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LOWER LINK FARM PESTICIDE SAMPLING

Permits no. P.05767 and P.05768

FINAL
and updated for permit variation

Version 6.0
November 2023

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Project Status Report

Project Name:	Lower Link Farm – Pesticide Sampling Plan – Permit No. P.05768
Department:	Environment
Focus Area:	Lower Link Farm salad washing discharge waters

Prepared By:

Document Owner (s)	Project Organisation Role
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Project Status Plan Version Control:

Version	Date	Author	Change Status
1.0	May 2021	Vitacress	Draft for EA comment
2.0	08-07-2021	Vitacress	Draft final plan
3.0	08-10-2021	Vitacress	Final plan
4.0	01-12-21	Vitacress	Additions after discussions with EA
5.0	14-02-22	Vitacress	Edits after discussions with EA
6.0	16-11-23	Vitacress	Updated for permit variation application

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Contents

1 Summary of Progress

Task	Progress description	Status
Passive sampling	004 VSL Pesticide Assessment & Analysis	Complete
Concentration sampling	004 VSL Pesticide Assessment & Analysis	Complete
Analysis of concentration results	Annual average and maximum concentration for each active calculated. 004 VSL Pesticide Assessment & Analysis	Complete
Traceability	Discontinued due to majority of raw material sprayed with the same pesticides – query over any benefit of this task	Discontinued
Ozone trial	Prepared aliquot of pesticides diluted in 400l factory water and treated with 2ppm, 4ppm, and 6ppm of ozone. 004 VSL Pesticide Assessment & Analysis	Complete
Prevent and Limit	Pesticide risk matrix – assessment of pesticides with result above the LOD for surface water and ground water. Ozone treatment identified as a prevent and limit measure; harvest intervals being assessed to see if they can be extended; and removal of some pesticides from the approval list. 004 VSL Pesticide Assessment & Analysis	In Progress
Approved Pesticides	Devise a system to inform of changes to approved pesticides and how to address and new substances added to the list.	In Progress

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2 Introduction

Vitacress is one of Europe's leading suppliers of fresh produce, specialising in watercress, salads, and fresh herbs. Vitacress Salads Ltd (VSL) grow salad and watercress on its own farms in the UK, Portugal and Spain and trusted 3rd party suppliers supplement the year-round supply of salad leaves. The raw material is brought into the St Mary Bourne factory at Lower Link farm for washing, packing and distribution to UK supermarkets and customers.

2.1 Purpose of plan

This pesticide sampling plan forms part of the investigations for permit variation application for the site under current operating conditions. A permit variation for the site is required to upgrade the current discharge permit to the new environmental permit, and to re-assess the outputs of the VSL operation. The focus of this plan is on pesticides only, but other contaminants, water level monitoring and other factors will be addressed in the permit application.

This pesticide sampling plan sets out the initial sampling requirements for establishing what, if any, pesticides are present in the VSL factory wash water, which is discharged to the Bourne Rivulet via the eastern channel and to establish baseline conditions of the source water for salad washing. The plan is flexible and will be developed as sampling progresses and results are received. Once the required samples and analysis have been completed, a new plan will be written for the purposes of compliance monitoring in accordance with the new permit.

In addition, VSL will be taking samples for pesticide, chemical and nutrient analysis from other surface water and groundwater locations to gather information on water quality across the site. This further data will enable VSL to establish what external influences there are on the site and may be used to inform the permit application but is strictly outside of the remit of the pesticide sampling of the factory wash water.

2.2 Pesticide use and management

VSL can apply pesticides to all crops across its European and UK operations. The exception to this is UK watercress. No pesticides are applied directly to watercress on the UK farms and a fungicide that was used as a soil drench in propagation has now been withdrawn with the introduction of a full organic watercress propagation system in 2022. The pesticides used on farms are dependent on crop type. The Plant Protection Product List (PPPL) lists all pesticides approved for use at each farm and for each type of crop, but this does not mean that these will be used, only that they can be used.

VSL conducts food safety multi-residue screening tests for all known pesticides. The actual results are listed against the maximum residue level (MRL), which is a measure of 'Good Agricultural Practice'. The Global Gap and Red Tractor certification audits ensure compliance for the safe and legal use of pesticides on crops in the field as well as food safety and environmental considerations.

2.3 Pesticides and environmental requirements

Environmental limits for pesticides are different to those in food safety and drinking water. The MRL described above uses the Level of Detection (LOD) of 0.1µg/l. This can be too high for environmental screening of some pesticides in surface water and groundwater. As a result, VSL has developed this plan in consultation with the Environment Agency (EA) to test its factory wash water for pesticides listed for use on its farms and the farms of its suppliers, using 30% of the relevant environmental standard for that substance for surface water and groundwaters. The testing also includes the source water for washing.

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Level of Quantification (LoQ) refers to quantitative analytical techniques and the term LoD applies to scans, but for the purposes of this plan, the term analytical techniques will be used, and this will be taken to mean LoQ or LoD depending on which is appropriate.

3 PPPLs and food multi-residue screening

VSL can apply pesticides to all crops across its European and UK operations. The pesticides used are dependent on crop type. The Plant Protection Product List (PPPL) lists all pesticides approved for use at each farm and for each type of crop, but this does not mean that these will be used, only that they can be used. Food Experts SL will approve a PPPL which is submitted by the grower. The PPPL provides all relevant information on dose rate, number of applications and other specific information, some of which is environmental information. The PPPL also provides information on application and harvest intervals. Typically, most crops are sprayed with 3 to 7 different products. PPPLs are issued annually. Pesticides can be withdrawn from use at any time within that annual period under the legislative framework of the country in which the crop is grown. VSL will retain a complete list of actives in its records. Fera Food Science Ltd (the laboratory) will use analytical techniques to assess all pesticides that could be used on crop, regardless of them being on the current PPPL.

VSL conducts food safety multi-residue screening tests for all known foliar application pesticides. The actual results are listed against the maximum residue level (MRL). An MRL is a measure of 'Good Agricultural Practice', and it is VSL's aim to achieve less than 50% of the MRL in the finished produce. The Global Gap and Red Tractor certification audits ensure compliance for the safe and legal use of pesticides on crops in the field as well as food safety and environmental considerations. VSL also assesses its summer and winter suppliers, with regard to food safety, against, but not limited to, historic performance, volume of product and location.

4 Prevent and Limit

Prevent and limit measures will be recorded along with the complete list of actives discussed above and this information will be detailed in the permit application. It must be noted that any interventions must not adversely affect food safety or quality.

Prevent. VSL is working hard on its own farms and with suppliers to remove as many hazardous compounds as possible. Where possible, VSL will cease to use any of the pesticides listed as hazardous. This may be due to a pesticide being withdrawn from use or that VSL is able to grow commercial crops without it due to new alternative pest control methods being adopted. VSL will also seek to install an ozone treatment plant to remove hazardous compounds that may be present in factory wash water.

Limit. VSL will limit, where possible, the potential for non-hazardous pesticides being present on leaf, and entering the ground and surface waters, through modification of harvest intervals and changes in dose application. VSL is also looking at hazardous compounds in the same context. VSL will also seek to install an ozone treatment plant to remove non-hazardous compounds that may be present in factory wash water.

5 Pesticide Sampling Plan

Sampling for and analysis of the VSL list of pesticides will be conducted according to this sampling plan. Sampling will be carried out across a 12-month period, from January to December 2022, and will cover any potential seasonal variations in pesticide application, i.e., when certain pesticides are most likely to be used such as insecticides in spring and summer and fungicides in autumn; and when crops are mainly brought in from overseas or are mainly of UK origin. Once all sampling and analysis has been completed the list of pesticides for testing will be reviewed. Where a compound has not be identified following completed

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analysis over the 12 months, it will be removed from the sampling schedule, but only if it has been applied during the time period assessed. This will ensure that all pesticides can be accounted for. Measures will then be put in place to eliminate any pesticides that have been detected. Once these measures are in place further testing will be conducted under a revised sampling plan. Once the new permit has been approved an appropriate monitoring schedule will be agreed with the EA.

In consultation with the EA, VSL has developed this sampling and analysis plan. It is to be used in combination with the list of actives save in an Excel spreadsheet, which provides details on the pesticides used by VSL, the detection concentrations that the EA require the laboratory to meet, the laboratory capabilities, and prevent and limit measures in place. This includes all the relevant LoQs taken from the 'Copy of lowest PNEC values.xls' provided by the EA National Permitting Officer on 9th June 2021.

VSL will take samples from the source water for salad washing and the effluent directly discharged from the washing operation to establish what, if any, pesticides are being released because of the washing operation. VSL will also take other surface and ground water samples to understand pesticide presence and concentrations that may be due to external influences or legacy.

5.1.1 Seasonality

VSL will sample over a 12-month period from January 2022. Sampling will be carried out at a weekly frequency within three defined sample seasons resulting in 48 weekly samples per season (12 samples from each of the 4 sampling locations). These seasons are timed to ensure the best capture for pesticide application in the field.

- January to March (incl.) –3rd party supplier crops and likely time for insecticide and fungicide application
- June to August (incl.) – UK crops and likely time for insecticide application
- September to November (incl.) – UK and 3rd party supplier crops and likely time for insecticide and fungicide application.

5.1.2 Sampling stages

There will be four stages of sampling.

- Stage 1 – Passive sampling
- Stage 2 – Concentration testing
- Stage 3 – Passive sampling and / or concentration testing to test intervention success
- Stage 4 – Operational monitoring for permit conditions

Sampling will be carried out under current operating conditions to establish baseline conditions and impacts from existing operations (stages 1-3 above). Once this program of baseline sampling has been completed a draft sampling plan for operational monitoring will be prepared (stage 4). The number of samples and location of sampling points for stage 4 will be based on how the site is operated - see 4.3 Sample locations and rationale.

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5.2 List of pesticides

The table below list the pesticides currently approved for use on VSL crops. The list is taken from the VSL_Pesticide_Project_Database_Ver-3_10-21 - Pesticide List & LoQs (Appendix 1). This spreadsheet lists all pesticides that have been approved, whether they have been withdrawn or are no longer used.

Abamectin	Fosetyl-aluminium
Acetamiprid	Indoxacarb
Azadirachtin A	Lambda-Cyhalothrin
Azoxystrobin	Lenacil
Benfluralin	Mancozeb
Boscalid	Mandipropamid
Bupirimate	Metalaxyl -M
Chlorantraniliprole	Methoxyfenozide
Clomazone	Metrafenone
Cycloxydim	Napropamide
Cyflufenamid	Pendimethalin
Cymoxanil	Piperonyl butoxide
Cypermethrin	Pirimicarb
Cyprodinil	Propamocarb
Deltamethrin	Propamocarb hydrochloride
Difenoconazole	Propaquizafop
Dimethomorph	Propyzamide
Emamectin	Pymetrozine
Famoxadone	Pyraclostrobin
Fenhexamid	Pyrethrins
Fenpyroximate	Spinosad
Flonicamid	Spirotetramat
Fludioxonil	Tefluthrin
Fluopicolid	Thiacloprid
Fluopyram	Trifloxystrobin
Fluxapyroxad	

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5.3 Sample locations and rationale

This plan is specifically for pesticide sampling. Other water quality requirements will be discussed in a Hydrogeological Risk Assessment (HRA) and H1 surface water assessment, as appropriate for the permit application.

The sample locations described in this section have been selected for current operating conditions - the source water for washing and the direct discharge of the wash water; and for further sampling to assist VSL in understanding external influences on the site and potential legacy impacts to surface water and groundwater both upstream and downstream of the site. The Bourne Rivulet flows from north to south and groundwater follows the same general direction (see HRA for further detail), thus upstream locations are in the north and downstream are in the south.

For the purposes of this plan and to ensure the direct influence of the salad washing operation is captured, VSL will sample:

- The wash water source from the factory borehole in the Chalk Principal aquifer
- The direct factory wash water discharge

For the purposes of gathering data on external influences and potential legacy impacts to the site, VSL will sample:

- Groundwater from the Chalk Principal Aquifer and Secondary Aquifer River Terrace Deposits gravels up-hydraulic gradient and down-hydraulic gradient of the site.
- Surface water from upstream of the main operations and downstream of the site.

It is important to note that groundwater quality from the Chalk aquifer that provides water for the factory (BH1/BH2) shows exactly what is going into the factory and the factory water discharge shows what is leaving the factory. Any other data collected from other sampling points is supplementary to this plan and will be used to provide further understanding of the site.

The sample locations for current operating conditions are shown in 4.4 below. If wetlands or other interventions are put in place on site these sampling locations may be supplemented with additional pesticide sampling locations to monitor new potential points of discharge through ground and surface water, should this be required.

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5.4 Sample locations – Current Operating Conditions

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The table below provides further details on the sampling locations. Monitoring for other analytes and groundwater levels will be addressed in a Groundwater Monitoring Plan and an H1 Surface Water Risk Assessment with regard to the permit.

	Bottle label	**Sample ID**	**NGR**	**Description**	**Purpose**
Source water	BH1 BH2 BH14	BH1 or BH2	SU 42792 48965 SU 42817 49095 SU 42822 49131	Groundwater Principal chalk aquifer (active)	Used to measure pesticide background of the chalk aquifer water source for the factory to determine baseline of what is used in the factory. BH1 or BH2 or BH14 will be used depending on which one is pumping.
Factory discharge	Factory	Factory	SU 43003 48972	Process water	Factory discharge water pesticide background to be assessed against BH1 / BH2 and understand what if any pesticide outputs are present and in what concentrations.
Other groundwater	MW19-02	MW19-02	SU 42671 49608	Groundwater River terrace deposits	Up-hydraulic gradient of operations to provide representative of pesticide background of secondary aquifer.
	MW21-01	MW21-01	SU 43035 48958	Groundwater Principal chalk aquifer	Down-hydraulic gradient of operations used to monitor potential off-site migration of pesticides in the chalk aquifer south of the site.
	MW21-02	MW21-02	SU 43036 48959	Groundwater River terrace deposits	Down-hydraulic gradient of operations used to monitor potential off-site migration of pesticides in the secondary aquifer south of the site.
Other surface water	River US	River top of site	SU 42551 49520	Surface water	Water quality up-gradient of operations to monitor pesticide background entering from above the site.
	East	East	SU 43033 48985	Surface water	Water quality down-gradient of operations in the eastern channel discharge to monitor pesticide background exiting the site, and to identify any corresponding results with the factory samples.
Passive sampling and spot samples	Factory	Factory	SU 43003 48972	Process water	Chemchatcher® deployment out outlet from silt trap Spot bottle sample taken from direct output of process water to parabolic screens.
	East	East	SU 43033 48985	Surface water	Chemchatcher® deployment in eastern channel discharge point.
	River US	River top of site	SU 42551 49520	Surface water	Spot bottle sample taken from river at top of site and analysed using passive sampling analytical techniques.
	BH1 BH2	BH1 or BH2	SU 42792 48965 SU 42817 49095	Groundwater Principal Chalk Aquifer	Spot bottle sample taken from factory BH1 or BH2 sample tap and analysed using passive sampling analytical techniques.

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5.4.1 Sampling techniques

5.4.2 Passive sampling

Chemcatcher® passive sampler devices have been deployed at two locations: Factory outlet from silt trap (Factory) and the eastern channel EA discharge point (East) to determine the presence / absence of a suite of pesticides. The devices were deployed in duplicate for LC/MS and GC/MS screening. They were deployed for a period of three weeks in winter, spring, and summer to gather evidence representative of seasonal variation in produce washing. Bottle spot samples were also be taken from the river upstream of the operational a site, from the factory borehole (BH1), and once from the direct discharge from the factory for analysis using the same analytical techniques to determine background presence in surface waters entering the site, the source water used for washing produce, and the presence in the direct factory discharge. Analysis was carried out by the University of Portsmouth in a suitable laboratory.

Progress to date

In November 2019 VSL began pesticide screening of its wash water using Chemcatcher® passive sampling to establish whether the pesticides on its list were found in the discharge waters. Due to the seasonal variation in the origin and type of product that is washed, any potential presence of pesticides in the salad wash water will be in trace levels and may fluctuate over time.

Chemcatcher® devices were deployed for three weeks in the factory outlet channel and the eastern channel EA discharge sampling point in November 2019, March 2020, and July 2021. Bottled spot water samples were also collected in February 2020 from the factory borehole (BH1) to represent the baseline condition pre-factory washing, and the Bourne Rivulet (River US) entering the farm at the northern end of the site to represent a baseline condition of surface water entering the site; and in July 2021 with the addition of a sample taken from the direct factory discharge pipe.

The University of Portsmouth was commissioned to analyse the samples through Natural Resources Wales. Due to Covid restrictions the sampling programme was suspended, and it has taken over a year to obtain the analysis results of the November deployment and 18 months to obtain the results from the bottled samples.

- The November 2019 sampling identified 12 pesticides on the VSL list along with another 17 compounds not associated with VSL.
- The spot bottle samples of March 2020 identified no pesticides in the BH1 and three pesticides in the Bourne Rivulet not associated with VSL.
- The March 2020 sampling identified 12 pesticides on the VSL list along with another 12 compounds not associated with VSL.
- The July 2021 deployment and spot bottle sample results are due shortly.

All the results will help inform which compounds are most likely to be released from the washing operation and if any further analytical techniques are required.

The results of this sampling have been recorded in the 004 VSL Pesticide Assessment & Analysis.

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5.4.3 Concentration sampling

Surface water and groundwater samples will be taken for analysis of concentration of pesticides in the VSL factory water, surface water and groundwater. The factory water sample will be taken from a source discharging directly to the parabolic screens, and not after the silt trap as in the passive sampling, to reduce the chance of contamination from external sources. Any factory detections will be subject to further investigation.

Sampling and analysis over the 12-month period will use analytical techniques to assess all pesticides on the VSL list. These results will be compared to the results from the passive sampling. Pesticides identified in surface water that do not occur in the factory water will be recorded as not originating from VSL operations. Pesticides identified in groundwater that do not occur in factory water will be checked against past pesticide use to assess if they could have originated from VSL in the past. If they do not match VSL pesticide records they will be recorded as not originating from VSL operations. If they do match, then VSL will check to see if they are likely to be used again.

VSL will use UKAS accredited laboratories for both surface and ground water analysis. For surface water sampling, VSL will follow the instructions given by the laboratory regarding method collection, bottles and preservation, handling, storage, and transport.

Surface water and groundwater sampling will be carried out in accordance with laboratory instructions, and methodologies used by sampling contractors.

Samples will be collected using bottles stipulated by the chosen UKAS accredited laboratory. Each bottle will be labelled with date, time, and location of sample. The time and date information will be recorded to ensure VSL can carry out traceability with regard to the factory water samples.

A fully quantitative analysis of Abamectin, Cypermethrin, Deltamethrin, Fenpyroximate or Tefluthrin will be completed if they are detected by the passive sampling. To date these pesticides have not been detected.

5.4.4 Laboratories

Identifying a laboratory that has the capabilities and capacity to analyse water for pesticides at environmental LoQs has been very difficult. VSL has spent the best part of a year trying to identify a suitable laboratory but is yet to find one facility that can cover every requirement. Therefore, VSL is proposing to use the laboratory offering the most comprehensive analysis and the best fit for the situation. This will be FERA. At the time of writing, FERA is able provide the most comprehensive coverage – they can test for everything on the PPPL list but some of the analytical techniques will be short of the required LoQ / LoD. VSL will continue to work with the chosen lab and others to see if this can be improved.

FERA will use fully quantitative analysis for all compounds. The Solid Phase Extraction (SPE) method will be used prior to LCMS and GCMS. Details of the FERA methodology is in Appendix 3.

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5.5 Sampling Frequency

The table below provide details on sampling frequency for initial pesticide analysis for the permit variation and future monitoring for compliance. Other analytes and groundwater level monitoring are detailed in the Groundwater Monitoring Plan and H1 Surface water Risk Assessment.

Stage	**Water**	**Frequency for permit application and permit assessment**	**Notes**
1. Passive sampling and spot bottle sampling	SW GW	Passive samplers deployed for: 3 weeks in November 2019 3 weeks in March 2020 3 weeks in July 2021 Bottle samples taken: 13th February 2020 19th July 2021	Passive sampler deployment in the factory discharge and eastern channel discharge to establish presence / absence Nov 2019 completed and analysed. March 2020 completed and analysed Summer (2021) - awaiting results. Spot samples taken March 2020 from BH1 and River US - analysed. July samples to have additional factory sample from outlet directly to parabolic screens – awaiting results.
2. Concentration testing	SW GW	Weekly samples of **Factory, eastern channel, BH1/BH2, River U/S** 12 samples January to April 2022 12 samples May to August 2022 12 samples September to December 2022	Surface water samples and BH1 / BH2 will be taken weekly throughout each sample period. BH1 / BH2 are included to obtain baseline pesticide results that can be compared to the weekly factory results. The river u/s results will be collated to provide VSL with an understanding of external influences. SW – Tuesday each week at 8 to 8.30am
	GW	Monthly for 12 months **MW19-02, MW21-01, MW21-02**	Groundwater samples will be taken monthly for 12 months due to the slower movement of water. Results will be collated to provide VSL with an understanding of external influences and legacy. Scheduled for first week of each month. Sampling will take a day.
3. Passive sampling and / or concentration testing to test intervention success	SW GW	To be agreed if required	This sampling will take place once we establish if we have pesticides at unacceptable levels (Stage 1 and 2). If there is a concern, then VSL will propose interventions and then carry out this stage 3 sampling to assess the impact of the interventions. See section 5 of this plan.
4. Monitoring	SW GW	To be agreed if required	Pesticide sampling.

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5.6 Traceability

VSL will trial a traceability exercise. This will trace crops and associated spray records of the batch that was being washed at the time of sampling. Traceability can only take place once samples have been collected as the date and time of sampling is required to identify the batches washed. VSL will also record the factory production level at the time of sampling, although it must be noted that this is unlikely to vary as the factory operation is consistent. Traceability has proved to be unreliable due to the majority of raw material being sprayed with the same pesticides. To replace traceability, we consider it more significant to assess what pesticides are approved for use, why they are on the approved lists and whether they can be removed or modification to harvest intervals made. Please see Prevent and Limit Assessment in 004 VSL Pesticide Assessment & Analysis.

If any pesticides are detected in any other locations but not in the factory water, then these pesticides are not considered to be originating from VSL.

5.7 Recording and reporting

Pesticide sampling results and the Prevent and Limit assessment have been collated in 004 VSL Pesticide Assessment & Analysis.

Once the sampling programme is completed, the results will be shared with the EA as part of a permit variation. VSL will include an annual average and a maximum concentration for each substance identified.

6 Sampling plan outcomes and actions

On completion of all sampling, the results will be discussed with the EA. If no pesticides are detected at the levels required, then VSL will take no further action and continue to operate as normal. If pesticides are detected at the levels required, VSL will propose Prevent and Limit (004 VSL Pesticide Assessment & Analysis) interventions to address any concerns. These proposed interventions will be discussed with the EA as part of the permit application and stage 3 sampling will be agreed and take effect.

End.