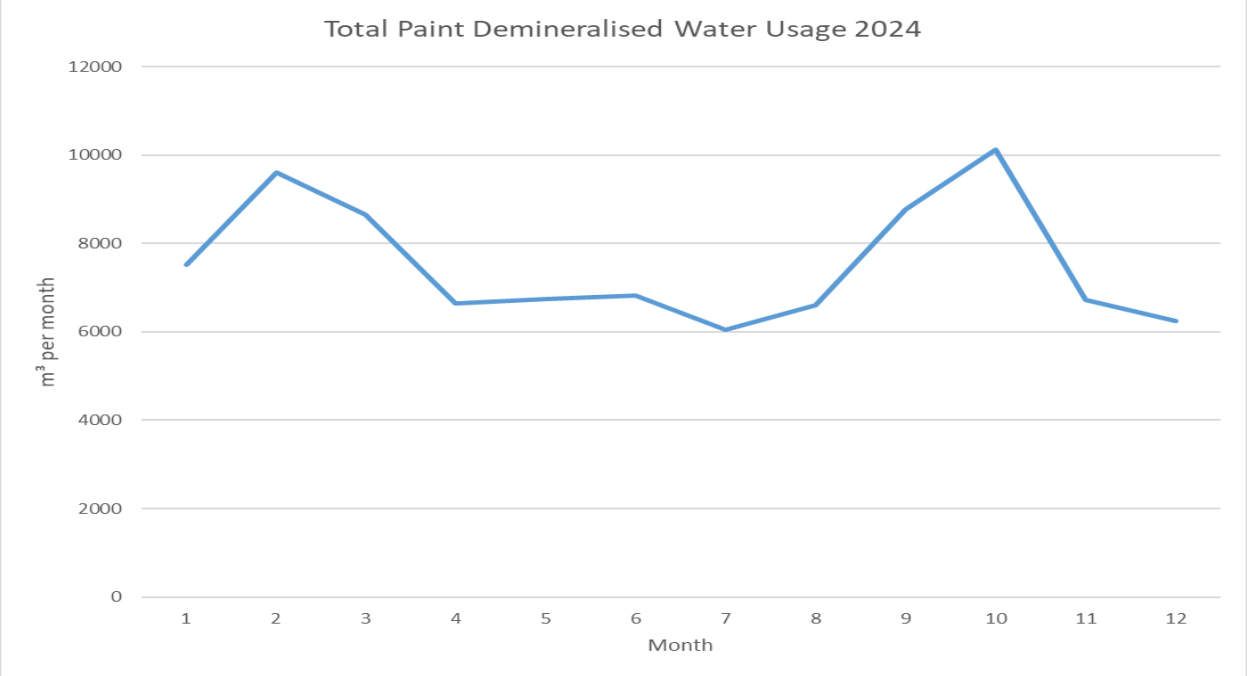


Table 5C details the Paint Shop's water usage from the last 5 years. Weekly tank drops are still performed to maintain production quality irrespective of production volumes.

Table 5c – Water Comparison with Previous Years

	2019 (units)	2020 (units)	2021 (units)	2022 (units)	2023 (units)	2024 (units)
Volume	127950	85162	69701	61574	48986	59730
	2019 (m^3)	2020 (m^3)	2021 (m^3)	2022 (m^3)	2023 (m^3)	2024 (m^3)
Process Water	57113	41635	35605.0	37282.5	21344.0	20456.0
Process Water Per Unit	**0.45**	**0.49**	**0.51**	**0.61**	**0.44**	**0.34**
Demineralised Water	145319	107824	92060.0	78663.3	62239.0	90491.0
Demineralised Water Per Unit	**1.14**	**1.27**	**1.32**	**1.28**	**1.27**	**1.52**
Total water	202432	149459	127665.0	115945.8	83583.0	110947.0
Total Water Per Unit	**1.58**	**1.75**	**1.83**	**1.88**	**1.71**	**1.86**

5.2 Water Initiatives

Water usage reduction activities are driven by actions within the Jaguar Land Rover Environmental Management System and company scorecard metrics. The JLR Water Focus Group shares best practices and water-saving initiatives across all JLR manufacturing sites, reviewing performance against targets. Additionally, Jaguar Land Rover has signed up for the Carbon Disclosure Project for water, focusing on metering

and water reductions. Further optimization of the Pre-Treatment cascade has also contributed to improved water usage.

Process water reduction was achieved through pipe modifications that reduced replenishment requirements. Closer monitoring of bacteria levels has provided a better understanding of material longevity, reducing the number of tank drops needed. By working closely with material suppliers, JLR has gained a better understanding of the shelf life of tank materials, further reducing tank drops. The increase in demineralized water usage was due to heating circuit drain downs during the summer shutdown. As Halewood still currently provides comfort heating via a high temperature hot water circuit it is sometimes necessary to isolate legs of the system for work which involved draining part, or all of a circuit. In Summer 2024 there were multiple jobs planned on the sites heating circuits which meant more sections had to be drained than usual.

This water usage is not a paint sho use but is supplied via the demin plant who also supply paint shop with demineralised water. Due to a lack of metering on the system it is not possible to see how much water was used to refill the heating circuits. Installation of sub metering in the demin plant is part of larger project for 2025 led by the Halewood estates team.

Water Breaches (consent limit is 1700m³)

- 9/4/24 - 2193m³
- 22/5/24 - 2427m³
- 23/5/24 - 1930m³
- 30/9/24 - 1911 m³
- 16/10/24 – 2109m³

The corrective actions to prevent further breaches

- Re-calibration of flow meter
- Re-routing of SW drains which are connected to foul system

6. Materials

6.1 Material Review

All chemical products (liquids, powders, etc.) at JLR must go through the Materials Review Process. Occupational Hygiene and Toxicology ensure that all products meet company standards and ensure the lowest harm product is selected for each process. As a standard all products known to be carcinogenic, mutagenic and reprotoxic are prohibited for use and where it is not possible to remove these products immediately, the products must be strictly controlled. Toxicology works closely with suppliers and product owners to seek and implement safer alternatives. The site continues to be supported by industry suppliers and various company forums to identify and share Best-In-Class initiatives across all JLR sites.

In 2024 JLR began a companywide training programme for the transition to Chemwatch which is a web-based application to manage JLR chemical review system. Chemwatch hosts and regularly updates an online library of more than 150 million vendor MSDS's. We will continue to run our previous iPoint approval process alongside the new application but iPoint will be phased out in 2027. Chemwatch is a much more user-friendly interface and MSDS updates are managed by the application instead of relying on individual associates.

JLR also introduced a company training programme for the safe use of materials containing isocyanates in 2024 which has now been completed.

6.2 Raw Material Inventory

Tables 6a to 6g summarise the principal materials used in the installation, including quantities used in 2024, chemical compositions, and known alternatives.

Table 6a – RM1 Solvents (Data supplied by Gage Products Ltd)

Raw Material/ Function	Annual Usage (kg or L)	Process	Fate:% to: Product, ETP, Air, Waste	Practical Alternatives	Storage Location and Type*	Chemical Nature/ Composition
RM1 - Solvents						
Purge Solvent - CN 31306	109,436 L	Purge solvent	70% to reclaim tank, 30% to Stay-Clean®	None	Paint & Oil Stores 2,000 litres max in 1000 litre IBCs. 10,000 litre bulk tank at Paint Mix	Xylenes, Mibk, Butac
Line cleaning solvent - CN 33380	86,873 L	Line cleaning solvent for use as a cleaning solvent in all spray booths and used to flush / clean systems	25% to Stay-Clean®, 75% to reclaim tank	None	Paint & Oil Stores 3200 litres max in 205 litre drums. 10,000 litre bulk tank at Paint Mix	Xylenes, Mibk, Butac
Cutting solvent - Xylene	7,790 L	Primer 2 and clear coat cutting solvent	100% to air via Paint emissions	None	Paint & Oil Stores 1640 litres max in 205 litre drums	Xylenes
CN 10440	9,420 L	Clear coat cutting solvent	100% to air via Paint emissions	None	Paint & Oil Stores 2 x 1000 litre Tote tanks	
CN 71718	4,920 L	Cleaning of stainless steel floors	100% to air	None	Paint & Oil Stores 205 litre drums	2-Butoxyethanol
CN 31247	500 L	Wiping Solvent used in garage repair	100% to air	None	Paint & Oil Stores 25 litre kegs	Light Aliphatic Naphtha
CN 36701	7,200 L	Water based purge solvent for use in the basecoat booth for cleaning and purging the equipment, also used to flush system for new paint colours	90% to reclaim tank, 10% to Stay-Clean®	None	Paint & Oil Stores 3,000 litres max in 1000 litre IBCs. 2,000 litres in totes at Paint Mix	Butyldiglycol, Amine, Hexyl Cellosolve

The Paint Shop has engaged with Gage Products Ltd about the possibility of practicable alternatives, but nothing is available since transitioning over to no VOC Hydropurge in 2019.

Table 6b – RM2 Paint & E/Coat (Data supplied by BASF & Axalta)

Raw Material/ Function	Annual Usage (kg or L)	Process	Fate:% to: Product, ETP, Air, Waste	Practical Alternatives	Storage Location and Type*	Chemical Nature/ Composition
RM2 - Paints and E-Coat						
Generic Clearcoat	159700	Clearcoat Spray Booths	Vehicle Surface / Air / Waste	None	1000 litre steel tote bunded in the paint mix building and paint and oil stores. Max storage 20 Totes	CAS 64742-95-6 solvent naphtha (petroleum), light arom. (<0,1% benzene) 15 - < 20 % CAS 95-63-6 1,2,4-trimethylbenzene 15 - < 20 % CAS 71-36-3 n-butanol 5 - < 7 % CAS 1330-20-7 xylene 5 - < 7 % CAS 68002-25-5 1,3,5-Triazine-2,4,6-triamine, polymer with formaldehyde, butylated 3 - < 5 % CAS .no number. EC 918-811-1 Solvent naphtha (petroleum), heavy arom 3 - < 5 % CAS 108-67-8 mesitylene 2 - < 2.5 % CAS 100-41-4 ethylbenzene 1 - < 2 % CAS 1445-45-0 trimethyl-orthoacetate 1 - < 2 % CAS 103-65-1 n-propylbenzene 1 - < 2 % EC 400-830-7A mixture of: a-3-(3-(2H-benzotriazol-2-yl)-5-tert-butyl-4-hydroxyphenyl)propionyl-w-hydroxypoly(oxyethylene); a-3-(3-(2H-benzotriazol-2-yl)-5-tert-butyl-4-hydroxyphenyl)propionyl-w-3-(3-(2H-benzotriazol-2-yl)-5-tert-butyl-4-hydroxyphenyl)propionyloxypoly(oxyethylene) 0.5 - < 1 % CAS 41556-26-7 bis(1,2,2,6,6-pentamethyl-4-piperidyl) sebacate 0.3 - < 0.5 %
Generic primer	99705	Primer Spray Booths	Vehicle Surface / Air / Waste	None	1000 litre steel tote or 200 litre steel drums bunded in the paint mix building and paint and oil stores. Max storage 60 drums and 5 totes	EC: 918-668-5 Hydrocarbons, C9, aromatics ≤12% EC: 905-588-0 Reaction mass of ethylbenzene and xylene CAS: 85940-94-9 Hexane, 1,6-diisocyanato-,homopolymer, Me Et ketone oxime-blocked <10% CAS: 25068-38-6 reaction product: bisphenol-A-(epichlorhydrin); epoxy resin ≤5% CAS: 123-86-4 n-butyl acetate ≤4.1% CAS: 68036-97-5 1,3,5-Triazine-2,4,6-triamine, polymer with formaldehyde, butylated methylated ≤5% CAS: 71-36-3 butan-1-ol ≤2.9%
Generic water borne basecoat	209280	Basecoat spray booths	Vehicle Surface / Air / waste	None	1000 & 200 litre steel containers bunded in the paint mix building / Paint and Oil Stores. Max storage 30,000 litres	CAS: 111-76-2 2-butoxyethanol ≤10% CAS: 71-36-3 butan-1-ol <3% CAS: 64742-48-9 Hydrocarbons, C11-C12, isoalkanes, <2% aromatics ≤3% CAS: 126-86-3 2,4,7,9-tetramethyldec-5-yne-4,7-diol <1% EC: 400-830-7 A mixture of: α-3-(3-(2Hbenzotriazol-2-yl)-5-tert-butyl-4-hydroxyphenyl)propionyl-ω-hydroxypoly(oxyethylene); α-3-(3-(2H-benzotriazol-2-yl)-5-tert-butyl-4-hydroxyphenyl) propionyl-ω-3-(3-(2H-benzotriazol-2-yl)-5-tert-butyl-4-hydroxyphenyl)propionyloxypoly (oxyethylene) ≤0.3% CAS: 121-44-8 triethylamine ≤0.2% CAS: 1065336-91-5 Reaction mass of bis(1,2,2,6,6-pentamethyl-4-piperidyl) sebacate and methyl 1,2,2,6,6-pentamethyl-4-piperidyl sebacate ≤0.2% CAS: 50-00-0 formaldehyde <0.1%
E-coat Resin	262980	Electrocoating process	Vehicle Surface / Air / Effluent Treatment Plant	None known	28,000 litre Bulk Tank near wax kitchen - unbunded plus additional day storage tank of 3,500 litres	LER - 17%, ISO - 7%, Solvent - 2.5% Water 57%
Pigment Paste	47690	Electrocoating process	Vehicle Surface / Air / Effluent Treatment Plant	None known	5x 1400kg Steel tote in Paint and Oil Stores and E-coat Mix Room	LER 12%, Titandioxide - 25%, Water - 30% other pigments 22%
EC Butoxipropanol	6860	Electrocoating process	Vehicle Surface / Effluent Treatment Plant	None known	12 x 180 litre steel drum Paint and Oil stores and E-coat Mix Room	Butoxipropanol 100%
Formic Acid	11210	Electrocoating process	Vehicle Surface / Effluent Treatment	None known	Paint stores and e-coat mix room max. 35 x 25kg plastic drum	Formic acid 50%, water 50%

The materials for the Electrocoating process have previously been converted to a reduced energy material in 2019 enabling the oven temperatures to be lowered.

Table 6c – RM3 Sealers & Waxes (Data supplied by Henkel Technologies)

Raw Material/ Function	Annual Usage (kg or L)	Process	Fate:% to: Product, ETP, Air, Waste	Practical Alternatives	Storage Location and Type*	Chemical Nature/ Composition
RM3 - Sealers and Waxes						
Duplex Sealer Teroson PV 3133	**64991 Kg**	Sealer line	Vehicle Surface / air	Non-PVC tapes	Bulk tank near admin building - Unbunded	Hydrocarbons, C11-C12, isoalkanes, < 2% aromatics (1- < 3 %), Fatty acids, C18-unsatd., dimers, reaction products with polyethylenepolyamines (0,1- < 1 %)
Duplex Sealer Teroson PV 1979JFS	**127092 Kg**	Sealer line	Vehicle Surface / air	Non-PVC tapes	Bulk tank near admin building - Unbunded	plastisol PVC, petroleum diluent 1-<10%, polyaminoamide 1-<10%, 1,2 Ethandiol <1%.
Terolan 1984 Roof Ditch Sealer	**750 Kg**	Sealer line	Vehicle Surface / air	Expanding Tapes	Day Tank located on Paint Floor - Un bunded	Naphtha (petroleum), hydrotreated heavy Benzene < 0,1 % = < 2.5%, Calcium oxide = < 2.5%, Fatty acids, C18-unsatd., dimers, reaction products with polyethylenepolyamines = < 2.5%
Reflow Wax Pfinder AP13/18	**23870 L**	Reflow wax booth	Vehicle surface / air	Water based wax	Wax kitchen Bulk Tank - bunded	Solvent free rust prevention. Corrosive inhibitors, paraffin oil etc
One compartment Polyuethane sealer IDH-744475	**16 L**	Sealer line / Watertest Repair / Containment	Vehicle surface approx 100%	None known	Paint and Oil Store Twelve 310ml cartridges per metal box	Polyurethane based one compartment paintable adhesive / sealant
NVH Dampener Teroson RB 8275 JA	**40800 Kg**	NVH Robot Cell	Vehicle Surface approx 100%	Bitumen Pads	Wax Kitchen 1200Kg stell totes, two lineside @ pumping station	Rubber Based, Sulfur <10%, Calcium Oxide <5%, Zinc bis <1%, Zinc dis <1%, Benzothiazole-2-thiol <0.25%

Henkel Technologies have now introduced Teroson PV 3133 as a replacement for Teroson 1979 JFS, 3133 has a lower VOC content and is less dense lowering the weight of our vehicles improving fuel performance.

Table 6d – RM4 Garage Repairs (Data supplied by Axalta)

Raw Material/ Function	Annual Usage (kg or L)	Process	Fate:% to: Product, ETP, Air, Waste	Practical Alternatives	Storage Location and Type*	Chemical Nature/ Composition
RM4 - Garage Repairs						
Tints	195 L	Garage Repair	Product / Air	None known	12 x 1 litre steel tins in flammable cupboard Garage Repair Area and Paint and Oil Stores	**CAS 1330-20-7 xylene 20 -< 25%** **CAS 123-86-4 n-butyl acetate 20 -< 25%** **CAS 108-65-6 2-methoxy-1-methylethyl acetate 5 -< 7%** **CAS 100-41-4 ethylbenzene 5 -< 7%** **CAS 108-83-8 2,6-dimethylheptan-4-one 3 -< 5%** **CAS 123-92-2 isopentyl acetate 2 - < 2.5%** **CAS 64742-95-6 solvent naphtha (petroleum), light arom. (<0,1% benzene) 1 - < 2%** **CAS 763-69-9 ethyl 3-ethoxypropionate 1 - < 2%** **CAS 108-88-3 toluene 0.1 - < 0.2%** **CAS 688-84-6 2-ethylhexyl methacrylate 0.1 - < 0.2%**
Binders	300 L	Garage Repair	Product / Air	None Known	Max 40 x 1-5 litre steel tins in flammable cupboard in Garage Repair Area and Paint and Oil Stores	**CAS 64742-95-6 solvent naphtha (petroleum), light arom. (<0,1% benzene) 15 - < 20 %** **CAS 95-63-6 1,2,4-trimethylbenzene 15 - < 20 %** **CAS 71-36-3 n-butanol 5 - < 7 %** **CAS 1330-20-7 xylene 5 - < 7 %** **CAS 68002-25-5 1,3,5-Triazine-2,4,6-triamine, polymer with formaldehyde, butylated 3 - < 5 %** **CAS .no number. EC 918-811-1 Solvent naphtha (petroleum), heavy arom 3 - < 5 %** **CAS 108-67-8 mesitylene 2 - < 2.5 %** **CAS 100-41-4 ethylbenzene 1 - < 2 %** **CAS 1445-45-0 trimethyl-orthoacetate 1 - < 2 %** **CAS 103-65-1 n-propylbenzene 1 - < 2 %** **EC 400-830-7A mixture of: a-3-(3-(2H-benzotriazol-2-yl)-5-tert-butyl-4-hydroxyphenyl)propionyl-w-hydroxypoly(oxyethylene); a-3-(3-(2H-benzotriazol-2-yl)-5-tert-butyl-4-hydroxyphenyl)propionyl-w-3-(3-(2H-benzotriazol-2-yl)-5-tert-butyl-4-hydroxyphenyl)propionyloxypoly(oxyethylene) 0.5 - < 1 %** **CAS 41556-26-7 bis(1,2,2,6,6-pentamethyl-4-piperidyl) sebacate 0.3 - < 0.5 %**
Thinners	400 L	Garage Repair	,,	None Known	60 x 5-25 litre tins stored in flammable cupboard in Garage Repair Area and Paint and Oil Stores	**CAS 108-10-1 4-methylpentan-2-one ≥25 - ≤30%** **CAS 64742-95-6 solvent naphtha (petroleum), light arom ≥10 - ≤25%** **CAS 123-86-4 n-butyl acetate ≥10 - ≤25%** **CAS 95-63-6 1,2,4-trimethylbenzene ≤11%** **CAS 1330-20-7 xylene ≤10%** **CAS 100-41-4 ethylbenzene ≤2.5%**
Primer Filler	149 L	Garage Repair	Product / Air	None Known	12 x 5 litre tins strored in flammable cupboards in garage repair area and Paint and Oil Stores	**CAS 123-86-4 n-butyl acetate ≥10 - ≤25%** **CAS 1317-65-3 Limestone ≥10 - ≤25%** **CAS 1330-20-7 xylene ≤10%** **CAS 100-41-4 ethylbenzene ≤3%** **CAS 110-12-3 5-methylhexan-2-one ≤3%** **CAS 13463-67-7 titanium dioxide ≤1%** **CAS 1333-86-4 carbon black, non respirable ≤1%** **CAS 14808-60-7 Quartz ≤0.3%**
Activator	259 L	Garage Repair Area	Product / Air	None Known	Max 90 x 1-5 litre tins or plastic containers in Garage Repair Area or Paint and Oil Stores	**CAS 28182-81-2 Hexamethylene diisocyanate, oligomers ≥50 - ≤75%** **CAS 123-86-4 n-butyl acetate ≥25 - ≤50%** **CAS 2530-83-8 [3-(2,3-epoxypropoxy)propyl]trimethoxysilane <3%** **CAS 64742-95-6 solvent naphtha (petroleum), light arom. ≤3%** **CAS 4083-64-1 4-isocyanatosulphonyltoluene 4083-64-1 ≤0.3%**
Repair Clear Coat	530 L	Garage Repair Area	Product / Air	None Known	5-25 litre tins in Garage Repair Area or Paint and Oil Stores	**Polymeric aspartate - ≥25 - ≤50%** **CAS 123-86-4 n-butyl acetate ≥25 - ≤50%** **CAS 623-91-6 diethyl fumarate <3%** **CAS 112-07-2 Ethylene glycol butyl ether acetate ≤3%** **CAS 41556-26-7 bis(1,2,2,6,6-pentamethyl-4-piperidyl) sebacate ≤1%** **CAS 82919-37-7 methyl 1,2,2,6,6-pentamethyl-4-piperidyl sebacate ≤0.3%**

Table 6e – RM5 Paint Overspray Treatment Plant (Data supplied by Nalco Water)

Raw Material/ Function	Annual Usage (Lts)	Process	Fate:% to: Product, ETP, Air, Waste	Practical Alternatives	Storage Location and Type*	Chemical Nature/ Composition
RM5 - Stay-Clean						
715D+ Defoamer	2390	Coagulation treatment plant	Effluent Treatment / waste	n/a	Stayclean Facility 1000litre tote – bunded	Hydrated Middle Distilate 50-<=100 % 1 Octanol 1- <25% Hydrotreated Light Distilate 20- <25 %
93033 HCL	16200	Coagulation treatment plant	Effluent Treatment / waste	n/a	Stayclean Facility 1000litre tote – bunded	Sodium Hypochlorite 10- 20 %
74824 Biocide	5800	Coagulation treatment plant	Effluent Treatment / waste	n/a	Stayclean Facility 1000litre tote – bunded	5-chloro-2-methyl-2H-isothiazol-3-one and 2-Methyl-2H-isothiazol-3-one 3- <5 %
PK9516 Paint Kill	7290	Coagulation treatment plant	Effluent Treatment / waste	n/a	Stayclean Facility 1000litre tote – bunded	Glyoxalated acrylamide 1 - <2.5% Alukinium Chloride hydroxide 25- < 30%
Nalco 8735	1100]	Coagulation treatment plant	Effluent Treatment / waste	n/a	Stayclean Facility 1000litre tote – bunded	Sodium Aluminate 10 -<20% Sodium Hydroxide 10- <20 % Sodium Nitrate 1 - < 2.5%
71308 Polymer	300	Coagulation treatment plant	Effluent Treatment / waste	n/a	Stayclean Facility 1000litre tote – bunded	2-Hydroxyethel Methacacrylate 0.5 < 1 % Hydrotreateed Light Distilate 25- <30 %

Table 6f – RM6 Pre-treatment (Data supplied by Henkel Technologies)

Raw Material/ Function	Annual Usage (kg or L)	Process	Fate:% to: Product, ETP, Air, Waste	Practical Alternatives	Storage Location and Type*	Chemical Nature/ Composition
RM6 - Pre-treatment						
Zinc phosphating - Bonderite M-ZN 958 R22	**36082 kg**	Zinc phosphate – zone 6	Effluent Treatment	None known	20000litre Bulk Tank - bunded	Phosphoric Acid 5-10%, Zinc Bis 10-25%, Manganese Bis 10-20%, Ni salts 1-5%, Ammonium hydrogen fluoride 1-2.5%, Nitric Acid 1-5%
Alkaline liquid cleaner – Bonderite C-AK-1 1574	**42832 kg**	Pre-treatment – zone 1-3	Foul sewer	None known	15000 litre bulk tank – bunded	Potasium Hydroxide >25%, Tetrasodium 1-5%, Tetrapotassium pyrophosphate 5-10%
Phosphate Accelerator – Bonderite m-ad 150	**25215 kg**	Zinc phosphate accelerator – zone 6	Effluent treatment	None known	10000 litre bulk tank - bunded	Na Nitrite 20-40%
Phosphate crystal refiner – Bonderite M-AC 50	**735 kg**	Zinc phosphating – zone 5	Effluent Treatment	None known	15kg Bags at paint line and Paint and Oil Store	Tetrasodium 10-20%, Sodium Hydroxide 0.5-2.0%
Surfactant additive – Bonderite c-ad 1270	**3200 kg**	Alkaline cleaner – surfactant – zone 1-3	Effluent Treatment	None Known	200litre drums at paint line and Paint and Oil Store - bunded	Surfactant blend, Alcohols C12-18, ethoxylated 68213-23-0
Phosphate passivator – Bonderite M-PT 54 NC	**5001 kg**	Zinc phosphate Passivator – zone 9	Effluent treatment	None Known	23kg pails at paint line and Paint and Oil Store - bunded	Dihydrogen hexafluorozirconate 3-7%, ammonium hexafluorozirconate 1-3%
Alkaline pH Adjuster – Bonderite M-AD 565	**2461 kg**	Zinc phosphate additive – zone 6&7	Effluent Treatment	None Known	23kg pails at paint line and Paint and Oil Store - bunded	Sodium Hydroxide 5-10%
Phosphate flocculent Bonderite M-AD FE-1	0	Zinc phosphate additive – zone 6	Effluent Treatment	None known	23kg pails at paint line and Paint and Oil Store - bunded	Iron trinitrate >25%, Nitric Acid 1-5%
Zinc supplement Bonderite m-ad zn-2	0	Zinc phosphate additive – zone 6	Effluent Treatment	None known	23kg at paint line and Paint and Oil Store - bunded	Zinc nitrate > 25%
Fluoride supplement - Bonderite M-AD 339L	**14625 kg**	Fluoride phosphate additive – zone 6	Effluent Treatment	None known	650kg tote at paint line in bunded and locked off area	Potassium Hydrogendifluoride 7-25%
Fluoride supplement - Bonderite M-AD 100	**1725 kg**	Ph adjuster – zone 1-3	Effluent Treatment	None known	23kg pails at paint line and Paint and Oil Store - bunded	Phosphoric Acid >50%

Currently, there are no alternative products approved at JLR but in the mid-term the replacement surface technology is Thin Film technology. Test panels with Thin Film

coating have passed JLR corrosion specification but a full panel testing program needs to be initiated to determine if the Thin Film meets all JLR quality requirements. Ideally JLR would want to replace M-AD 339 because of the Potassium Hydrogendiflouride content but current technologies and chemistry require the use of the material in processing our vehicles. A very robust process is in place for handling this material and fully respirated “one use only” chemical suits are required to enter the area. This area has its own safety protocols which are tested annually and specialist exposure products are in place:

- Hexaflourine Portable Showers – This material is a neutralising agent for fluoride exposure
- Hexaflourine Eye Wash – As above

Table 6g – RM7 Effluent & Demin Plant (Data supplied by EQUANS)

Raw Material/ Function	Annual Usage (kg or L)	Process	Fate:% to: Product, ETP, Air, Waste	Practical Alternatives	Storage Location and Type*	Chemical Nature/ Composition	Comments
RM7 - Effluent & Demin Treatment Plant							
Iron (III) Chloride	11,368kg	Effluent Treatment Plant	Effluent Treatment	None known	10,000 litre Bunded Bulk Tank – ETP	40% Ferric chloride solution	Quantities from JLR Stores System Delivery Quantities
Sodium Hydroxide	40,000kg	Effluent Treatment Plant	Effluent Treatment	None known	28,780 litre Bunded Bulk Tank – ETP	NaOH 25%, water 75%	Quantities from JLR Stores System Delivery Quantities
Hydrochloric Acid	0kg	Effluent Treatment Plant	Effluent Treatment	None known	16,700 Bunded Bulk Tank – ETP	Hydrochloric acid 32%, water 68%	Quantities from JLR Stores System Delivery Quantities
Anti-Foam	575 ltrs	Effluent Treatment Plant	Effluent Treatment	None known	25 ltr Drum. ETP	GE Betz Foamtrol AF4033, solution of fatty acid, polyol and silica	Quantities from JLR Stores System Delivery Quantities
Polymer	400kg	Effluent Treatment Plant	Effluent Treatment	None known	25 litre drum. ETP	GE Betz AE1125. Anionic polyacrylamide in emulsion 30-60%, Distillates (petroleum), hydrotreated light > 20%	Quantities from JLR Stores System Delivery Quantities - Local Stock
Sodium Hydroxide	0 kg delivered	Demin Plant	Effluent treatment	None known	33,000 litre Bunded Bulk Tank – Demin Plant	NaOH 46.6%, water 53.4%	Tank Redundant and empty
Sodium Hydroxide	75,000kg	New Demin Plant	Effluent treatment	None known	10000kg bunded tank	NaoH 32%	Quantities from JLR Stores System Delivery Quantities
Hydrochloric Acid	0 kg delivered	Demin Plant	Effluent Treatment	None known	33,000 litre Bunded Bulk Tank – Demin Plant	Hydrochloric acid 32%, water 68%	Tank Redundant and empty
Hydrochloric Acid	61,000kg	New Demin Plant	Effluent Treatment	None known	10000kg bunded tank	HCL 32%	Quantities from JLR Stores System Delivery Quantities
Continuum AEC3152	0kg	Demin Plant	Effluent Treatment	None known	1000 litre Bunded Bulk Tank – Demin Plant	1-5% Hydrogen Chloride	From Veolia
Castrol Perfecto T32 No 10 Centac Air Compressor	0 Litres	No.2 Compressor House	Waste	None known	600 litres Machine sump – Demin Plant	Petroleum distillates>60%, tributyl phosphate 0.1-<1%	Oil Change/machine service
Hydraulic Oil Filter Press	0 litres	Effluent Treatment Plant	Waste	None known	150 litre Machine sump	Mineral oil 100%	Oil top up
Biomate 5702	0kg	Demin Plant	Effluent Treatment	None known	Bunded storage tank max 1000 litres – Demin Plant	Sodium Hypochlorite >10%, Sodium Carbonate <20%, Sodium Hydroxide 0.5 - 2%	From Veolia
Techtrol Gold No 12 Centac Air Compressor	0 Litres	No.2 Compressor House	Waste	None known	600 litres Machine sump – Demin Plant	70% Polypropylene Glycol 30% Pentaerythritol Tetraester	No oil required at service

Conclusions

In addition to the ongoing optimisation of manufacturing equipment and processes, Paint Operations will continue to operate the Jaguar Land Rover Environmental Management System (EMS) to minimise impacts from the various environmental aspects, using defined internal objectives and targets, supported by regularly reviewed management programmes and policy deployment.

The following points are the main conclusions from the report:

- Mass Balance / Solvent use within permittable limits.
- Significant energy improvement actions including a strategic net zero carbon plan (2030) contributions.
- Water usage has remained relatively similar to previous year despite an increase in production levels
- EMS certification and legal compliance obligations are in place to ensure our commitment to reduce risk and hazard.
- As previously mentioned JLR Halewood is moving over to zero emission vehicles in late 2025.
- Total waste has reduced from 18.5 Kg to 11.6 Kg per unit