Appendix 1: Project details

NOTES:

1. THIS PIPING GENERAL ARRANGEMENT IS PRELIMINARY AND MAY CHANGE DURING DETAILED ENGINEERING.
2. FOR TIE-IN SCHEDULE REFER TO 2321DG001_PLOT PLAN AND TIE-IN SCHEDULE_MAIN & CALCUTTA PWT & OIL TRAIN.

NEW EQUIPMENT LIST:

1. V-001 (FLASH DRUM)
2. 20-P-01A/B (CRUDE FORWARDING PUMPS)
3. U-03-20-X01A/B (CRUDE OIL HEATERS)
4. U-03-20-V03A/B (3-PHASE SEPARATOR)
5. U-03-20-V04A/B (EC COALESCERS)
6. 20-P04A/B (WASH WATER PUMPS)
7. U-03-20-B13 (STEAM BOILER)
8. U-03-20-X05 (CRUDE OIL COOLER)
9. 44-P03A/B (PW FORWARDING PUMPS)
10. 44-P02A/B (SKIM OIL FORWARDING PUMPS)
11. 20-P05A/B/C (PRE COALESCER FEED PUMPS)
12. U-03-44-V01A/B (PRE-COALESCERS)
13. 44-K01A/B (BACKWASH BLOWERS)
14. STORAGE TANK 9A
15. STORAGE TANK 9B
17. 20-P07A/B/C (CALCUTTA PW FORWARDING PUMPS)
18. U-03-44-V03A (DISSOLVED AIR FLOATATION)
19. U-03-44-V03B (DISSOLVED AIR FLOATATION)
20. 44-P08A/B (NSF FEED PUMPS)
21. 44-P07A/B (DAF RECIRCULATION PUMP)
22. U-03-44-V04A/B/C (NUTSHELL FILTERS)
23. U-03-44-T09 (SLUDGE TANK)
24. 44-P31A/B (SLUDGE FEED PUMPS)
25. POLYMER DOSING SYSTEM
26. DELETED
28. DELETED
29. DELETED
32. U-03-44-Z06 (SLOP OIL CENTRIFUGE)
33. U-03-44-T07 (OIL FILTRATE TANK)
34. U-03-44-P23A/B (OILY FILTRATE TRANSFER PUMPS)
35. U-03-44-T08 (RECOVERED OIL TANK)
36. 44-P24 (RECOVERED OIL TRANSFER PUMP)
38. U-03-20-V25 (VENT KO DRUM)
39. U-03-20-V26 (VENT STACK)
40. 03-01-T-001 (CFWKO1)
41. 20-P47A/B (VENT KO DRUM PUMPS)
42. U-03-44-T02 (SKIM OIL BUFFER TANK)
43. 30-02-P-008 (BOX SEPARATOR 1 SKIM WATER PUMP)
44. 30-02-P-007 (BOX SEPARATOR 2 SKIM WATER PUMP)

REUTILISED EQUIPMENT LIST:

- A 03-02-T-011 (SKIM TANK 1)
- B 03-02-GD-003A/B/C/D (PUMPS NORTH)
- C 03-02-T-008 (TANK 5)
- D 03-02-T-012 (TANK 11)
- E 03-01-T-002 (CFWKO2)
- F 03-02-T-007 (TANK 3)
- G 20-P06A/B/C (CALCUTTA CRUDE OIL FORWARDING PUMPS)
- H 03-02-T-009 (STORAGE TANK 4)
- I 03-02-T-010 (STORAGE TANK 6)
- J 03-02-H-003 (HFWKO3)
- K 03-02-T-017 (SKIM TANK 2)
- L 03-02-T-018 (SKIM TANK 3)
- M 03-02-T-021 (SLOP TANK 2)
- N 03-02-T-022 (SLOP TANK 3)
- O 03-02-KW-005/6 (SLOP OIL PUMPS)
- P 03-03-BS-001/002 (BOX SEPARATOR 1/2)
- Q 03-02-P005/6 (SUMP PUMPS)
- S 03-02-T-015 (STORAGE TANK 7)
- T 03-02-T-016 (STORAGE TANK 10)
- U 03-02-H-002 (HFWKO2)

SUEZ Water Technologies & Solutions
UNITED ARAB EMIRATES

DWG No.	2321DG202	REV. 0

REV.	DATE	REVISION RECORD	DR.	CK.	APPR.
0		ISSUED FOR INFORMATION	RDI		

STAATSOLIE MAATSCHAPPIJ SURINAME N.V.
STATEOIL COMPANY SURINAME N.V.

FACILITY: JOSI KREEK
SUBJECT: PIPING GENERAL ARRANGEMENT MAIN AND CALCUTTA PRODUCED WATER AND OIL TRAIN
PROJECT NR.: ENGINEER:
DWG. SCALE: NTS DWG. UNITS: m
DESIGNED BY: CHECKED:
DRAWN BY: RDI APPROVED:
DRAWING NUMBER: U-2103-M&P-DR-0001

Appendix 2: Corporate Environmental Policies and Standards

Appendix 2A: Health, Safety, Environment and Quality (HSEQ) Policy Staatsolie

HSEQ BELEID

Wij zijn sterk toegewijd aan gezondheid, veiligheid en een schoon milieu voor al onze werknemers, contractors en de gemeenschappen waarin wij actief zijn. Bovendien streven wij naar klanttevredenheid door voortdurende verbetering van onze producten en diensten.

Dit zal worden bewerkstelligd door naleving van de volgende principes:

WET- EN REGELGEVING
Voldoen aan alle toepasselijke wet- en regelgeving en standaarden, rekening houdende met de behoeften van onze stakeholders en de bedrijfsomgeving waarin wij actief zijn.

VEILIGE EN GEZONDE|WERKPLEK
Zorgdragen voor een veilige en gezonde werkplek en het beschermen van het milieu, door de kans op incidenten of onveilige omstandigheden te voorkomen of te minimaliseren. We zijn continu bezig met het identificeren, analyseren en evalueren van risico's, gevaren en milieu-aspecten, om deze effectief te beheren door middel van eliminatie of mitigatie.

EXCELLENTE PRESTATIES
Behalen van excellente prestaties op een veilige en verantwoorde manier, waarbij de medewerkers betrokken en geraadpleegd worden bij de ontwikkeling en implementatie van de HSEQ-processen. We houden onze medewerkers en contractors verantwoordelijk voor het naleven van de kernwaarden, het beleid en de procedures van Staatsolie.

OPTIMALISATIE VAN PROCESSEN
Continu verbeteren van onze HSEQ-prestaties en -managementsystemen door het optimaliseren van processen, diensten en de productkwaliteit. Middels procesmonitoring, periodieke evaluaties en geplande acties, realiseren we gestelde doelen en signaleren we kansen.

TRAINING
Zorgdragen dat elke werknemer en contractor goed getraind en bekwaam is om desbetreffende werkzaamheden uit te voeren conform de vereisten van het Staatsolie HSEQ-managementsysteem.

Oktober 2021
Annand Jagesar
Managing Director

Appendix 2B: stakeholder management procedure

Stakeholdermanagement Procedure

Versie: 3.0

Opgemaakt door Governance & Communication (G&C), Maart 2024

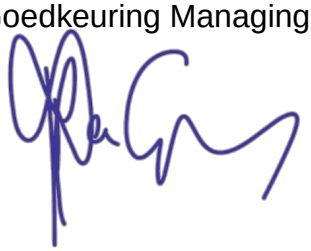
DOCUMENT MANAGEMENT

Door	Versie#	Goedgekeurd door	Datum van goedkeuring
Duncan Brunings/Steven Alfaisi	1	Rudolf Elias	30 April 2019
Steven Alfaisi/Nawien Debipersad/Monique Dinai	2	Annand Jagesar	27 Juli 2022
Steven Alfaisi/Dominique van Dijk	3	Annand Jagesar	

REVISIES

Revisie#	Revisiedatum	Belangrijkste redenen voor aanpasingen
1	Juli 2022	- Aanpassen van de stakeholderanalyse format & communicatiematrix naar geldende formats (QHSE als aandachtsgebieden, nadere toelichting op format toegevoegd) & update conform ISO 14001 & 45001 vereisten. - GOw2 en POC ook opnemen als dochtermaatschappij in dit document.
2	Oktober 2023	- Aanpassen van de naam van de nieuwe proces owner G&C - Aanpassen van de processtappen - Aanpassen van het Stakeholder Engagement Plan

Goedkeuring Managing Director



_____

Annand Jagesar

Datum van goedkeuring: 15 maart 2024

INHOUDSOPGAVE

1 ALGEMEEN

1.1. Inleiding en scope

Staatsolie heeft sinds 2016 een Corporate Communication (CC) beleid geïmplementeerd. Eén van de componenten van bovengenoemd beleid, nl. Stakeholdermanagement, wordt in dit document uitgewerkt. Dit document is van toepassing op Staatsolie en zijn dochtermaatschappijen GOw2, POC en SPCS.

1.2. Doelen

- Op een éénduidige wijze identificeren, analyseren, aangaan en onderhouden van gepaste relaties met de juiste stakeholders, zowel intern als extern.
- Het creëren van het gewenste imago door het opbouwen, behouden, bewaken en beschermen van de reputatie van Staatsolie.

1.3. Performance indicators

#	Performance Indicator	Target
1.	(Updated) stakeholderdatabase per directoraat en per project	Elk kwartaal updaten van de database per directoraat/asset (indien er sprake is van veranderingen) en gereed hebben projectstakeholderslijst tenminste 3 maanden voor projectstart.
2.	(Updated) Stakeholder engagement plan	Jaarlijks per directoraat/asset en tenminste 3 maanden voor een projectstart, Communicatieplan gereed en conform tijdsplan uitgevoerd.
3.	Tijdige communicatie met stakeholders	Tenminste 3 maanden voor aanvang fysieke activiteiten bij projecten en bij enkelvoudige activiteiten volgens plan, tenminste 2 weken van tevoren.

1.4. Verantwoordelijkheden en bevoegdheden

Functionaris	Verantwoordelijkheden	Bevoegdheden
Directie	Onderhouden van de relaties met stakeholders die onder hun directe verantwoordelijkheid vallen.	Goedkeuren, afwijzen of aanpassen stakeholder gerelateerde besluiten die onder betreffende directeurs verantwoordelijkheid vallen
Managers, Heads & Superintendents, overige medewerkers en contractors	– Onderhouden van de database. – Onderhouden van de relaties met stakeholders die onder hun directe verantwoordelijkheid vallen.	Managers zijn de eindverantwoordelijken voor het onderhoud van de database en het onderhouden van relaties met stakeholders, maar mogen deze bevoegdheid delegeren naar andere functionarissen bij hen in de organisatie.

1.5. Procesowner

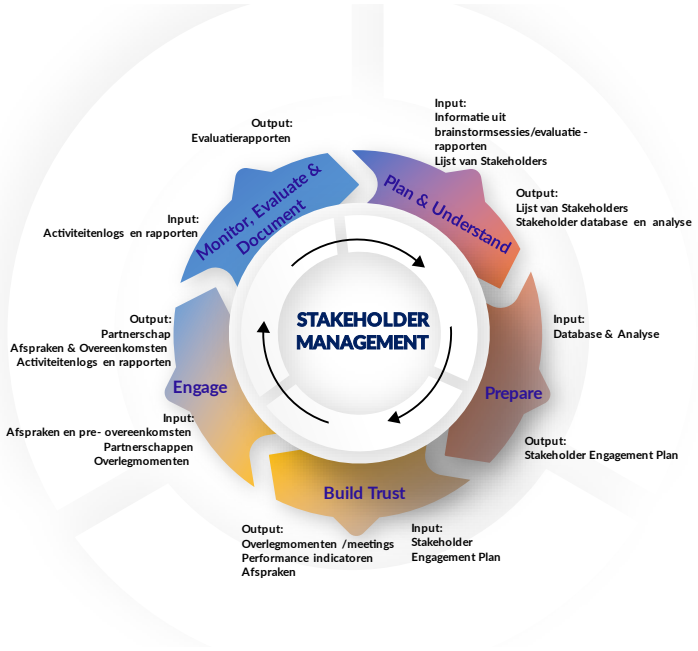
Manager Governance & Communication is de procesowner van deze procedure met de volgende verantwoordelijkheden:

- De effectieve werking in de praktijk conform de procedure en het houden van toezicht hierop;
- De implementatie van de procedure;
- Het aanpassen van de procedure en de goedkeuring hiervan;
- Het aandragen van voorstellen voor verbetering.

1.6. Referenties

- Corporate Communication Beleid
- Community Relations Policy
- Social Investment Beleid
- Social Media Policy
- Externe Klachtenprocedure
- Richtlijn stakeholdermeeting
- HSEQ Beleid
- ISO-standaarden
- Toegang Tot Terreinen & landacquisitie Procedure
- Database Staatsolie stakeholders

2 Stakeholder Management Proces



Noot: In het kader van dit proces, zijn het de functionarissen van en contractors bij Staatsolie die voorzien in de benodigde informatie en data. Tegelijkertijd zijn deze ook de ontvangers en gebruikers van de noodzakelijke producten en data uit dit proces.

3 Stakeholder Engagement Plan

Een Stakeholder Engagement Plan omschrijft strategieën hoe met de verschillende stakeholders van zelfstandige activiteiten, projecten en operaties van Staatsolie te communiceren en eventueel een relatie op te bouwen c.q. te onderhouden. Het doel is, om het risico te reduceren dat een stakeholder het project of de bedrijfsactiviteiten negatief kan beïnvloeden, terwijl de positieve invloeden van het project of bedrijfsactiviteiten en positieve opstelling van stakeholders ten opzichte van het project, worden gemaximaliseerd.

Door middel van aangegeven formats, onder andere, worden stakeholders met hun belangen, invloeden en behoeften in kaart gebracht en specifieke communicatiestrategieën en activiteiten worden daarvoor geformuleerd. De verschillende assets zijn verantwoordelijk voor het opstellen van dit plan, G&C ondersteunt de interne stakeholders, indien daartoe de behoefte bestaat.

Het Stakeholder Engagement Plan bevat minimaal de volgende hoofd– of sub-componenten:

a) Achtergrond
b) Omschrijving van het directoraat of project
c) Situatie analyse
d) Doelstellingen & middelen
e) Engagementstrategie
f) Stakeholders
g) Stakeholderanalyse
h) Stakeholder Engagement Matrix
i) Monitoring & Evaluatie
j) Budget

Ad. a) Achtergrond
Omschrijf de achtergrond waarbinnen het directoraat opereert of het project wordt uitgevoerd.

Ad. b) Omschrijving van het directoraat/project
Omschrijf de taak en doelstellingen van het directoraat of het project en omschrijf in algemene zin de typen stakeholders.

Ad. c) Situatieanalyse
Geef in een samenvatting aan in welke sociale en maatschappelijke environment het directoraat functioneert of het project zal worden uitgevoerd.

Ad. d) Doelstellingen, doelgroepen & middelen
Omschrijf de engagement doelen en list de doelgroepen en middelen in dit kader.

Ad. e) Engagement strategie
Beschrijf de toe te passen strategie, afhankelijk van de situatieanalyse en de stakeholderanalyse. De engagementmatrix komt hier aan de orde.

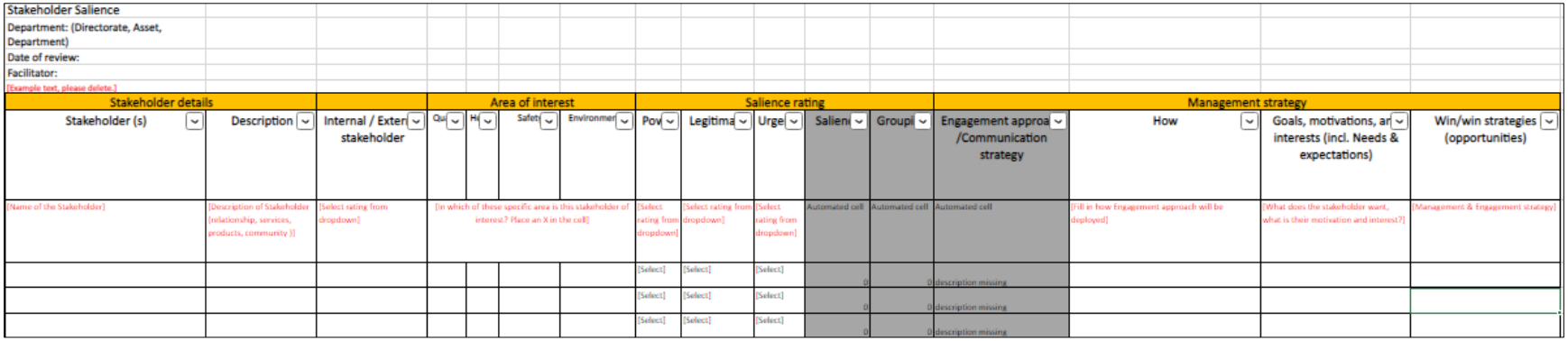
Ad. f) Stakeholders
Dit omvat een opsomming van bij het bedrijf, directoraat, divisie, project stakeholders.

Voorbeeld: Finance Directoraat

Intern	Extern
• RvC • Directie • CLA • HRM divisie(s) • Alle directoraten • Dochtermaatschappijen (GOw2, POC & SPCS)	• Gold Partners • Service Providers • External Auditor • Suppliers/ Contractors • Fiscale autoriteiten • Banken • Centrale Bank van Suriname • Crediteuren • Instituten (Publicaties) • Hoge overheidsfunctionarissen & instituten (Min EZ, Min Fin, Min NH, Min GB, Min ROM) • Deviezencommissie

Ad. f) Stakeholder analyse

Gebruik onderstaande format Stakeholder-Salience-Template_10_2021.xlsx om de resultaten van de stakeholder analyse vast te leggen. Identificeer de doelen en de win/win strategieën voor iedere stakeholder of stakeholder groep. G&C kan bij deze ondersteuning verlenen.



Stakeholder Salience

Department: (Directorate, Asset, Department)

Date of review:

Facilitator:

[Example text, please delete.]

Stakeholder details			Area of interest				Salience rating					Management strategy			
Stakeholder (s)	Description	Internal / External stakeholder	Qu	H	Safety	Environment	Pow	Legitima	Urge	Salien	Groupi	Engagement approa /Communication strategy	How	Goals, motivations, an interests (incl. Needs & expectations)	Win/win strategies (opportunities)
[Name of the Stakeholder]	[Description of Stakeholder (relationship, services, products, community)]	[Select rating from dropdown]	[In which of these specific area is this stakeholder of interest? Place an X in the cell]				[Select rating from dropdown]	[Select rating from dropdown]	[Select rating from dropdown]	Automated cell	Automated cell	Automated cell	[Fill in how Engagement approach will be deployed]	[What does the stakeholder want, what is their motivation and interest?]	[Management & Engagement strategy]
							[Select]	[Select]	[Select]	0	0	description missing			
							[Select]	[Select]	[Select]	0	0	description missing			
							[Select]	[Select]	[Select]	0	0	description missing			

Ad. g) Stakeholder Engagement Matrix

Gebruik onderstaande matrix om de engagement met de stakeholders met high salience te plannen. Leg alle geplande communicatie vast, ook als dat op dagelijkse of ad hoc basis dient te geschieden. Eventuele performance indicatoren dienen ook te worden vastgelegd, Dit zal de garantie bieden dat de engagement in dit kader efficiënt, effectief zal plaatsvinden en kan worden gemonitoord.

Stakeholder	Kanaal/medium	Strategie	Doel	Wanneer/Pl's	Verantwoordelijke

Ad. i en j) Monitoring, Evaluatie en Budget

Deze onderdelen spreken voor zich.

Appendix 2C: Risk Management Policy Staatsolie

Risk Management Policy & Procedure

Version: 4.0

Approval Board of Executive Directors, 24 October 2023

Managing Director, A. Jagesar_____

Governance & Communication
October 2023

Table of Contents

Abbreviations

BCM	Business Continuity Management
BCP	Business Continuity Plans
BIA	Business Impact Assessment
BoED	Board of Executive Directors
ERM	Enterprise Risk Management
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EWI	Early Warning Indicator
G&C	Governance and Communication
ISO	International Organization for Standardization
MOR	Major Operating Risk
NIMOS	National Institute for Environment and Development in Suriname
RAS	Risk Appetite Statement
RR	Risk Register

1.0 General

Introduction

As a state-owned company involved in the exploration, drilling, production, refining, marketing and transport of petroleum and petroleum-related products, as well as electricity generation, Staatsolie Maatschappij Suriname N.V. (Staatsolie) is exposed to a wide range of risks with the potential to impact health, safety, environment, reputation, community, legal and the financial performance of Staatsolie and thereby the achievement of our objectives.

Staatsolie has implemented an Enterprise Risk Management (ERM) system, based on ISO 31000, in order to manage risk by identifying, quantifying, prioritizing and mitigating it in order to satisfy our risk appetite and tolerance levels. Risk management is and will continue to be applied to our entire organization, at each division as well as to projects ≥ USD 250,000.

Risk assessments must be done for all projects, but for projects < USD 250,000 no formal reporting is required.

Objectives and scope

The integrated risk management process will guide Staatsolie in facing internal and external risks and influences that make it uncertain whether and when we will achieve our business objectives. The effect this uncertainty has on an organization's objectives is called a “risk”.

The purpose of risk management is the creation and protection of value. It improves performance, supports realizing objectives and encourages innovation.

The focus of risk management is to:

I. Monitor business activities to identify new or changing risks.
II. Understand and minimize the cost and other impacts of business activities.
III. Focus management attention on higher priority risks.
IV. Ensure risk-related decisions are made at the proper level of authority.
V. Communicate clearly about risks with the team and stakeholders.
VI. Maintain a clear and accurate record of risks over the life of a project.
VII. Development of integrated business continuity plans against the key assets and processes that can be adversely affected by risk(s).
VIII. Exercise of the business continuity plans (regular basis).

This procedure is also applicable to Staatsolie’s subsidiaries.

Process Performance Indicators

I. Review of all business Risk Registers by Process Owners at least once a year.
II. Reporting of risks and KRIs at least once a year.
III. Review of business continuity plans by Process Owners at least once a year.
IV. Exercise of business continuity plans at least once a year.

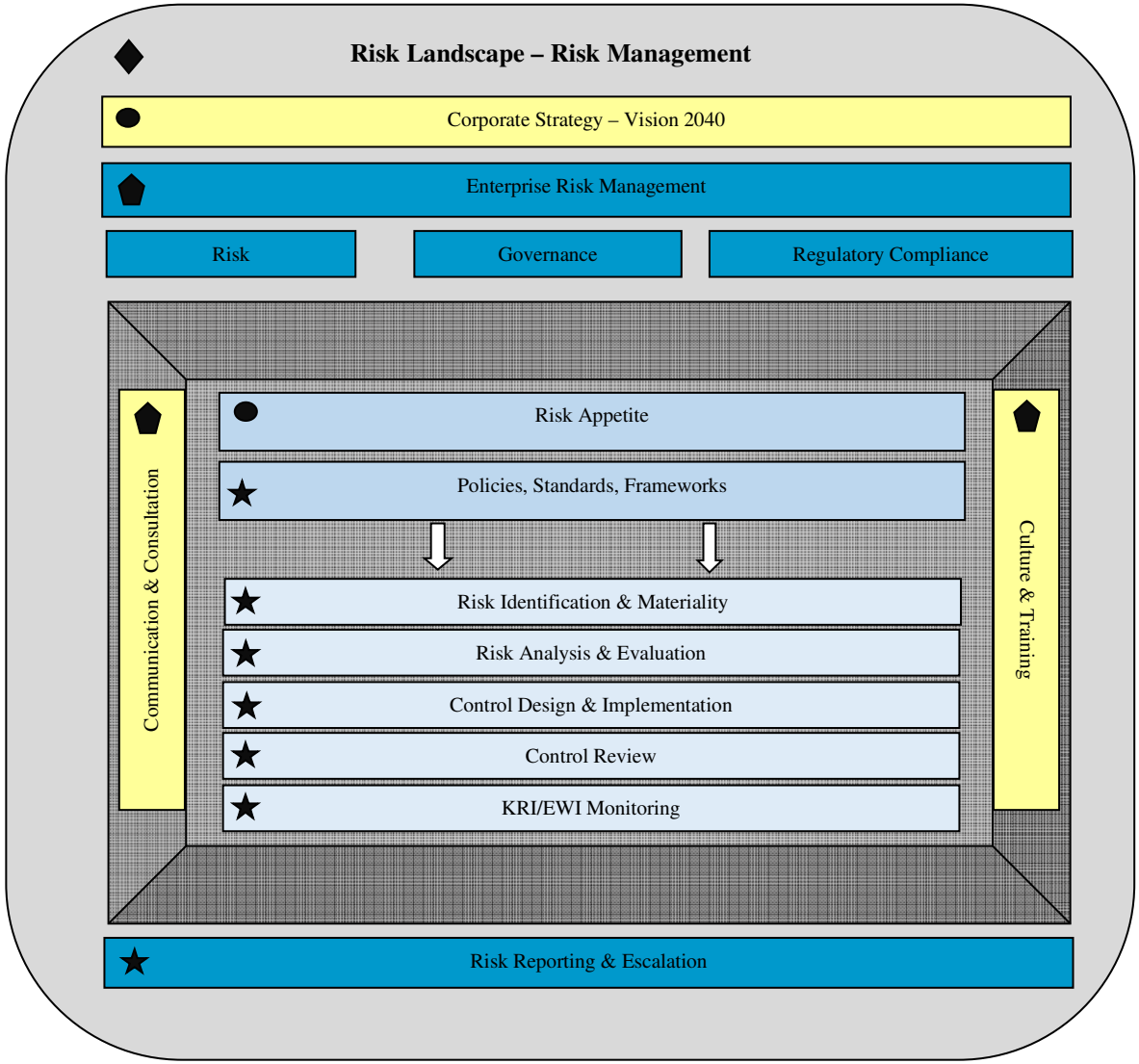
2.0 Policy: ERM Framework

Staatsolie's risk landscape outlines the integrated frameworks, processes and systems that are used to effectively identify, evaluate, mitigate, and monitor risks to facilitate the achievement of operational and strategic objectives.

Risk Strategy
Staatsolie's risk propensity, as outlined in the corporate RAS is driven by the overall corporate strategy and should facilitate achievement of these objectives.

Risk Management
Staatsolie's risk management frameworks, processes and systems facilitate the timely and effective identification, assessment and management of risk to ensure exposure of Staatsolie's risk is within the defined risk appetite.

Enabling Factors
To facilitate effective risk management processes, these key enablers require consideration to enhance the overall awareness and management of risk across Staatsolie to achieve Vision 2040 objectives.



3.0 Risk Management Procedure

3.1 Risk Appetite

Risk appetite can be defined as the amount and type of risk that an organization is willing to take in order to meet their strategic objectives. The current Staatsolie risk categories, in the Risk Appetite Statement (RAS), that could materially impact the achievement of Staatsolie's Vision 2040 are Health, Safety and Environment, Regulatory and Compliance, Reputation and Brand, Operational, People and Culture, Strategic, Financial and Market Forces, Investment and Capital Allocation.

Key Risk Indicators (KRIs), otherwise known as Early Warning Indicators (EWI), are metrics that provide information about an event that will have adverse effects on Staatsolie's objectives. KRIs help Staatsolie identify the risk exposure, assuring that the preventive steps can be taken to avoid negative outcomes or, at least, mitigate those negative effects. KRIs are determined annually in order to complement the qualitative risk appetite statements.
Monitoring of the KRIs is done quarterly and reported in G&C's PBI portal application.

The Risk Appetite Statement is available on the network:
Authorized > Governance & Communication > Enterprise Risk Management
Risk Appetite Statement.pdf

Staatsolie operates in a volatile and complex environment, and is therefore obliged to execute proactive, forward-looking identification and assessment of emerging and evolving risks. Horizon scanning provides a logical and pragmatic process to identify, assess, monitor, and manage emerging[1] and evolving[2] issues and trends to ensure the potential negative or positive impact on Staatsolie is managed in line with overall risk appetite.

Staatsolie's Horizon Scanning exercise is available on the network:
Authorized > Governance & Communication > Enterprise Risk Management
Staatsolie Horizon Scanning - Final Report - 2023.pdf

[1] An emerging risk is a risk that is newly identified or recognized and has the potential to have significant impact on an organization or society. These risks may arise from new technologies, social and demographic changes, geopolitical shifts, or other factors. Emerging risks can be characterized by not yet being fully understood and widely recognized across Staatsolie.

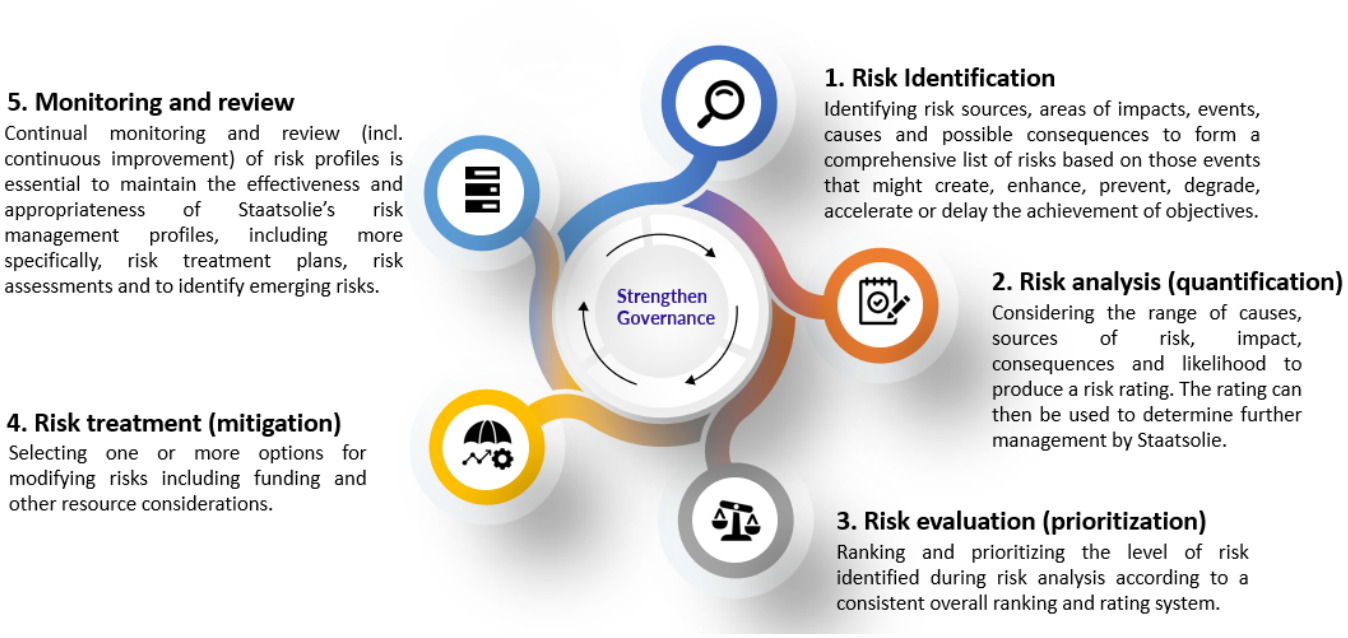
[2] An evolving risk is a risk that is known but continues to change in nature, frequency, or severity, requiring ongoing monitoring and adaptation. These risks may be driven by factors such as climate change, cyber threats, or regulatory changes, and may require new strategies or approaches to manage effectively.

3.2 Risk Management Process

The risk management process is built upon a sequence of continuous activities that results in a better understanding of the risks that Staatsolie is exposed to and what is being done to reduce or eliminate those risks.

The risk management process will enable conducting risk identification & review sessions. Staatsolie considers both external and internal factors when identifying and managing risks associated with the achievement of strategic and operational objectives.

The risk management process (iterative), including its sub-processes, is presented in the figure below:



For detailed guidelines regarding the sub-processes please refer to attachment 5.
The risk assessment is guided by the risk register template file, which is available in the PowerApps application; link: https://apps.powerapps.com/play/e/default-2f9af6da-fe0a-4993-9349-aa3800e7063f/a/8cc09c24-74e5-4ec8-b6a2-7b8c7b9c36ec?tenantId=2f9af6da-fe0a-4993-9349-aa3800e7063f&hint=60c4cf6a-1faa-4748-81f0-429a35767ad5&sourcetime=1698175917799.

Inherent to the Risk Management process is Business Continuity Management (BCM). BCM is the management process that oversees and implement strategies to address the risk of unexpected disruptions and minimizes the impact on business operations, assets and reputation. Disruptions can include fires/explosions, floods, workers strikes, pandemic, computer system hacked, supply chain cut-off, etc.
All Business Units/Assets must have in place Business Continuity Plans (BCPs) that includes a structure for response, continuity of operations, and return to business as usual.
In the risk register template the following is registered:
existent BCPs, when BCP was last stress-tested and BCPs in concept (incl due date to be finalized).

In addition, review of the assessments of insurance companies will be done by G&C every time new insurance contracts are concluded.

3.3 Types of risk assessments

Please find below the types of risk assessments executed within Staatsolie:

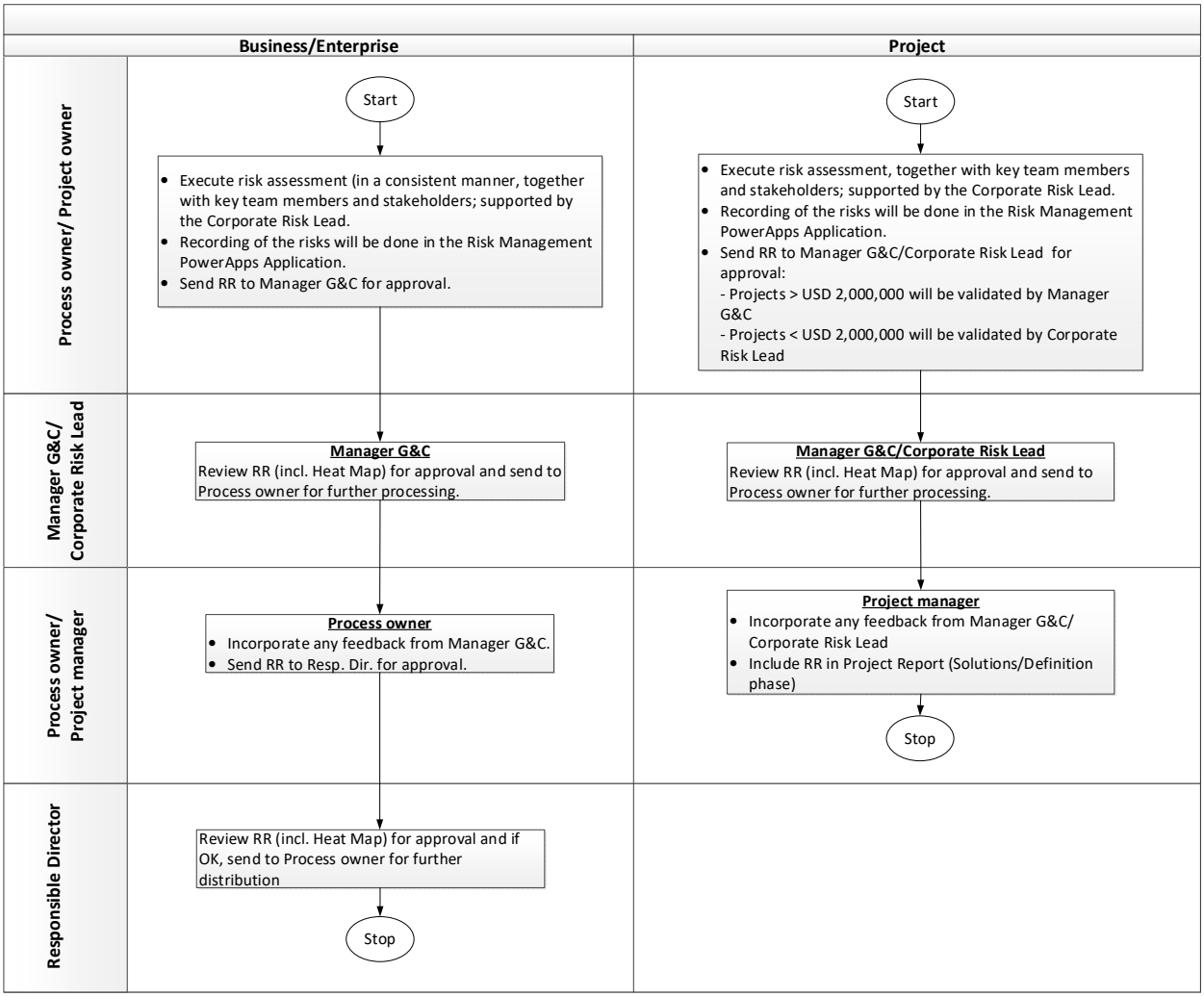
Type risk assessment	Owner	Description
Business[3]	Process Owners of Divisions/ Assets/ Directorates	Owner and stakeholders identify and assess risks and determine mitigation plans at least once a year based on their processes and/or objectives. In case of significant changes of the processes/objectives, the risk identification should be repeated. Process Owners of the divisions Supply Chain Management, Marketing and Treasury also assess fraud related risks and determine mitigation plans at least once a year.
Project	Project Managers/ Leads	Owner and stakeholders of projects ≥ USD 250,000 identify and assess project risks and determine mitigation plans during the different project phases. Risk assessment will include an evaluation of environmental factors, organizational culture and the project management plan including the project scope.
Major Operating (HSE) Risk[4]	Process Owners of Divisions/ Assets	HSE risks with potential catastrophic consequences, are called Major Operating Risks (MOR), and are identified in separate sessions that focus specifically on capturing those types of risks, then documented in the form of a MOR X-Matrix[5]. Procedure and supporting templates to be found at SP Authorized HSSE Upstream: Authorized > Onshore Directorate > HSSE Upstream > 04 Procedures and Guidelines > MOR Major Operating Risk (MOR) The high (MOR) risks, those with impact rating 4 and 5, must be included in the Asset/Directorate's risk register.
Environmental and Social Impact Assessment (ESIA)	Project Managers/	The Environmental and Social Impact Assessment (ESIA) process, which is executed by independent consultants, includes the identification and assessment of environmental and social risks. The process ensures compliance with relevant (local, national, international) legal and regulatory requirements and other commitments, and involves stakeholder engagement and consultation in the scoping, review, assessment and disclosure phase when ESIA results are discussed. The ESIA report and associated project-specific Environmental and Social Management Plan (ESMP) are reviewed and commented upon by the public and by NIMOS. After NIMOS' final advice, project execution can commence. The high risks, those with impact rating 4 and 5, must be included in the project's risk register.
Information Security Risk Assessment	ICT	Risk assessments serve as basis for developing and implementing an information security program. These risk assessments, executed by ICT, map the Business Impact Analysis (BIA). Based on the BIA rating the necessary security measures are implemented on that specific information asset. Additional measures are defined when the likelihood is also considered. Procedure and supporting templates to be found at SP Authorized ICT: Authorized > Managing Directorate > ICT Data Governance and Security Policies and Procedures_Attachment II_BIA Template.xlsx The high risks, those with impact rating 4 and 5, must be included in the Directorate's risk register.

[3] Not included in the ERM scope are HSE risk assessment at job level, the so-called Job Safety Analysis (JSA). A JSA is a procedure done to help integrate accepted safety and health principles and practices into a particular task or job operation while Risk Assessment is a systematic process of evaluating the potential risks that may be involved in a projected activity or undertaking.

[4] Currently for Upstream Operations

[5] The X-Matrix is a unique one-pager which provides an overview of the MOR, the critical barriers to control this risk, the critical activities that should ensure the integrity of mentioned barriers, plus the critical accountabilities.

3.4 ERM Process flowchart



Remarks:

- Risk Registers will be compiled per Asset/Directorate.
- Risk Mitigation will be done by process owners according to submitted due dates.
- Relevant high risks are presented/discussed in quarterly performance updates to BoED.
- Review of the Risk Register will be done annually or whenever changed business circumstances have occurred.

Attachment 1: Risk register template

Template available in the Risk Management PowerApps application.
An excel version is also available on SP: Authorized > Managing Directorate > Governance and Communication > Enterprise Risk Management

Attachment 2: Risk Rating Tables

A. IMPACT SCORE (1/2)

RATING		FINANCIAL	OPERATIONS		COMPLIANCE		STRATEGIC	
		Losses/write offs/exp.	**Operational Performance**	**Health & Safety**	**Environmental**	**Legal/Regulatory**	**Reputation/Community**	**Strategy**
5	**Severe**	>$50.0MM	Inability to achieve business objectives. Significant shutdown in operations, prolonged national blackouts. Extended shutdown of facilities, extensive damage to pipeline infrastructure.	Multiple fatalities or permanent disabilities. Occupational hygiene exposure with potential for multiple fatalities or disabilities.	National or international environmental catastrophe, severe sanctions, long term cleanup efforts. Environmental impact is local or regional and impossible to reverse	Severe breach of local or international laws and/or contracts and/or regulations, resulting in significant legal cases against Staatsolie/Directors and/or penalties and/or blacklisting, and/or loss of licenses and/or lawsuits and/or injunctions.	Loss of social license to operate: - Complete loss of stakeholder confidence – Market share potentially irrecoverable (i.e. >24 months). - Inability to establish new customers or manage existing relationships. - Adverse media coverage (social media and print). - Governmental intervention.	Inability to execute strategy; disintegration of Staatsolie or one or more of its subsidiaries. Potential acquisition or bankruptcy.
4	**Major**	$20.0 MM - $50.0MM	Significant delays (~12 Months) and slight variation of the achievement of business objectives Extended stoppage in operations, damage to facilities resulting in shutdowns.	Permanent disability, serious chronic long-term effects or single fatality. Multiple medical treatment injuries. Multiple restricted workday cases. Multiple loss time injuries (LTIs).	Extensive environmental damage, regulator investigations & fines, extended cleanup efforts. Environmental impact is local or regional and difficult to reverse.	Major breach of local or international laws and/or regulations, resulting in fines imposed, major complaints with warning of litigation.	Serious public outcry: - Extensive decrease of stakeholder confidence – Market share recovery long term (i.e. 12-24 months). - Increased difficulty in customer relationship management. - Stakeholder comments in print and social media.	Severe problems with strategy execution, company and subsidiary consistency and development. Significant financial restructuring.
3	**Moderate**	$2.5 MM - $20.0MM	Moderate delays (~6 Months) and slight variation of the achievement of business objectives. Temporary shortfall in production or temporary stoppage, damage to facilities and equipment.	Medical treatment injury. Restricted workday case. Single loss time injury (LTI), hospitalization. No chronic long-term effects.	Moderate environmental impact resulting in regulatory directives and limited cleanup efforts. Environmental impact is regional and easily reversible.	Moderate breach of local or international laws and/or regulations, resulting in written reprimand from regulators, written complaints and no fine imposed.	Heightened concern from community: - Noticeable decrease of stakeholder confidence – Market share recovery mid-term (i.e. 6-12 months). - Media coverage preventable through good public relations and customer relationship management.	Notable deceleration of strategy execution or development. Significant change to Strategic Plan.

A. IMPACT SCORE (2/2)

RATING		FINANCIAL	OPERATIONS		COMPLIANCE		STRATEGIC	
		Losses/write offs/exp.	**Operational Performance**	**Health & Safety**	**Environmental**	**Legal/Regulatory**	**Reputation/Community**	**Strategy**
2	**Minor**	$500k - $2.5 MM	Small potential delays (~3 Months) on the achievement of business objectives. Production shortfall resulting in minor delivery shortfall or brief stoppage.	First aid treatment.	Minor environmental impact, low level regulator response. Environmental impact is local and easily reversible.	Minor breach of local or international laws and/or regulations, resulting in verbal reprimand from regulators, verbal complaints.	Minor adverse public attention and complaints: - Minimal decrease of stakeholder confidence. Market share recovery short term (i.e. < 6 months) - Limited negative feedback in social media or print media.	Minor impact on strategy execution. Minor adjustments to operating plans and execution.
1	**Low**	<$500k	Immaterial impact on the achievement (<1 Month) on the achievement of business objectives. Negligible impact to operations, inconsequential reduction in production capacity.	No /slight injury – no treatment required	Environmental impact is local and considered as negligible*. **negligible: not worth considering/ minimal*	Negligible breach of local or international laws and/or regulations, recognized internally, unlikely regulatory response, no complaints.	Individual local complaints: - Little to no loss of stakeholder confidence and no effect on customer relationship management. - No negative media coverage.	Limited impact to Staatsolie.

B. LIKELIHOOD SCORE

Likelihood		Quantitative measure	Qualitative measure
5	Almost certain	>75% likely for the incident to occur within 12 months	Expected to occur within 12 months
4	Likely	50-74% likely for the incident to occur within 12 months	Probably will occur within 12 months
3	Possible	35-49% likely for the incident to occur within 12 months	Might occur within 12 months
2	Unlikely	10-34% likely for the incident to occur within 12 months	Could occur within 12 months
1	Rare	<10% likely for the incident to occur within 12 months	Not expected to occur within 12 months

C. RISK SCORE

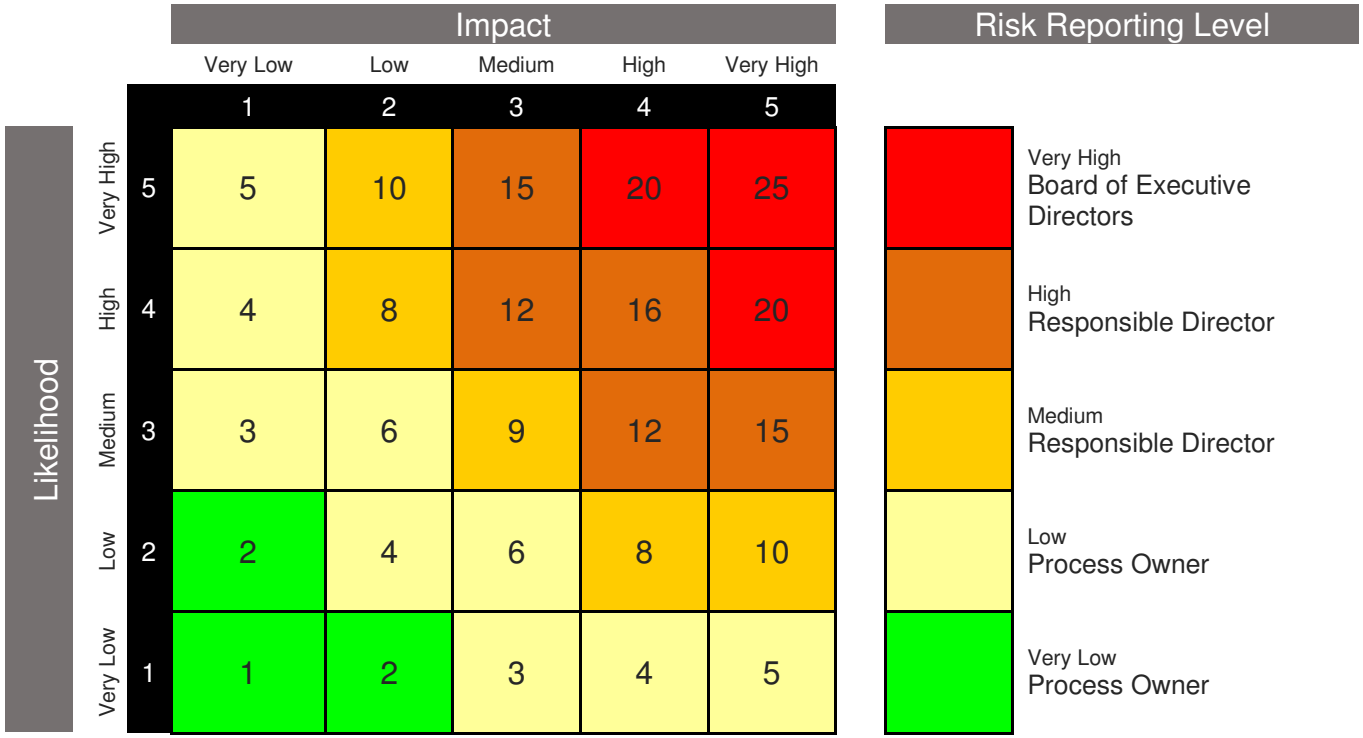
Risk Score = Impact X Likelihood

Maximun score = 25

Minimun score = 1

Attachment 3: Heat Map

RISK RATING MATRIX



Attachment 4: Roles and responsibilities

Functionary	Responsibilities	Authorities
BoED	Endorses and promotes the risk management process.	– Determines the risk appetite for Staatsolie.
Manager G&C	– Process Owner of the Risk Management Procedure – Ensures that the overall risk management procedure is effective and relevant and being applied to Staatsolie enterprise–wide. – Evaluates the process on a regular basis to ensure its continuing value adding contribution to the organization. – Gives advice related to risks including the prioritization of risks and what actions are to be taken to manage the risks. – Monitors that risks that have been escalated to the BoED have been managed.	
Corporate Risk Lead	– Facilitates Process Owners in the process of risks assessment and risk treatment. – Monitors validity of Risk Register (RR). – Reports enterprise[6] risks to BoED and Audit & Risk Committee biannually. – Ensures integrated Business Continuity Plans are developed for key assets and processes and progress is reported to BoED. – Monitors validity of Business Continuity Plans.	
Process Owner	– Ensures that risk assessments are conducted for all processes as well as projects ≥ USD 250,000 and the actions to address the risks are implemented. – Ensures that risks that cannot be adequately managed by the Process Owner, are escalated to the Responsible Director. – Monitors that risks that have been escalated to the Responsible Director have been managed. – Ensures that risk mitigation actions are done according submitted due date. – Reviews risk registers at least annually or whenever changed business circumstances (internally and externally) have occurred. – Assesses work processes and controls related to these risks (control self-assessment). – Ensures integrated Business Continuity Plans are kept up to date and remain valid. – Ensures Business Continuity Plans are stress tested at least once per year.	
Responsible Director	– Endorses and promotes the Risk Management and BCM process. – Ensures resources are provided to implement Risk Management. – Monitors that risks that have been escalated to the BOED have been managed.	Approves the Risk Registers of their respective directorate.

[6] An enterprise risk is a high level risk which can have a negative impact on the organization's strategy and the achievement of the strategic goals on short/medium term; these risks are not necessarily related to one (specific) business process.

Attachment 5: Guidelines for risk identification, rating, mitigation and escalation

A. Guidelines for Risk identification

Comprehensive identification is critical, because a risk that is not identified will not be included in further analysis.

- For business and enterprise risk assessments: risk identification should seek to establish vulnerabilities introduced by employees, internal processes and systems, contractors, regulatory authorities and external events that can hamper daily operations, people doing their job, optimal revenue stream.
- Risk identification should be an embedded continuous process to identify new and emerging risks and consider shifts in known risks. Risk identification should be repeated when changes occur, or at least once a year, to identify new and emerging risks.
- For project risk assessments: project risks impacting workforce, required capital, opex, HSE (needs to be mentioned in project RR) should be identified for all major projects, covering the whole lifecycle and for long term projects, the project risk register should be reviewed during every new project phase to identify new and emerging risks.
- Identification should include risks whether their source is under the control of the organization or not, even though the risk source or cause may not be evident.
- All significant causes and consequences should be considered.
- People with appropriate knowledge should be involved in identifying risks.

For a comprehensive outcome of risk identification, the following can be considered as guidance.

Take the following into consideration when evaluating internal risks:	**Take the following into consideration when evaluating external risks:**
– Governance, organizational structure, roles and accountabilities. – Policies, procedures, objectives, and the strategies that are in place to achieve them. – Capabilities, understood in terms of resources and knowledge (e.g. capital, time, people, processes, systems and technologies). – Information systems, information flows and decision-making processes (both formal and informal). – Relationships with, and perceptions and values of, internal stakeholders and the Staatsolie's culture. – Standards, guidelines and models adopted by the organization. – The form and extent of contractual relationships.	– The social, legal, regulatory, financial, technological, economic, natural and competitive environment, whether international, national, regional or local. – Key drivers and trends impacting on the objectives of the organization. – Relationships with, and perceptions and values of, external stakeholders.

B. Guidelines for Risk rating

Risk rating is the process of risk analysis (quantification) and risk evaluation (prioritization).

- Risk rating provides an input to risk evaluation and to decisions on whether risks need to be treated, and on the most appropriate risk treatment strategies and methods and the priority for mitigation implementation.
- Risk rating can also provide as input into making decisions where choices must be made and the options involve different types and levels of risk.
- Risk rating involves consideration of the causes and sources of risk, their negative consequences, and the likelihood that those consequences can occur.
- Risk is rated by determining consequences and their likelihood, and other attributes of the risk.
- An event can have multiple consequences and can affect multiple objectives.
- Existing controls and their effectiveness and efficiency should be considered.
- The way in which consequences and likelihood are expressed and the way in which they are combined to determine a level of risk should reflect the type of risk, the information available and the purpose for which the risk assessment output is to be used.
- Consequences can be expressed in terms of tangible and intangible impacts.

C. Guidelines for Risk mitigation

Risk mitigation involves selecting one or more options for modifying risks, and implementing those options.

- Once implemented, mitigation provides or modifies the controls.
- Risk mitigation involves a cyclical process of assessing a risk mitigation, deciding whether residual risk levels are tolerable, if not tolerable, generating a new risk mitigation, assessing the effectiveness of that mitigation.
- Risk mitigation options are not necessarily mutually exclusive or appropriate in all circumstances. The options can include the following:
    - Accept: No action is taken to change the severity of the risk. This response is appropriate when the risk to strategy and business objectives is already within risk appetite. Risk that is outside the entity's risk appetite and that management seeks to accept will generally require approval from the board or other oversight bodies.
    - Avoid: Action is taken to remove the risk, which may mean ceasing a product line, declining to expand to a new geographical market, or selling a division. Choosing avoidance suggests that the organization was not able to identify a response that would reduce the risk to an acceptable level of severity.
    - Pursue: Action is taken that accepts increased risk to achieve improved performance. This may involve adopting more aggressive growth strategies, expanding operations, or developing new products and services. When choosing to pursue risk, management understands the nature and extent of any changes required to achieve desired performance while not exceeding the boundaries of acceptable tolerance.
    - Reduce: Action is taken to reduce the severity of the risk. This involves any of myriad everyday business decisions that reduces risk to an amount of severity aligned with the target residual risk profile and risk appetite.
    - Share: Action is taken to reduce the severity of the risk by transferring or otherwise sharing a portion of the risk. Common techniques include outsourcing to specialist service providers, purchasing insurance products, and engaging in hedging transactions. As with the reduce response, sharing risk lowers residual risk in alignment with risk appetite.

      Each of these options requires developing a plan that is implemented and monitored for effectiveness.
- Selecting appropriate risk treatment option involves balancing the costs and efforts of implementation against the benefits derived, with regard to legal, regulatory, and other requirements such as social responsibility and the protection of the natural environment.
- When decisions are taken, risks which can warrant risk mitigation that is not justifiable on economic grounds, e.g. severe (high negative materiality/impact) but rare (low likelihood) risks, should be taken into account.
- Risk mitigation plans formally document how the chosen mitigation options will be implemented.

- Decision makers and other stakeholders should be aware of the nature and extent of the residual risk after risk treatment.
- The residual risk should be documented and subjected to monitoring, review and, where appropriate, further mitigation.

D. Guidelines for Risk escalation

Risks should be escalated when the following conditions exist:

- The risk score is between 10 and 25; the risk reporting level shifts to the Responsible Director of the BoED (see attachment 3, the Heat Map).
- Addressing a risk requires actions that are beyond the authority level of the group.
- The risk cuts across multiple groups and/or addressing the risk requires cross-functional collaboration.
- Addressing a risk requires corporate changes (changes to corporate policies).
- The risk could impact the rest of the organization (risks that could negatively impact the reputation of Staatsolie).
- Managing the risk entails financial/human capital beyond the existing capital of the unit.
- When a risk is escalated, the escalating group must indicate the specific actions that it is asking the receiving group to take regarding the risk.
- In addition to escalating the risk the escalating group shall initiate discussions with the receiving group to ensure a timely and adequate response.

Attachment 6: Glossary

A common risk language has been established for purposes of enhancing consistency and clarity in the ongoing dialogue concerning risk.

Consequence	Outcome of an event affecting objectives. NOTE 1 : An event can lead to a range of consequences. NOTE 2 : A consequence can be certain or uncertain and can have positive or negative effects on objectives. NOTE 3 : Consequences can be expressed qualitatively and/or quantitatively. NOTE 4 : Initial consequences can escalate through knock-on effects.
Control	Measure that is modifying risk NOTE 1 : Controls include any process, policy, device, practice, or other actions which modify risk. NOTE 2 : Controls may not always exert the intended or assumed modifying effect.
ERM framework	ERM framework refers to a structured, standardized and integrated approach to enterprise risk management that is used by Staatsolie to identify, assess, monitor, and mitigate risks across all its operations and functions
Event	Occurrence or change of a particular set of circumstances NOTE 1 : An event can be one or more occurrences, and can have several causes. NOTE 2 : An event can consist of something not happening. NOTE 3 : An event can sometimes be referred to as an "incident" or "accident". NOTE 4 : An event without consequences can also be referred to as a "near miss", "incident", "near hit" or "close call".
Level of risk	Magnitude of a risk, expressed in terms of the combination of consequences and their likelihood.
Likelihood	Chance of something happening NOTE 1: In risk management terminology, the word "likelihood" is used to refer to the chance of something happening, whether defined, measured or determined objectively or subjectively, qualitatively or quantitatively, and described using general terms or mathematically (such as a probability or a frequency over a given time period). NOTE 2: The English term "likelihood" does not have a direct equivalent in some languages; instead, the equivalent of the term "probability" is often used. However, in English, "probability" is often narrowly interpreted as a mathematical term. Therefore, in risk management terminology, "likelihood" is used with the intent that it should have the same broad interpretation as the term "probability" has in many languages other than English.
Monitoring	Continual checking, supervising, critically observing or determining the status in order to identify change from the performance level required or expected NOTE: Monitoring can be applied to a risk management framework, risk management process, risk or control.
Risk	ISO 31000 - Effect of uncertainty on objectives. NOTE 1 : An effect is a deviation from the expected — positive and/or negative. NOTE 2 : Objectives can have different aspects (such as financial, health and safety, and environmental goals) and can apply at different levels (such as strategic, organization-wide, project, product and process). NOTE 3 : Risk is often characterized by reference to potential events and consequences, or a combination of these. NOTE 4 : Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood of occurrence. NOTE 5 : Uncertainty is the state, even partial, of deficiency of information related to, understanding or knowledge of an event, its consequence, or likelihood.
Risk analysis	Process to comprehend the nature of risk and to determine the level of risk NOTE 1 : Risk analysis provides the basis for risk evaluation and decisions about risk treatment. NOTE 2 : Risk analysis includes risk estimation.
Risk appetite	Amount and type of risk that an organization is prepared to pursue, retain or take.
Risk assessment	Overall process of risk identification, risk analysis and risk evaluation.

Risk evaluation	Process of comparing the results of risk analysis with risk criteria to determine whether the risk and/or its magnitude is acceptable or tolerable NOTE: Risk evaluation assists in the decision about risk treatment.
Risk identification	Process of finding, recognizing and describing risks NOTE 1 : Risk identification involves the identification of risk sources, events, their causes and their potential consequences. NOTE 2 : Risk identification can involve historical data, theoretical analysis, informed and expert opinions, and stakeholder's needs.
Risk management	Coordinated activities to direct and control an organization with regard to risk.
Risk management process	Systematic application of management policies, procedures and practices to the activities of communicating, consulting, establishing the context, and identifying, analyzing, evaluating, treating, monitoring and reviewing risk.
Risk Rating	A rating based on the Level of Risk (based on the consequence and likelihood) and the Time to Impact.
Residual risk	Risk remaining after risk treatment NOTE 1 : Residual risk can contain unidentified risk. NOTE 2 : Residual risk can also be known as “retained risk”.
Risk treatment	Process to modify risk NOTE 1 : Risk treatment can involve: – avoiding the risk by deciding not to start or continue with the activity that gives rise to the risk; – taking or increasing risk in order to pursue an opportunity; – removing the risk source; – changing the likelihood; – changing the consequences; – sharing the risk with another party or parties (including contracts and risk financing); and – retaining the risk by informed choice. NOTE 2 : Risk treatments that deal with negative consequences are sometimes referred to as “risk mitigation”, “risk elimination”, “risk prevention” and “risk reduction”. NOTE 3 : Risk treatment can create new risks or modify existing risks.

Appendix 2D: List of Applicable /Procedures/ guidelines and plans

Listing of applicable Procedures/guidelines

GFI No/ Procedure/plan	Subject	Scope
Section 1 ADMINISTRATIVE		
-Handbook	Security Handbook	This instruction outlines the security rules and regulations applicable to the Saramacca Operations for the different groups concerned.
Procedure HSSE-G-Routine Safety Talks	Routine Safety Talks. English/Dutch	This instruction formalizes the dissemination of information through regular meetings, approximately ten minutes long, commonly called "Toolbox Meetings" or "Safety Talks".
General Field Instruction 106	HSE and Security Induction for New Arrivals. English	This instruction describes the management of the system that controls HSE and Security Induction through which every new arrival is made familiar with the company's health, safety, environmental and security requirements as they relate to the activity that they are about to undertake.
HSEQ Incident Management procedure	Incident Reporting and Investigation English	This instruction details the process for investigation according to the incident type in accordance with Staatsolie policy and legislation. This will help to control further losses of human and material resources by identifying and correcting unsafe acts and conditions that can lead to an incident.
General Field Instruction 119C	Personal Protective Equipment and Dress Code. English/Dutch	This GFI identifies the most common types of personal protective equipment for the various locations on the Saramacca Field.
-Procedure	General traffic rules. English/Dutch	This procedure defines the general traffic rules to guide the performance of company employees, contractor's employees, and visitors while on company roads. It also defines rules for the behavior of drivers of company owned and rented vehicles on public roads.
Procedure ISoW	Procedure Integrated System of Work English	This procedure enables all Staatsolie and contractor employees to systematically manage operating risks by adhering to the elements of the Integrated system of Work.
Guideline	Guidelines for Departmental HSE Teams. English	This guideline outlines the terms of reference and composition of the Departmental HSE Teams which are intended to assist the departmental head in the execution of the departmental HSE program and to achieve workers participation.
–Corporate Contractor Health, Safety and Environmental Management procedure	Corporate Contractor Health, Safety and Environmental Management procedure English	This procedure provides instructions with the objective to prevent harm to people and the environment and damage to equipment / properties as a result of works carried out by Contractors

Section 2 JOB SAFETY INSTRUCTIONS		
Procedure HAZCOM	Hazard Communication Procedure. English	The purpose of this procedure is to ensure that information regarding the hazards associated with all chemicals used on Staatsolie Upstream's premises is readily available to all personnel and that the health and physical hazards from chemical products used in the workplace are identified. It provides the information necessary for personnel to protect themselves from exposure to hazards associated with chemicals and to have the information necessary to minimize the consequences if exposure were to occur.
Procedure PTW	Permit to Work (PTW)	This procedure describes the management system managing work activities that have inherently higher risks or unique aspects that could lead to a higher level of risk than routine or daily work activities. It is supported by other procedures and processes to regulate all work activities and manage risk.
Procedure MOC	Management of Change Procedure English	This procedure manages all proposed changes that might have adverse economic, health and safety or environmental consequences within the Upstream Operations, by defining the steps used to identify and manage change-associated risks and their effects within the operations.
Procedure Abrasive Blasting	Abrasive Blasting Procedure. English/Dutch	This procedure provides guidelines for the protection of personnel engaged in abrasive blasting and others who may be in the surrounding areas where abrasive blasting is conducted.
Procedure Spray Painting	Spray painting Procedure. English/Dutch	This procedure provides guidance for the safe use of spray painting whereby care must be taken to protect the workers involved, other personnel in the vicinity, nearby equipment and the environment.
Housekeeping	Housekeeping Guidelines English	This guideline provides guidance to employees to ensure that proper housekeeping is maintained.
Procedure Safety Color Codes	Safety Color Codes Procedure	This procedure establishes the requirements for a uniform visual system for marking potential hazards and provides an effective means of communicating hazard information to the employees & contractors, in order to reduce the likelihood of injury from potential hazards in the work environment. It defines the color codes of signs, tags and barricades to be used in controlling exposure to potential hazards and specifies requirements for design uniformity to promote employee's recognition and avoidance of hazards.
Section 3		

EMERGENCY RESPONSE		
Emergency Response plan	Emergency Response Plan Upstream Saramacca	This plan describes the procedure that needs to be followed when an emergency situation at the Staatsolie Saramacca Location turns up.
Section 4 ENVIRONMENT PROTECTION		
Waste Management Plan	Waste Management Plan Onshore	This plan provides guidance for solid waste handling and disposal requirements for waste listed in the appendix of this field instruction.

Appendix 2E: Method Statement

SOM DEPARTMENT:…… **DATE:**……

PROPOSED ACTIVITY (give title of method statement and reference to Environmental specification):

WHAT WORK IS TO BE UNDERTAKEN (give a brief description of the works):

WHERE ARE THE WORKS TO BE UNDERTAKEN (where possible, provide an annotated plan and a full description of the extent of the works):

START AND END DATE OF WORKS FOR WHICH METHOD STATEMENT IS REQUIRED:

Start Date:	End Date:

HOW ARE THE WORKS TO BE UNDERTAKEN (provide as much detail as possible, including annotated maps and plans where possible):

In case on private land: include signature of owner/user to show that he/she is aware

Please attach extra pages if more space is required

Appendix 2F: Weekly Checklist

To be submitted to the HSSE-U Division

Location:

Mitigation measure	Compliance Yes/No	Responsible	Remarks
General			
A copy of the following documents is available onsite: EMMP, WMP, OSRP and ERP			
A traffic management plan is developed and implemented			
All personnel on site are aware of the contents of the EMMP and were made aware of environmental issues			
All personnel on site are aware of the ERPs (spill response, medevac, fire contingency plan)			
Have any ER drills been held?			
MSDS's are available for all hazardous substances on site			
All equipment is regularly maintained and is kept in optimum condition.			
All equipment has been certified			
Oil spill response			
Fuel is stored in tanks within a bunded area (with 110% of the stored fuel volume)			
All containers and storage tanks are leaking proof			
Are there spills or leakages?			
Drip trays are being used where there is a risk of spillage (i.e. fueling of equipment).			
Spill response equipment and materials are present, functional, and accessible.			
Occupational Health and Safety, Emergency Response			
Daily/ Weekly safety talks conducted.			

Required PPE supplied to workers			
Construction area properly marked/ fences from ongoing activities.			
Firefighting equipment is functional and accessible			
Any accidents registered?			
Water Quality			
There are no signs of oil pollution (oil sheen, oil product) observed on water surface at the discharge point in the Jossiekreek.			
Waste Management			
Waste handling conform WMP: no waste lying around, waste bins available, etc.			
Air Quality and Noise control			
No increased dust (during dry periods) observed along the Jossiekreekweg during transport.			
Measures for suppressing dust implemented			
Speed limits have been implemented and maintained to minimize dust			
All vehicles and construction equipment is properly maintained.			
Archaeological/historical resources			
Were archaeological or historical resources encountered during excavation?			
Stakeholder Engagement			
Are the complaints received?			
All received complaints about project activities have been registered and are being addressed			
Any other observations or comments			

Department Delegate

Completed by: ……

Date: …….

Sign: ……..

Project Manager or his delegate

Received and checked by: ……

Date: …….

Sign: …….

Appendix 2G: Chance Find Procedure

Introduction

This Chance Finds Procedure (CFP) is developed in compliance with the Environmental Management and Monitoring Plan (EMMP) established for the "Optimized fluid handling capacity and efficiency project at the Jossiekreek Crude Treatment Plant" and describes necessary measures to be taken in response to the chance discovery of (a) physical cultural resource(s) due to project associated activities.

National legislation of relevance to the development of the CFP is the Monuments Act 2002, S.B. 2002 no. 72, that aims to preserve historical monuments and architecture in Suriname, since archaeological or historical items may be encountered during construction activities (construction of foundations and fillings). International best practice standards, such as the guidelines of the World Bank Group also provided guidance for the writing of the CFP document.

Objective and scope

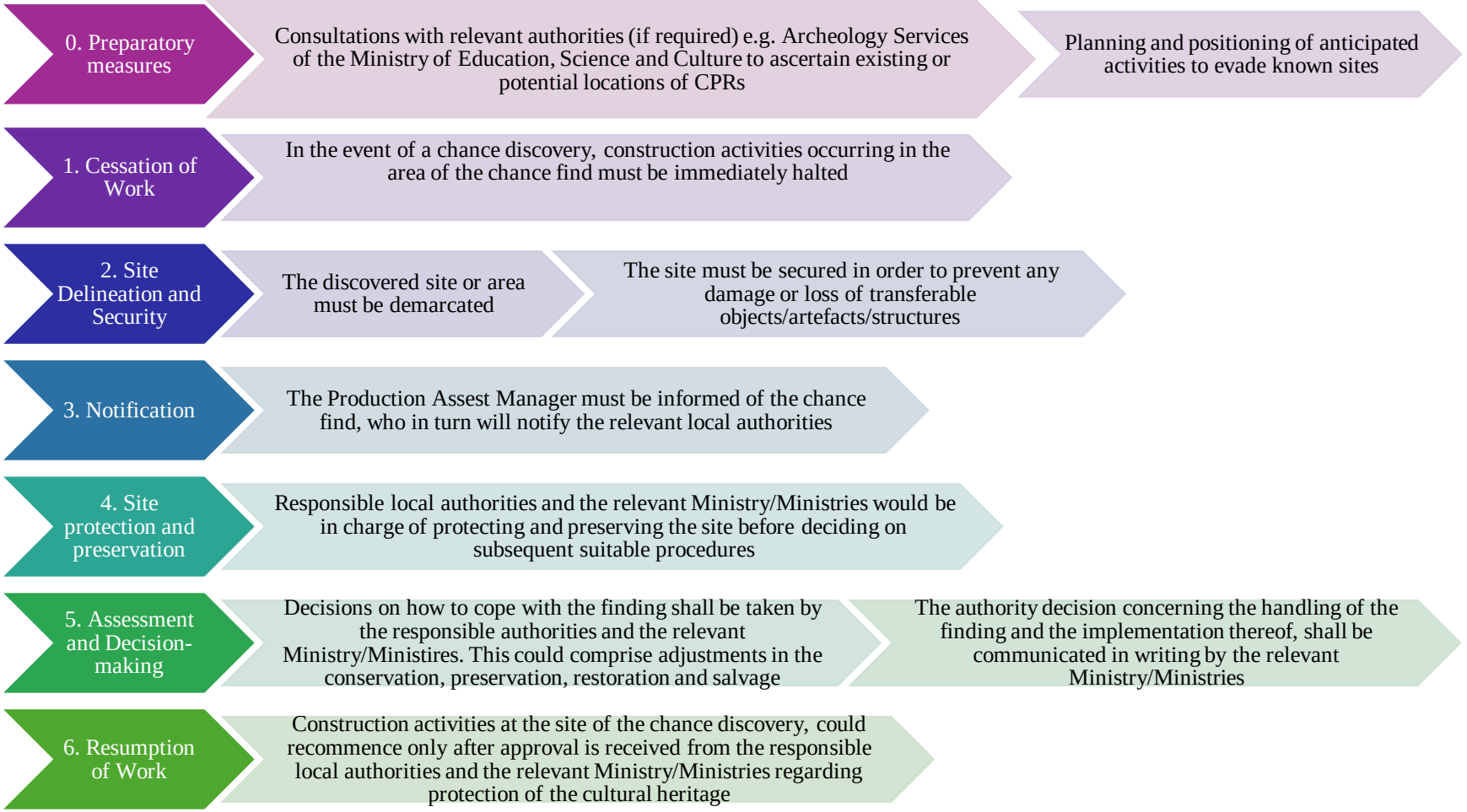
The chance finds procedure serves to monitor how chance finds of Physical Cultural Resources (PCRs). PCR are managed in order to ensure their protection from adverse impacts of project activities (e.g. damage) and to support their preservation.

The CFP contains actions for avoiding and/or mitigating unsolicited impacts on possible PCRs, including:

- Consultations with relevant authorities and local residents/communities to ascertain existing or potential locations of CPRs;
- Planning and positioning of anticipated activities to evade known sites (including protected areas and zones);
- The interruption/stoppage of work until the importance of a 'find' has been assessed by appropriate authorities or relevant experts; and
- Measures for managing and alleviating undesirable impacts (for example establishment of buffer zones).

This CFP pertains to physical cultural resources located on land, that may include movable or immovable objects, (groups of) structures, and sites and natural features/landscapes having archaeological, historical, religious, or other cultural significance or value.

Schematic overview Chance Finds Procedure



Roles and responsibilities

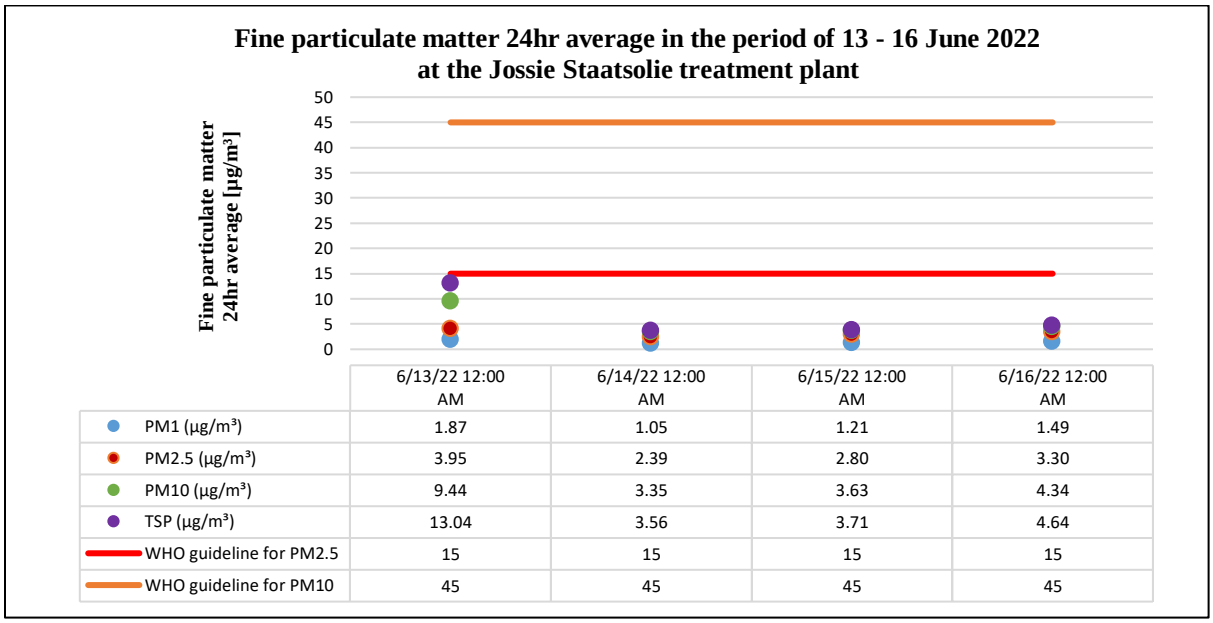
Roles and responsibilities attributed to the following actors under the Chance Finds Procedure (CFP) are:

Actor	Role(s) and/or responsibility/(ties)
Production Aset Manager	• Consultations with relevant authorities to ascertain existing or potential locations of CPRs, during the planning of project activities • Planning and positioning of anticipated activities to evade known sites • In case of a chance discovery, notify the responsible local authorities e.g. Archaeology Services of the Ministry of Education, Science and Culture; possibly the support or assistance of the Foundation Built Heritage (*Stichting Gebouwd Erfgoed Suriname*-SGES) and the *Stichting Surinaams Museum* will be necessary • Providing permission to the Projects & Engineering Support Manager for resumption of work
Projects & Engineering Support Manager	• Conducting field observations during scouting activities • Empower staff to stop works on (chance) discovery of artefacts • In the event of a chance discovery, construction activities occurring in the area of the chance find must be immediately halted • The discovered site or area must be demarcated and secured in order to prevent any damage or loss of transferable objects / artefacts / structures; no archaeological or historical object may be removed from the ground without prior authorization issued by the Government • The Project Manager/CCU must be informed of the chance find • Permission must be sought of the Production Aset Manager, before construction activities at specific area can be resumed.
Staatsolie Management	Responsible for: • Protecting and preserving the site before deciding on subsequent suitable procedures in consultation with other relevant local authorities • Assessment and Decision-making on how to cope with the finding in relation to conservation, preservation, restoration and salvage of the find • Communicating the outcome of the assessment in writing to the Production Aset Manager.
Ministry of Education, Science and Culture; Archaeology Services	Supporting/advisory role to the other government entities in particular concerning the conservation, preservation, restoration and salvage of the find
Foundation Built Heritage (Stichting Gebouwd Erfgoed Suriname-SGES)	Supporting/advisory role to the other government entities in particular concerning the conservation, preservation, restoration and salvage of the find
Stichting Surinaams Museum	Supporting/advisory role to the other government entities in particular concerning the conservation, preservation, restoration and salvage of the find
National Institute for Environment and Development in Suriname (NIMOS)	Advisory role to the relevant Ministries regarding the execution of the EMMP for the project, in particular the protection of Heritage Resources

Appendix 3: Air quality data

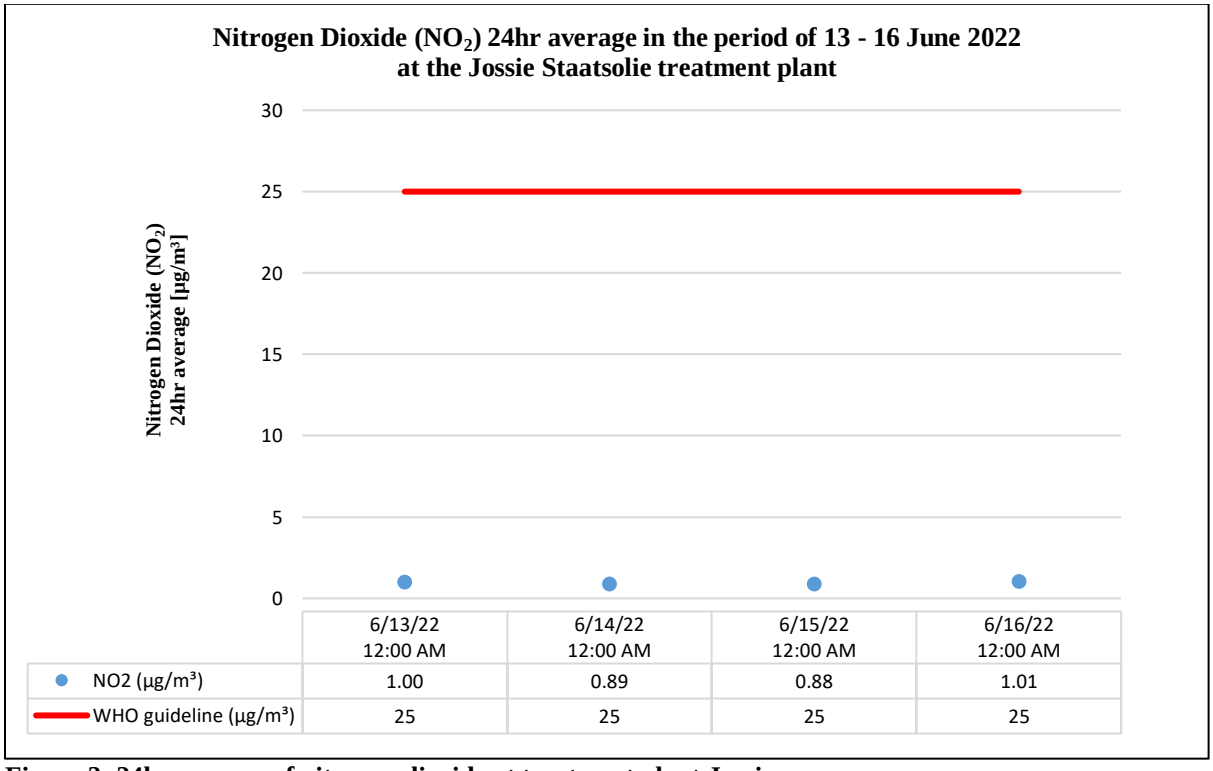
Ambient Air Quality Baseline Results Jossie- ILACO, 2023

The measurement was carried out at the south side of the treatment plant near an office. The area consisted predominantly of sand and partially of low vegetation (grass). The measurement location was approx. 50 m away from the collection tanks. The measurement results for fine particulate matter ($PM_{1.0}$, $PM_{2.5}$, PM_{10} and TSP), NO_2, O_3 and SO_2 are presented in **Figures 1-4**. The comparison with applicable WHO/IFC guideline values are also included in the figures.



	6/13/22 12:00 AM	6/14/22 12:00 AM	6/15/22 12:00 AM	6/16/22 12:00 AM
PM1 (µg/m³)	1.87	1.05	1.21	1.49
PM2.5 (µg/m³)	3.95	2.39	2.80	3.30
PM10 (µg/m³)	9.44	3.35	3.63	4.34
TSP (µg/m³)	13.04	3.56	3.71	4.64
WHO guideline for PM2.5	15	15	15	15
WHO guideline for PM10	45	45	45	45

Figure 1: 24hr average of fine particulate matter at treatment plant Jossie



	6/13/22 12:00 AM	6/14/22 12:00 AM	6/15/22 12:00 AM	6/16/22 12:00 AM
NO2 (µg/m³)	1.00	0.89	0.88	1.01
WHO guideline (µg/m³)	25	25	25	25

Figure 2: 24hr average of nitrogen dioxide at treatment plant Jossie

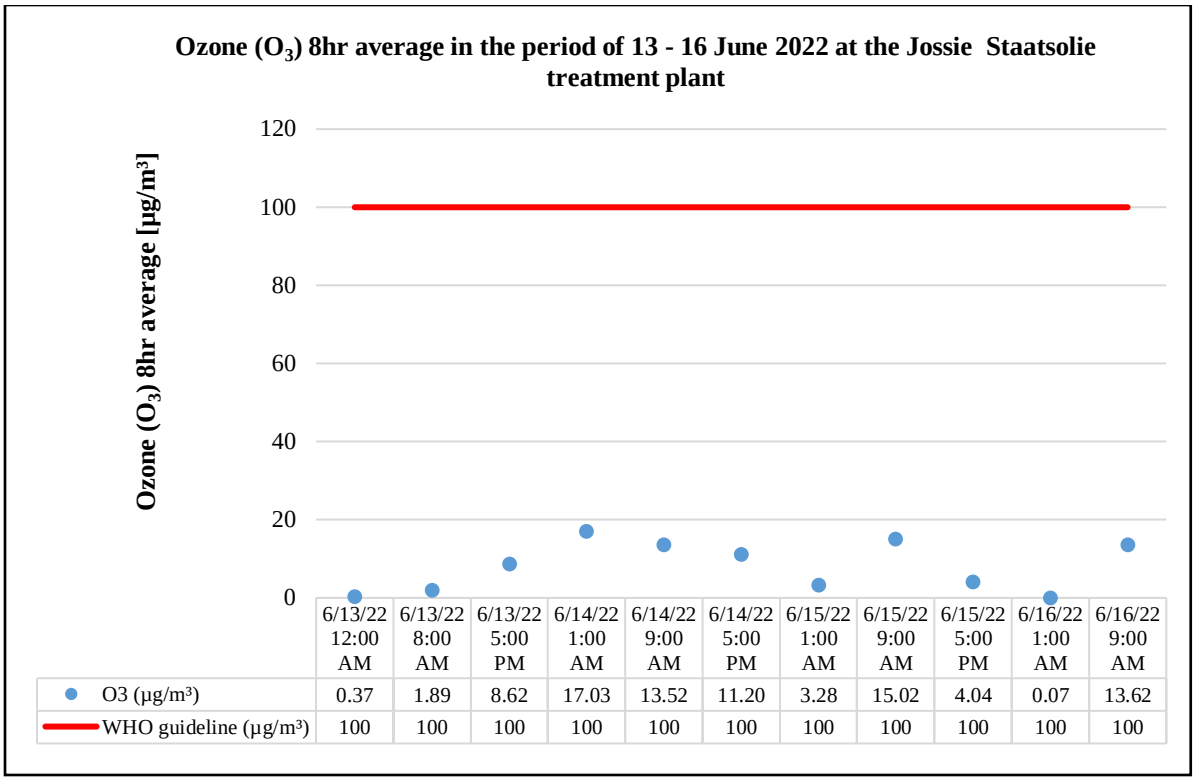


Figure 3: 8hr average of ozone at treatment plant Jossie

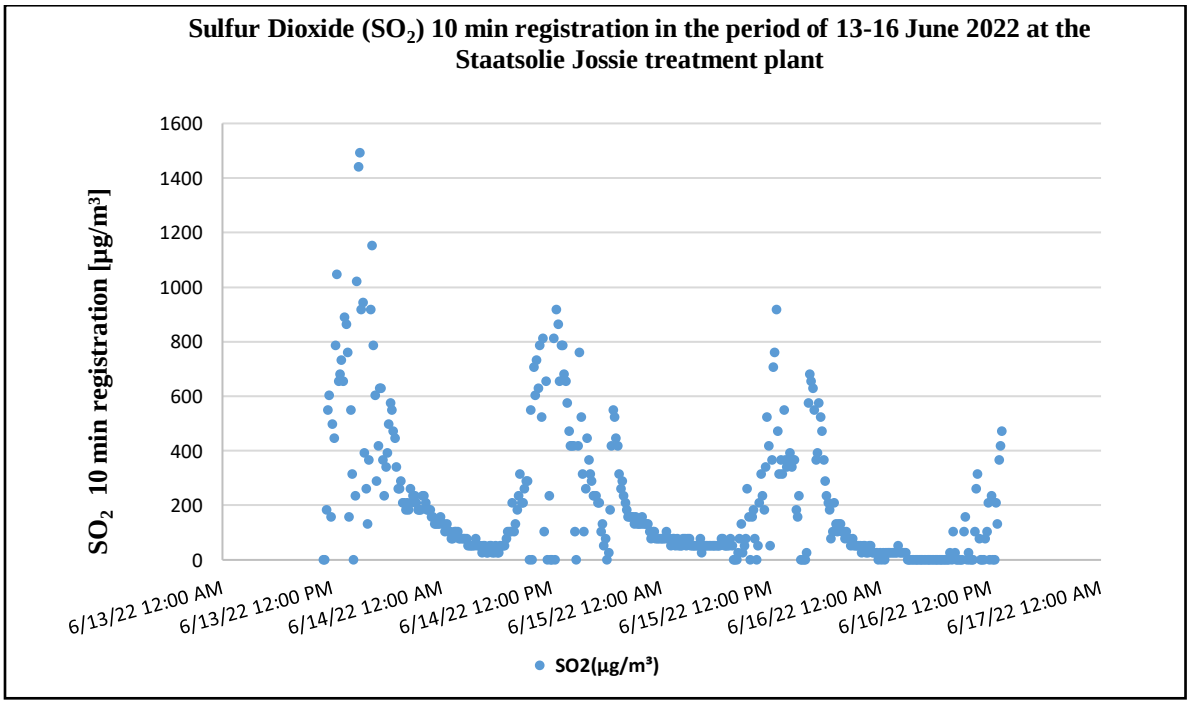


Figure 4: 10 min registration of sulfur dioxide at treatment plant Jossie

The following can be concluded from the measured dust and gaseous data:

- All the measured PM data are below the WHO/IFC guidelines of respectively 15 µg/m^3 for $PM_{2.5}$ and 45 µg/m^3 for PM_{10}.
- The measured NO_2 (g) and O_3 (g) data are below the WHO/IFC guidelines of respectively 25 µg/m^3 for NO_2 and 100 µg/m^3 for O_3.
- High levels of SO_2 concentrations were measured with a strong fluctuation: towards the afternoon the concentrations peaked, with the highest peaks observed in the afternoon (12:00 PM – 5:00 PM) and lowest peaks during nighttime (9:00 PM – 6:00 AM). The highest SO_2 measured concentration out of the 3 days is 1441 µg/m^3 (13th of June, 14:51 PM). These levels seem to be common at and around petroleum plants and/or plants where oil products are processed (Elem, 2014 & EPA, 2022) and mostly originate from local sources (within a zone of 100-500 m, see below). The fluctuation can be explained by the strong influences of meteorological factors such as wind direction, wind speed and relative humidity. Especially with relative humidity a strong correlation was found. Due to the strong fluctuation and the short measuring period, it did not seem correct to compare the results with the applicable standards as values over shorter measurement periods are always higher than over longer periods. Considering the wind directions for Jossie (mostly from the east, with stronger winds from the northeast), it can be concluded that these high levels of SO_2 originate from local sources and in this case the tanks, heater treaters, the snake separator, and Wemco Units, all within a 100 m zone of the measurement location. **Figure 5** gives an overview of the SO_2 measurement location in relation to local sources within a radius of 500 m (yellow circle).

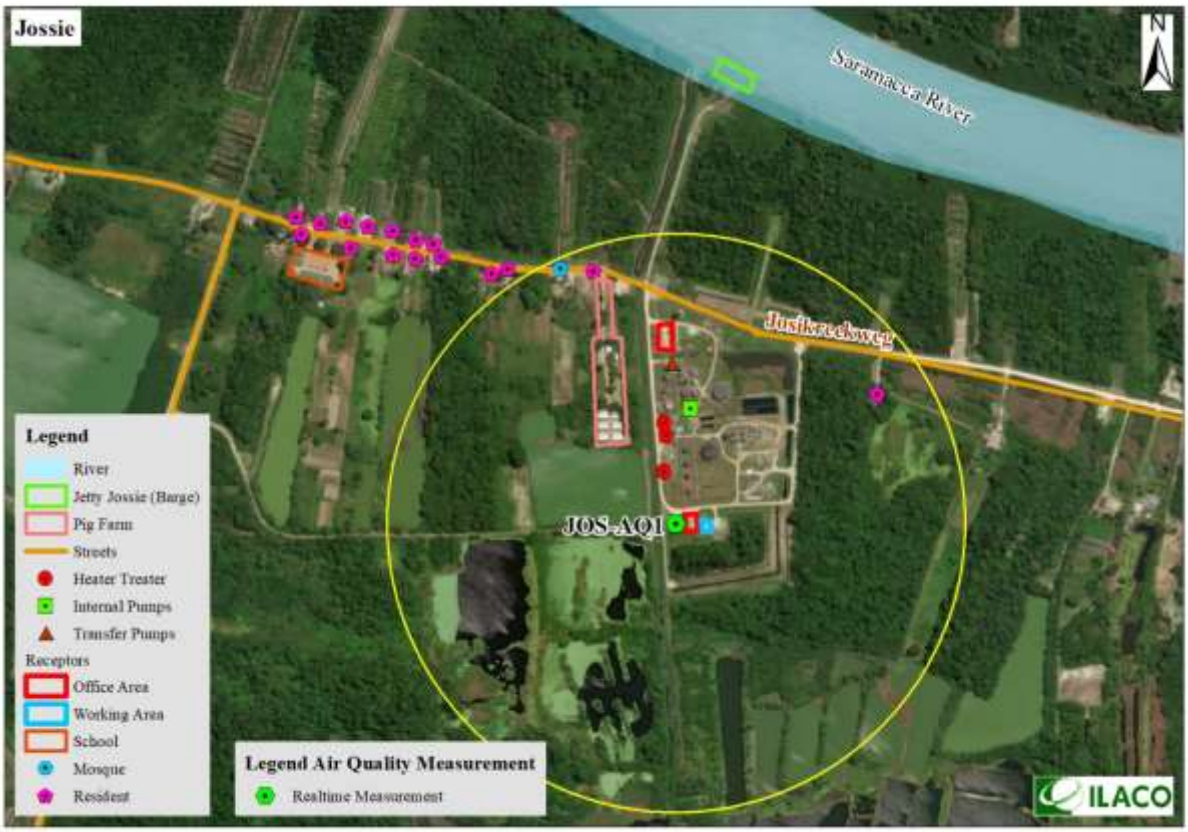


Figure 5: Overview of SO_2 measurement location and local sources Jossie within a radius of 500 m

Appendix 4: Noise Baseline Data

Appendix 4A: SVAN 977c Sound & Vibration Level Meter and Analyser

SVAN 977C

Sound & Vibration Level Meter and Analyser

SVANTEK

sound and vibration

What's inside the SVAN 977C kit?

The kit consists of SVAN 977C Class 1 sound & vibration level meter with a detachable preamplifier SV 12L and high quality MK 255 microphone. The list of accessories includes: SA 143 carrying case, SA 22 windscreen, 16 GB microSD card, four AA batteries, USB cable, and CD with user manual. Each SVAN 977C has its factory calibration certificate and 36 months warranty card.

SVAN 977C Technical Specifications

Sound Level Meter & Analyser

Standards	Class 1: IEC 61672-1:2013; Class 1: IEC 61260-1:2014
Weighting Filters	A, B, C, Z, LF, U, AU
Time Constants	Slow, Fast, Impulse
Microphone	Microtech Gefell MK 255, 50 mV/Pa, prepolarised 1/2" condenser microphone
Preamplifier	SV 12L detachable (TNC)
Linear Operating Range	23 dBA RMS ÷ 140 dBA Peak (in accordance to IEC 61672)
Total Dynamic Measurement Range	16 dBA RMS ÷ 140 dBA Peak (typical from noise floor to the maximum level)
Internal Noise Level	Less than 16 dBA RMS
Dynamic Range	>110 dB
Frequency Range	3 Hz ÷ 20 kHz with Microtech Gefell MK 255
Meter Mode Results	Elapsed time, Lxy, Leqx (LEQ), Lxpeak (PEAK), Lxymax (MAX), Lxymin (MIN), LR (ROLLING LEQ), Ovl (OVERLOAD), Lxye (SEL), LN (LEQ STATISTICS), Lden, LEPd, Ltm3, Ltm5
Measurement Profiles	Simultaneous measurement in three profiles with independent set of filters (x) and detectors (y)
Analyser[1] (optional)	1/1 octave or optional 1/3 octave real-time analysis, up to 40.0 kHz band meeting Class 1: IEC 61260-1 FFT analysis 1600 lines, up to 40.0 kHz band (optional) RPM rotation speed measurement parallel to the vibration measurement (optional) RT60 reverberation time measurement (optional)
Statistics	L_n (L_1-L_{99}), complete histogram in meter mode and 1/1 or 1/3 octave analysis
Data Logger[1]	Time-history logging of summary results, spectra with adjustable double logging steps down to 2 ms
Audio Recording[1] (optional)	Audio records to time-history data or WAV format with selectable band and recording period

Vibration Level Meter & Analyser

Standards	ISO 20816-1
Meter Mode	RMS, Max, Peak, Peak-Peak Simultaneous measurement in three profiles with independent filter sets and detectors
Filters	HP1, HP3, HP10, Vel1, Vel3, Vel10, VelMF, Dil1, Dil3, Dil10, Wh
Accelerometer	SV 80 (100 mV/g) or any IEPE accelerometer (optional)
Analyser[1] (optional)	1/1 octave or optional 1/3 octave real-time analysis, up to 40.0 kHz band meeting Class 1: IEC 61260-1 FFT analysis 1600 lines, up to 40.0 kHz band (optional) RPM rotation speed measurement parallel to the vibration measurement (optional)
Data Logger	Time-history logging of summary results, spectra with two adjustable logging steps
Time-domain Signal Recording[1]	Continuous or triggered time-domain signal recording to WAV format (optional)

General information

Input	IEPE with TNC connector	
Memory	MicroSD card 16 GB (removable & upgradeable)	
Display	Super contrast (10000:1) OLED 2.4" colour display (320 x 240 pixels)	
Interfaces	USB 2.0 Client, Bluetooth®, RS 232 (with optional SV 55)	
	External I/O - AC output (1 V Peak) or Digital Input/Output (Trigger – Pulse)	
Power Supply	Four AA batteries	operation time > 12 h (6 V / 2 Ah)[2]
	Four rechargeable AA batteries	operation time > 16 h (4.8 V / 2.6 Ah)[2] (not included)
	External power supply	6 V/500 mA DC ÷ 15 V/250 mA DC
	USB interface	500 mA HUB
Environmental Conditions	Temperature	from -10 °C to 50 °C
	Humidity	up to 90 % RH, non-condensed
Dimensions	343 x 79 x 39 mm (with microphone and preamplifier)	
Weight	Approx. 0.6 kg with batteries	

[1]works together with the meter mode
[2]dependent on instrument operation mode

The policy of our company is to continually innovate and develop our products. Therefore, we reserve the right to change the specifications without prior notice.

SVANTEK Sp. z o. o.
ul. Strzygłowska 81, 04-872 WARSAW, POLAND
phone/fax (+48) 22 51 88 320, (+48) 22 51 88 312
http://www.svantek.com e-mail: office@svantek.com.pl

Proudly distributed by:

SVANTEK

EU Declaration of Conformity

No. SVAN977C-CE-EN/07/2020

Manufacturer:	**SVANTEK Sp. z o. o**
Address:	Strzygłowska 81 04-872 Warszawa Poland
Kind of product:	SOUND LEVEL METER – ANALYSER, VIBRATION LEVEL METER – ANALYSER
Type:	**SVAN 977C**
Directive:	**Low Voltage Directive** (LVD) 2014/35/EU
Standard:	EN 61010-1: 2010 *Safety requirements for electrical measurement equipment*
Directive:	**Electromagnetic Compatibility Directive** (EMC) 2014/30/EU
Standards:	EN 61326-1:2006 *Measurement equipment: EMC emission and immunity*
Directive:	**Radio and Telecommunication Directive** (RTTE) 1999/5/EC
Standards:	
a.3.1a: SAFETY	EN 61010-1: 2010 *Information technology equipment*
art.3.1b: EMC	ETSI EN 301 489-1 V1.9.2:2011 *Radio transmission systems* ETSI EN 301 489-17 V2.2.1:2012 *Broadband transmission systems*
art.3.2: RADIO	ETSI EN 300 328 V1.9.1:2015 *Wideband transmission systems (2.4 GHz)*

Auxiliary industry standards:

EN 61672-1:2013	*Electroacoustics - Sound level meters: Class 1*
EN 61260-1:2014	*Octave-band filters*
EN ISO 8041:2005	*Human response to vibration - Measuring instrumentation*

I, the undersigned authorized manufacturer representative, declare that this declaration is issued under the sole responsibility of the manufacturer, and that the object of the declaration described above is in conformity with the relevant Union harmonization legislation.

Place of issue: **Warsaw, Poland**

Date of issue: **01. 07. 2020**

Bogdan Żmuda, CEO

.....
(signature)

SVANTEK Sp. z o. o.
Strzyglowska 81
04-872 Warsaw, Poland
tel.: 22 518 83 20
e-mail: office@svantek.com.pl

Registered in
the Warsaw District Court
XIII Economic Department
Initial Capital 100 000 zł

KRS 0000192065
REGON 002175672
VAT PL 5270105272

Appendix 4B: Baseline Noise Measurements

Daytime Baseline Measurements																							
Measuring date:	18 January 2024 & 7 March 2024																				**Legend**		
Number of measurements:	10																				1x	Counts of observations	
Measured by:	Welzijn B./ Fortune M./ Karijooetomo C.																				x	Observed noise (not countable)	
Noise measurement locations:	Treatment Plant Jossie, along the Jossiekreekweg & Tambaredjoweg																						
No #	**Location Description**	**Coordinates (UTM21N/ WGS84)**	**Time/ Weather**	**Provide numbers**								**Leaves/ Grass**	**Birds**	**Insects**	**Dogs**	**Music**	**Claxon**	**Alarm**	**Talking**	**See wind tab**	**Estimate**	**Remarks**	
				Cars	**Light truck**	**Bus**	**Cargo truck**	**Heavy truck**	**Moped**	**Bike**	**Overfly**									**Wind speed**	**Wind direction**		
Jos-BN1	Along the south berm of the Jossiekreekweg, between the main entrance and parking space of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg.	21N 663298.52 646149.76	18 January 2024 / 13:13 – 13:23 hrs. (10 min) / Sunny / cloud cover		3x							x	x				x		x	3.3–5.5 m/s	North-East	Continuous noise of heaters at distance; birds; leaves rustling by the wind and transfer pumps at distance. Occasional noise of light truck passing by, noise of claxon, noise of grinding machine at distance, noise of talking person at distance and noise of falling object at distance.	
Jos-BN2	Along the Jossiekreekweg, in front of a local mosque, approx. 150 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg.	21N 663182.62 646174.01	18 January 2024 / 13:35 – 13:45 hrs. (10 min) Sunny / cloud cover		1x							x	x							3.3–5.5 m/s	North-East	Continuous noise of heaters at distance; birds; leaves rustling by the wind and transfer pumps at distance. Occasional noise of light truck passing by, noise of falling object at distance and noise of zinc roof plate slamming against the roof.	
Jos-BN3	At the backyard of the treatment plant. The backyard consists of an office with several other buildings and a parking area. The meter was placed approx. 7 m away from axis of the road of the plant. ***Note: the internal pumps were operational during the last two minutes of the measurement.***	21N 663350.59 645758.67	18 January 2024 / 10:51 – 11:00 hrs. (9 min) / No Sun / cloud cover		2x					1x		x	x				x			3.3–5.5 m/s	North-East	Continuous noise of heaters at distance (2x); birds; leaves rustling by the wind and internal pumps at distance. Occasional noise of brushcutter at distance, noise of light truck passing by, noise of bike passing by and noise of claxon at distance.	
Jos-BN3	At the backyard of the treatment plant. The backyard consists of an office with several other building and a parking area. The meter was placed approx. 7 m away from axis of the road of the plant.	21N 663350.59 645758.67	18 January 2024 / 11:02 – 11:17 hrs. (15 min) / Sunny / cloud cover	1x	5x					1x		x	x						x	3.3–5.5 m/s	North-East	Continuous noise of heaters at distance (2x); birds; leaves rustling by the wind and internal pumps. Occasional noise of talking person at distance, noise of person walking by, noise of closing car door at distance, noise of bike passing by, noise of light truck passing by, hammering noise at distance, noise of reverse alarm at distance, noise of brushcutter at distance, noise of dropping object at distance and noise of closing office door at distance.	
Jos-BN4	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 466 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg	21N 662876.99 646214.78	18 January 2024 / 13:57 – 14:07 hrs. (10 min) / Sunny / cloud cover		1x							x	x		x					3.3–5.5 m/s	North-East	Continuous noise of heaters at distance; birds; leaves rustling by the wind and transfer pumps at distance. Occasional hammering noise at distance, noise of light truck passing by, noise of zinc roof plate slamming against the roof and noise of barking dogs at distance.	
Jos-BN5	At the entrance of a resident, along the north berm of the Jossiekreekweg approx. 630 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg	21N 662700.47 646261.21	18 January 2024 / 14:17 – 14:27 hrs. (10 min) / Sunny / cloud cover	1x				1x				x	x		x		x		x	3.3–5.5 m/s	North-East	Continuous noise of heaters at distance; birds; leaves rustling by the wind and transfer pumps at distance. Occasional noise of talking person at distance, noise of barking dogs at distance, noise of yelling baby at distance, noise of talking child at distance, noise of excavator in the background, noise of claxon at distance, noise of heavy truck passing by, noise of car passing by and noise of zinc roof plate slamming against the roof.	
Jos-BN6	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 413 m east from the entrance of the Jossie treatment plant. The meter was placed approx. 6 m away from axis of the Jossiekreekweg	21N 662700.47 646261.21	18 January 2024 / 12:51 – 13:01 hrs. (10 min) / Sunny / cloud cover	1x	1x				1x			x	x	x	x					3.3–5.5 m/s	North-East	Continuous noise of heaters at distance; birds; leaves rustling by the wind and insects. Occasional noise of moped passing by, noise of light truck passing by, noise of barking dogs at distance and noise of car passing by.	
Jos-BN7	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 610 m east from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg	21N 663926.69 645999.15	18 January 2024 / 14:39 – 14:49 hrs. (10 min) / Sunny / cloud cover	1x								x	x		x			x		3.3–5.5 m/s	North-East	Continuous noise of heaters at distance; birds and leaves rustling by the wind. Occasional noise of falling object at distance, noise of car passing by, unknown noise from the river side, noise of barking dogs at distance, noise of reverse alarm at distance and cracking noise of tree branch.	
Jos-BN8	At the entrance of a resident, along the west berm of the Tambaredjoweg approx. 1.4 km southwest from the entrance of the Jossie treatment plant. The meter was placed approx. 6 m away from axis of the Tambaredjoweg. ***Note: for the daytime the location is slightly shifted (approx. 83 m) from the previous location (of nighttime) due to obstacles.***	21N 662266.00 645259.00	7 March 2024 / 19:01 – 19:11 hrs. (10 min) / No sun / cloud cover						3x			x	x	x	x					1.5–3.3 m/s	North-East	Continuous noise of transfer pumps at distance and insects in the background. Occasional noise of leaves rustling by the wind, noise of cow at distance, noise of birds at distance, noise of sheep at distance, noise of falling object at distance, noise of barking dog at distance, noise of moped at distance and ticking noise of zinc roof plate.	
Jos-BN9	Near the residential house at the farm, approx. 127 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 7 m away from the wall of the house at the farm.	21N 663245.00 646027.00	7 March 2024 / 17:48 – 17:58 hrs. (10 min) / No sun / cloud cover									x	x							1.5–3.3 m/s	North-East	Continuous noise of transfer pumps (2x) at distance; noise of heaters (1x) at distance and noise of internal pump (1x) at distance. Occasional noise of leaves rustling by the wind, noise of pigs at distance, noise of birds at distance, noise of tree branch cracking at distance, noise of sheep at distance and noise of person sneezing.	
Jos-BN10	At the farm, approx. 165 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 4 m away from the fence.	21N 663243.00 645983.00	7 March 2024 / 18:11 – 18:21 hrs. (10 min) / No sun / cloud cover									x	x							1.5–3.3 m/s	North-East	Continuous noise of transfer pumps (2x) at distance; noise of heaters (1x) at distance and noise of internal pump (1x) at distance. Occasional noise of leaves rustling by the wind, noise of sheep at distance, noise of pigs at distance, noise of birds at distance and noise of hydrophore engine at distance.	

Baseline daytime measurements				A filter					
ID #	**Location**	**Date**	**Time**	**LAeq**	**L10**	**L50**	**L90**	**Lmax**	**Lmin**
Jos-BN1	Along the south berm of the Jossiekreekweg, between the main entrance and parking space of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg.	18 January 2024	13:13 hrs.	55.2	56.4	54.2	52.5	79.6	50.4
Jos-BN2	Along the Jossiekreekweg, in front of a local mosque, approx. 150 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg.	18 January 2024	13:35 hrs.	48.7	49.6	47.7	46.4	64.0	44.9
Jos-BN3	At the backyard of the treatment plant. The backyard consists of an office with several other buildings and a parking area. The meter was placed approx. 7 m away from axis of the road of the plant. ***Note: the internal pumps were operational during the last two minutes of the measurement.***	18 January 2024	10:51 hrs.	55.8	57.7	55.0	53.1	66.5	50.1
Jos-BN3	At the backyard of the treatment plant. The backyard consists of an office with several other building and a parking area. The meter was placed approx. 7 m away from axis of the road of the plant.	18 January 2024	11:02 hrs.	57.3	59.6	56.2	53.5	71.1	50.1
Jos-BN4	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 466 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg	18 January 2024	13:57 hrs.	50.4	50.0	45.8	43.8	70.6	40.7
Jos-BN5	At the entrance of a resident, along the north berm of the Jossiekreekweg approx. 630 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg	18 January 2024	14:17 hrs.	54.5	54.2	49.3	45.8	79.2	42.9
Jos-BN6	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 413 m east from the entrance of the Jossie treatment plant. The meter was placed approx. 6 m away from axis of the Jossiekreekweg	18 January 2024	12:51 hrs.	58.6	50.6	47.2	44.7	82.8	42.9
Jos-BN7	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 610 m east from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg	18 January 2024	14:39 hrs.	50.8	53.5	48.7	44.8	66.8	41.5

Jos-BN8	At the entrance of a resident, along the west berm of the Tambaredjoweg approx. 1.4 km southwest from the entrance of the Jossie treatment plant. The meter was placed approx. 6 m away from axis of the Tambaredjoweg. ***Note: for the daytime the location is slightly shifted (approx. 83 m) from the previous location (of nighttime) due to obstacles.***	7 March 2024	19:01 hrs.	45.6	48.5	42.5	39.3	58.3	37.1
Jos-BN9	Near the residential house at the farm, approx. 127 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 7 m away from the wall of the house at the farm.	7 March 2024	17:48 hrs.	55.5	56.2	55.3	54.4	66.8	53.1
Jos-BN10	At the farm, approx. 165 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 4 m away from the fence.	7 March 2024	18:11 hrs.	56.0	57.4	55.6	54.0	62.5	51.9

Nighttime Baseline Measurements

Measuring date:	29 & 30 January 2024 & 7 March 2024	**Legend**	
Number of measurements:	10	1x	Counts of observations
Measured by:	Welzijn B./ Karijooetomo C.	x	Observed noise (not countable)
Noise measurement locations:	Treatment Plant Jossie, along the Jossiekreekweg & Tambaredjoweg		

No #	Location Description	Coordinates (UTM21N/ WGS84)	Date / Time/ Weather	Provide numbers								Leaves/ Grass	Birds	Insects	Dogs	Music	Claxon	Alarm	Talking	See wind tab	Estimate	Remarks
				Cars	Light truck	Bus	Cargo truck	Heavy truck	Moped	Bike	Overfly									Wind speed	Wind direction	
Jos-BN1	Along the south berm of the Jossiekreekweg, between the main entrance and parking space of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg.	21N 663298.52 646149.76	29 January 2024 / 22:41 – 22:51 hrs. (10 min) / Clear sky / stars											x						<0.3 m/s	–	Continuous noise of heaters at distance; transfer pumps at distance and insects in the background.
Jos-BN2	Along the Jossiekreekweg, in front of a local mosque, approx. 150 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg.	21N 663182.62 646174.01	29 January 2024 / 23:25 – 23:35 hrs. (10 min) / Cloudy										x	x						<0.3 m/s	–	Continuous noise of heaters at distance; transfer pumps at distance and insects and toads in the background. Occasional noise of bird at distance.
Jos-BN3	At the backyard of the treatment plant. The backyard consists of an office with several other building and a parking area. The meter was placed approx. 7 m away from axis of the road of the plant.	21N 663350.59 645758.67	29 January 2024 / 22:15 – 22:30 hrs. (15 min) / Clear sky / stars											x						<0.3 m/s	–	Continuous noise of heaters at distance (1x); internal pumps at distance (2x) and insects in the background.
Jos-BN4	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 466 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg	21N 662876.99 646214.78	29 January 2024 / 23:49 – 23:59 hrs. (10 min) / Cloudy											x						<0.3 m/s	–	Continuous noise of heaters at distance; transfer pumps at distance; insects and toads in the background. Occasional cracking noise of tree branch at distance, noise of cat at distance, noise of falling object on zinc roof plate and noise of falling object at distance.
Jos-BN5	At the entrance of a resident, along the north berm of the Jossiekreekweg approx. 630 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg	21N 662700.47 646261.21	30 January 2024 / 00:50 – 01:00 hrs. (10 min) / Cloud cover											x						<0.3 m/s	–	Continuous noise of heaters at distance; transfer pumps at distance: insects and toads in the background. Occasional noise of falling object at distance.
Jos-BN6	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 413 m east from the entrance of the Jossie treatment plant. The meter was placed approx. 6 m away from axis of the Jossiekreekweg	21N 662700.47 646261.21	30 January 2024 / 01:18 – 01:28 hrs. (10 min) / Cloud cover											x						<0.3 m/s	–	Continuous noise of transfer pumps at distance; music at distance and insects and toads in the background. Occasional noise of falling object at distance.
Jos-BN7	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 610 m east from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg	21N 663926.69 645999.15	30 January 2024 / 01:39 – 01:49 hrs. (10 min) / Cloud cover										x	x						<0.3 m/s	–	Continuous noise of transfer pumps at distance; Moyno pump in the background and insects and toads in the background. Frequent noise of birds at distance. Occasional cracking noise of tree branch at distance.
Jos-BN8	At the entrance of a resident, along the west berm of the Tambaredjoweg approx. 1.4 km southwest from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Tambaredjoweg, approx. 6 m away from the axis of the Tambaredjoweg, 5 m away from the fence of the resident.	21N 662243.06 645179.34	30 January 2024 / 00:28 – 00:38 hrs. (10 min) / Cloud cover											x		x			x	<0.3 m/s	–	Continuous noise of transfer pumps at distance and insects and toads in the background. Occasional noise of talking persons at distance; noise of traffic from the Oost-West verbinding and noise of music at distance.
Jos-BN9	Near the residential house at the farm, approx. 127 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 7 m away from the wall of the house at the farm.	21N 663245.00 646027.00	7 March 2024 / 22:15 – 22:25 hrs. (10 min) / Clear sky									x	x	x						0.3–1.5 m/s	North-East	Continuous noise of transfer pumps (2x) at distance; noise of heaters (1x) at distance; noise of internal pump (1x) at distance; insects and toads in the background. Occasional noise of hydrophore engine at distance, noise of birds at distance and noise of leaves rustling by the wind.
Jos-BN10	At the farm, approx. 165 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 4 m away from the fence.	21N 663243.00 645983.00	7 March 2024 / 22:30 – 22:40 hrs. (10 min) / Clear sky									x		x						0.3–1.5 m/s	North-East	Continuous noise of transfer pumps (2x) at distance; noise of heaters (1x) at distance; noise of internal pump (1x) at distance; insects and toads in the background. Occasional noise of falling object on zinc roof plate, noise of chicken at distance, noise of tree branch cracking at distance and noise of leaves rustling by the wind.

Baseline nighttime measurements				A filter					
ID #	Location	Date	Time	LAeq	L10	L50	L90	Lmax	Lmin
Jos-BN1	Along the south berm of the Jossiekreekweg, between the main entrance and parking space of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg.	29 January 2024	22:41 hrs.	55.3	56.4	55.3	53.6	57.2	52.4
Jos-BN2	Along the Jossiekreekweg, in front of a local mosque, approx. 150 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg.	29 January 2024	23:25 hrs.	46.2	47.1	46.1	45.2	51.5	44.3
Jos-BN3	At the backyard of the treatment plant. The backyard consists of an office with several other building and a parking area. The meter was placed approx. 7 m away from axis of the road of the plant.	29 January 2024	22:15 hrs.	54.9	55.9	54.8	53.7	58.9	52.7
Jos-BN4	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 466 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg	29 January 2024	23:49 hrs.	41.2	42.2	41.0	40.0	47.9	39.0
Jos-BN5	At the entrance of a resident, along the north berm of the Jossiekreekweg approx. 630 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg	30 January 2024	00:50 hrs.	48.4	49.6	48.2	47.1	51.1	45.9
Jos-BN6	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 413 m east from the entrance of the Jossie treatment plant. The meter was placed approx. 6 m away from axis of the Jossiekreekweg	30 January 2024	01:18 hrs.	46.1	47.0	45.9	45.0	48.4	44.4

Jos-BN7	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 610 m east from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Jossiekreekweg	30 January 2024	01:39 hrs.	47.3	48.9	46.9	45.4	54.1	44.5
Jos-BN8	At the entrance of a resident, along the west berm of the Tambaredjoweg approx. 1.4 km southwest from the entrance of the Jossie treatment plant. The meter was placed approx. 3 m away from edge of the Tambaredjoweg, approx. 6 m away from the axis of the Tambaredjoweg, 5 m away from the fence of the resident.	30 January 2024	00:28 hrs.	46.3	47.1	46.2	45.3	50.0	44.1
Jos-BN9	Near the residential house at the farm, approx. 127 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 7 m away from the wall of the house at the farm.	7 March 2024	22:15 hrs.	55.5	56.1	55.4	54.7	57.6	53.8
Jos-BN10	At the farm, approx. 165 m west from the entrance of the Jossie treatment plant. The meter was placed approx. 4 m away from the fence.	7 March 2024	22:30 hrs.	54.5	55.4	54.3	53.4	57.1	52.4

Wind Beaufort scale

#	Description	Conditions	Wind speed
0	Calm	Calm. Smoke rises vertically.	<0.3 m/s
1	Light air	Smoke drift indicates wind direction. Leaves and wind vanes are stationary.	0.3–1.5 m/s
2	Light breeze	Wind felt on exposed skin. Leaves rustle. Wind vanes begin to move.	1.5–3.3 m/s
3	Gentle breeze	Leaves and small twigs constantly moving, light flags extended.	3.3–5.5 m/s
4	Moderate breeze	Dust and loose paper raised. Small branches begin to move.	5.5–8 m/s
5	Fresh breeze	Branches of a moderate size move. Small trees in leaf begin to sway.	8–10.8 m/s
6	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic bins tip over.	10.8–13.9 m/s
7	High wind	Whole trees in motion. Effort needed to walk against the wind.	49.9–61.8 km/h

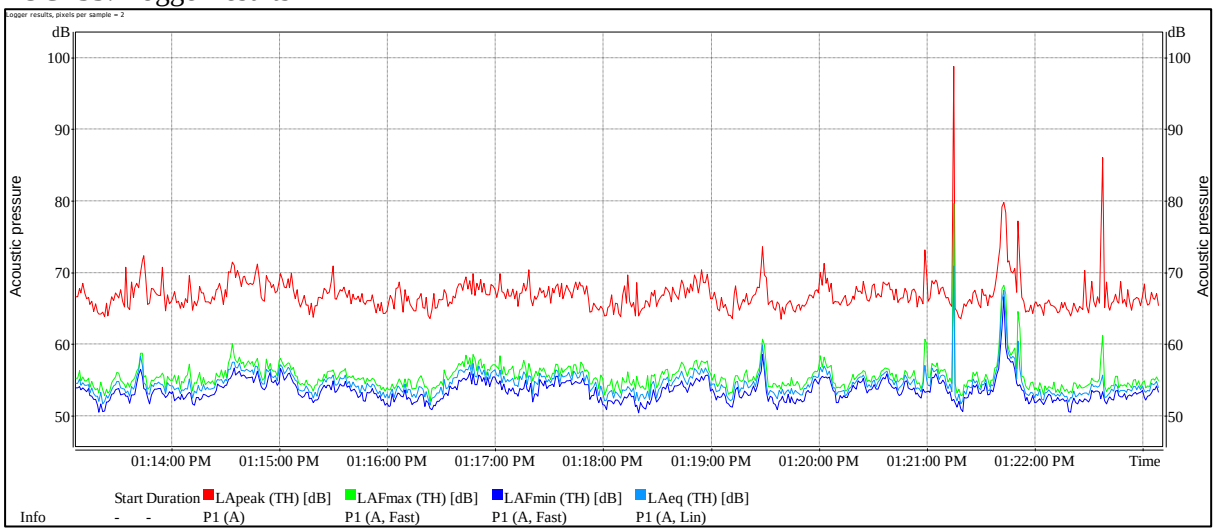
Appendix 4C: Logger Results

Daytime Baseline Noise Measurements
7:00 hrs. – 22:00 hrs.

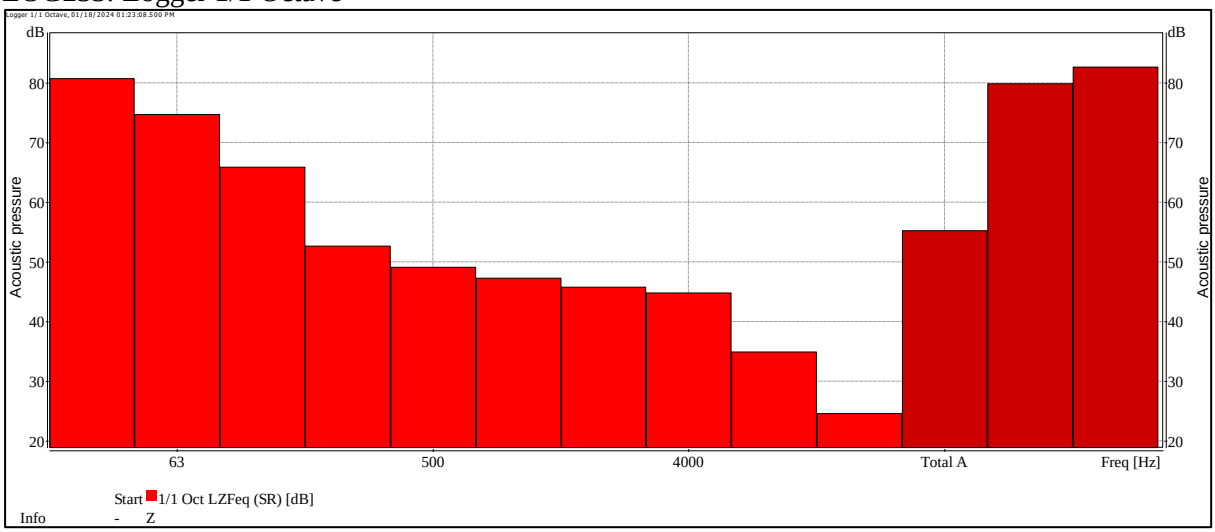
Location Jos-BN1

Log number:	LOG233
Date:	18 January 2024
Time:	13:13 – 13:23 hrs. (10 min)
Description of the location:	Along the south berm of the Jossiekreekweg, between the main entrance and parking space of the Jossie treatment plant.
Observation during measurement:	Continuous noise of heaters at distance; birds; rustling by the wind and transfer pumps at distance. Occasional noise of light truck passing by, noise of claxon, noise of grinding machine at distance, noise of talking person at distance and noise of falling object at distance. Wind speed: 3.3–5.5 m/s (Gentle breeze) Wind direction: North-East
Position of the noise meter:	The meter was placed approx. 3 m away from edge of the Jossiekreekweg and 1.5 m above surface level.

LOG233: Logger results



LOG233: Logger 1/1 Octave



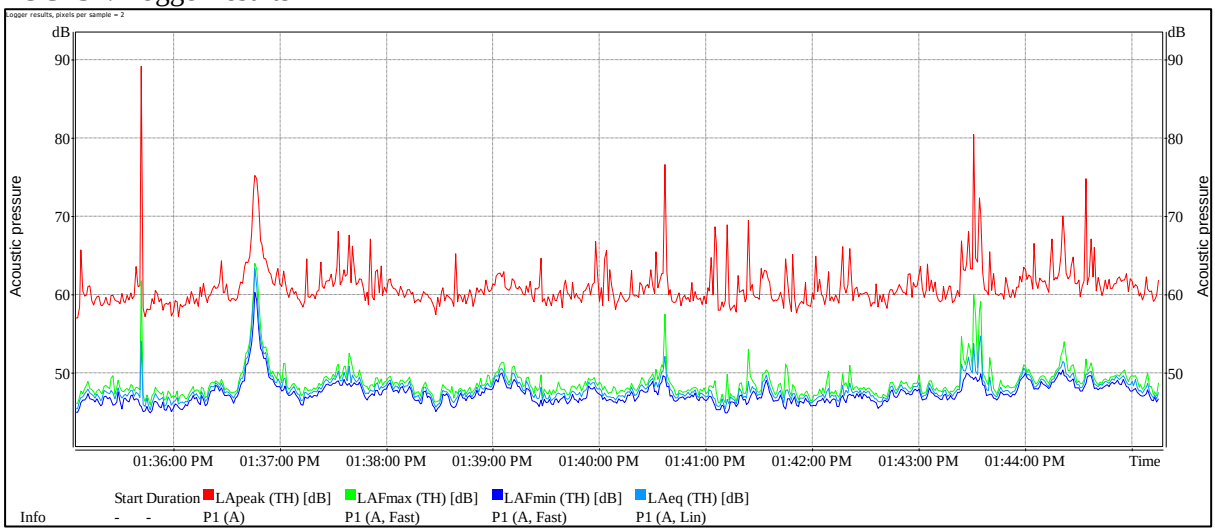
Causes of exceedance of the background level.

Nr.	Time	Cause
1	13:13 – 13:23 hrs.	Continuous noise of heaters at distance; birds; leaves rustling by the wind and transfer pumps at distance.
2	13:13 – 13:14 hrs.	Noise of light truck passing by (1x) and noise of claxon (1x).
3	13:14 – 13:15 hrs.	Noise of talking persons at distance.
4	13:16 – 13:17 hrs.	Noise of grinding machine at distance.
5	13:17 – 13:18 hrs.	Noise of grinding machine at distance.
6	13:19 – 13:20 hrs.	Light truck passing by (1x).
7	13:20 – 13:21 hrs.	Noise of grinding machine at distance.
8	13:21 – 13:22 hrs.	Noise of falling object at distance (2x); noise of light truck passing by (1x) and noise of claxon at distance (1x).

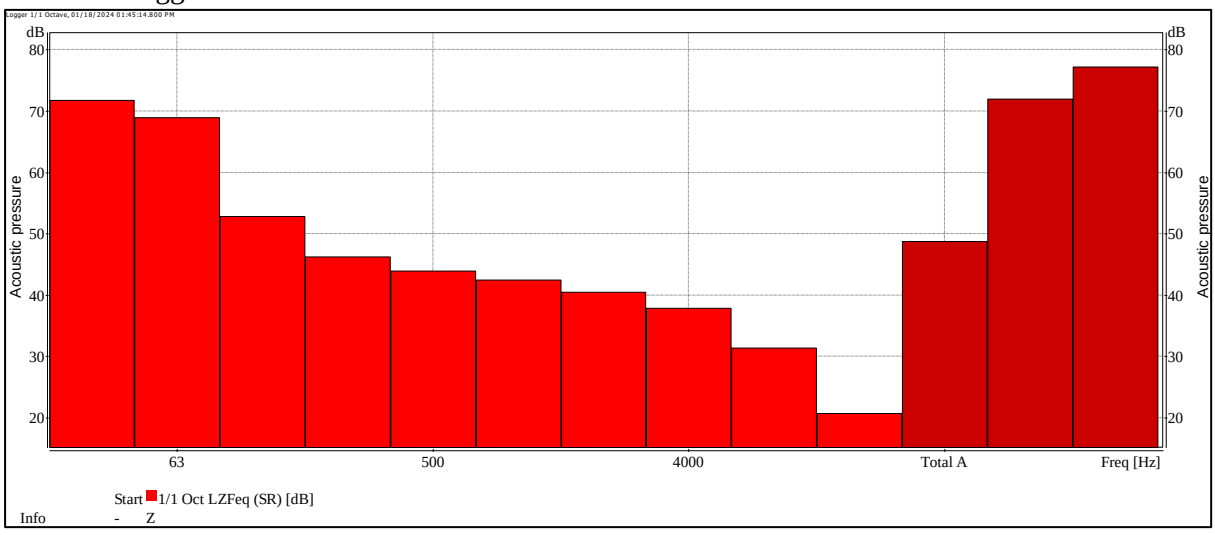
Location Jos-BN2

Log number:	LOG234
Date:	18 January 2024
Time:	13:35 – 13:45 hrs. (10 min)
Description of the location:	Along the Jossiekreekweg, in front of a local mosque, approx. 150 m west from the entrance of the Jossie treatment plant.
Observation during measurement:	Continuous noise of heaters at distance; birds; leaves rustling by the wind and transfer pumps at distance. Occasional noise of light truck passing by, noise of falling object at distance and noise of zinc roof plate slamming against the roof. Wind speed: 3.3–5.5 m/s (Gentle breeze) Wind direction: North-East
Position of the noise meter:	The meter was placed approx. 3 m away from edge of the Jossiekreekweg and 1.5 m above surface level.

LOG234: Logger results



LOG234: Logger 1/1 Octave



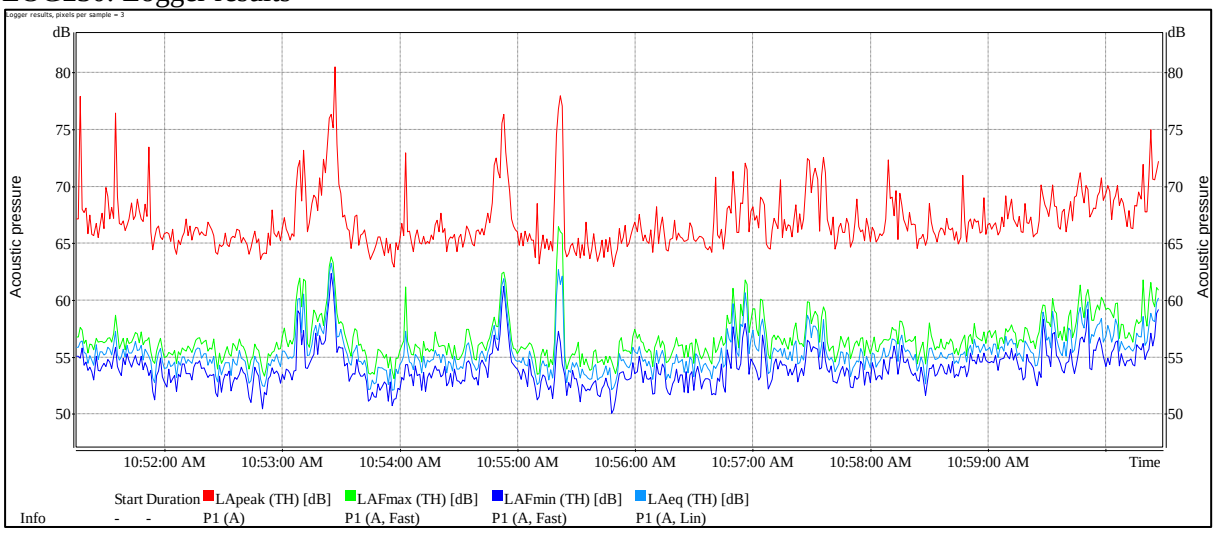
Causes of exceedance of the background level.

Nr.	Time	Cause
1	13:35 – 13:45 hrs.	Continuous noise of heaters at distance; birds; leaves rustling by the wind and transfer pumps at distance.
2	13:36 – 13:37 hrs.	Noise of light truck passing by (1x).
3	13:40 – 13:41 hrs.	Noise of falling object at distance.
4	13:42 – 13:43 hrs.	Noise of zinc roof plate slamming against the roof.

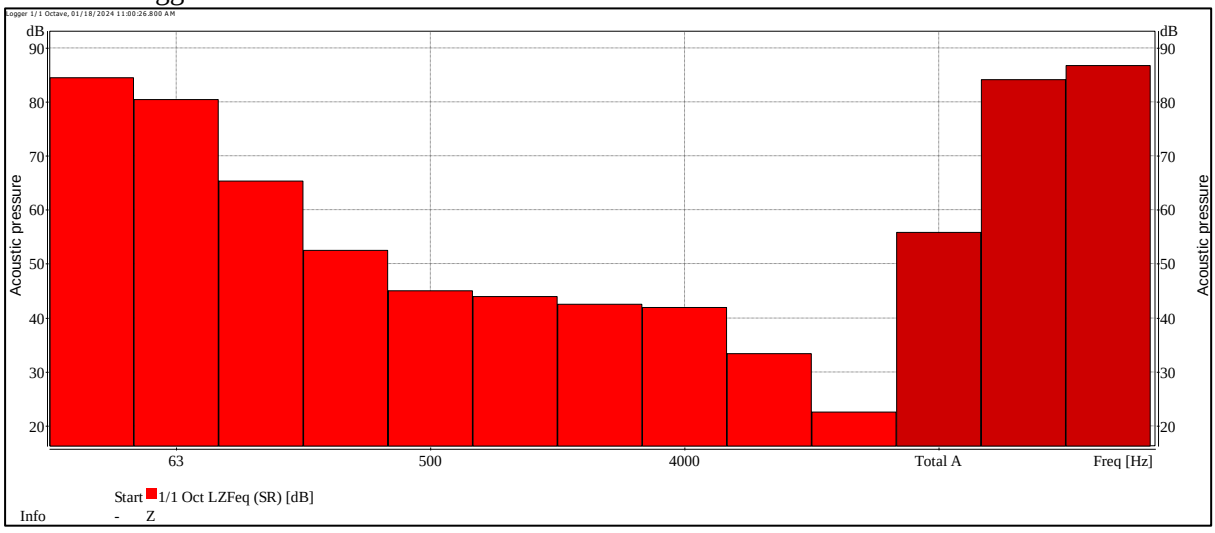
Location Jos-BN3

Log number:	LOG230
Date:	18 January 2024
Time:	10:51 – 11:00 hrs. (9 min)
Description of the location:	At the backyard of the treatment plant. The backyard consists of an office with several other buildings and a parking area.
Observation during measurement:	Continuous noise of heaters at distance (2x); birds; leaves rustling by the wind and internal pumps at distance. Occasional noise of brushcutter at distance, noise of light truck passing by, noise of bike passing by and noise of claxon at distance. ***Note: the internal pumps were operational during the last two minutes of the measurement.*** Wind speed: 3.3–5.5 m/s (Gentle breeze) Wind direction: North-East
Position of the noise meter:	The meter was placed approx. 7 m away from axis of the road and 1.5 m above surface level.

LOG230: Logger results



LOG230: Logger 1/1 Octave



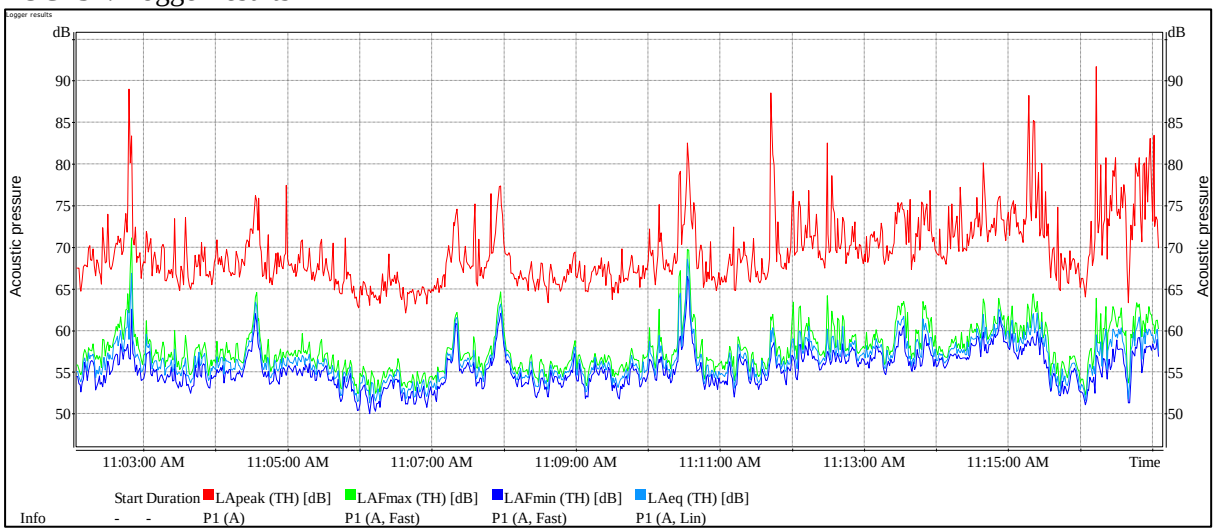
Causes of exceedance of the background level.

Nr.	Time	Cause
1	10:51 – 11:00 hrs.	Continuous noise of heaters at distance (2x); birds; leaves rustling by the wind and internal pumps at distance.
2	10:51 – 10:52 hrs.	Noise of brushcutter at distance.
3	10:52 – 10:53 hrs.	Noise of brushcutter at distance.
4	10:53 – 10:54 hrs.	Noise of light truck passing by (1x) and noise of brushcutter at distance.
5	10:54 – 10:55 hrs.	Noise of claxon at distance (1x); noise of brushcutter at distance and noise of light truck passing by (1x).
6	10:57 – 10:58 hrs.	Noise of bike passing by (1x) and noise of brushcutter at distance.
7	10:58 – 11:00 hrs.	Continuous noise of internal pumps at distance.

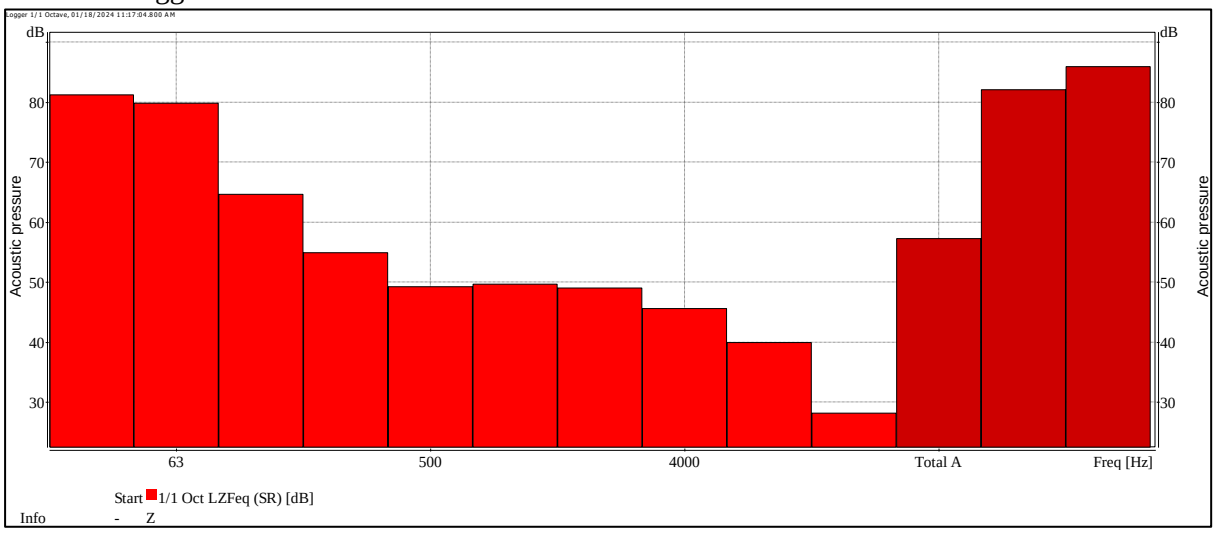
Location Jos-BN3

Log number:	LOG231
Date:	18 January 2024
Time:	11:02 – 11:17 hrs. (15 min)
Description of the location:	At the backyard of the treatment plant. The backyard consists of an office with several other building and a parking area.
Observation during measurement:	Continuous noise of heaters at distance (2x); birds; leaves rustling by the wind and internal pumps. Occasional noise of talking person at distance, noise of person walking by, noise of closing car door at distance, noise of bike passing by, noise of light truck passing by, hammering noise at distance, noise of reverse alarm at distance, noise of brushcutter at distance, noise of dropping object at distance and noise of closing office door at distance. Wind speed: 3.3–5.5 m/s (Gentle breeze) Wind direction: North-East
Position of the noise meter:	The meter was placed approx. 7 m away from axis of the road and 1.5 m above surface level.

LOG231: Logger results



LOG231: Logger 1/1 Octave



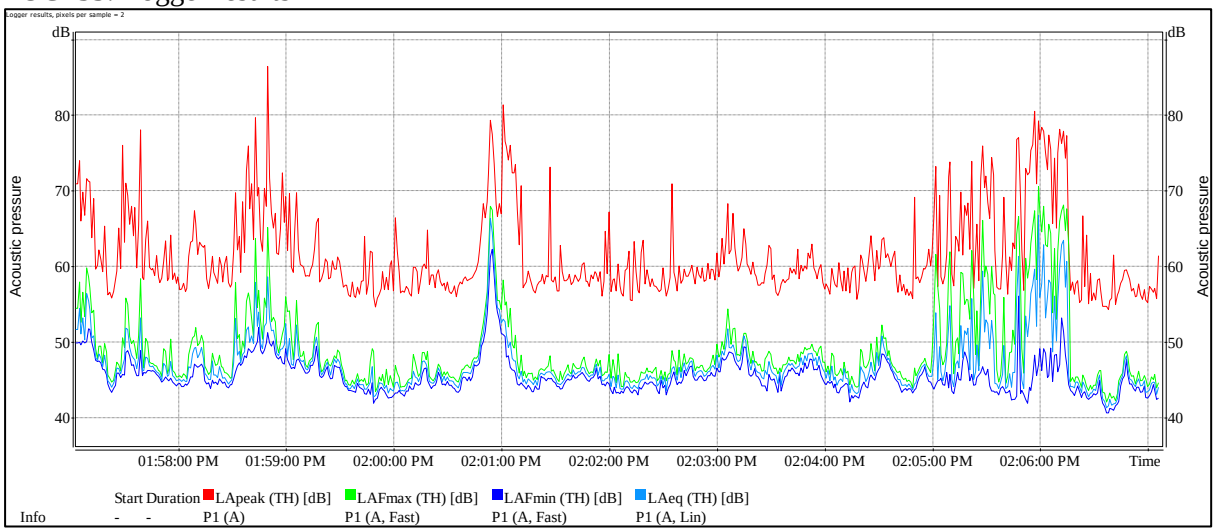
Causes of exceedance of the background level.

Nr.	Time	Cause
1	11:02 – 11:17 hrs.	Continuous noise of heaters at distance (2x); birds; leaves rustling by the wind and internal pumps.
2	11:02 – 11:03 hrs.	Noise of talking person at distance.
3	11:03 – 11:04 hrs.	Noise of talking person at distance and noise of person walking by.
4	11:04 – 11:05 hrs.	Noise of closing car door at distance; noise of bike passing by (1x) and noise of light truck passing by (1x).
5	11:05 – 11:06 hrs.	Hammering noise at distance.
6	11:06 – 11:07 hrs.	Hammering noise at distance and noise of talking persons at distance.
7	11:07 – 11:08 hrs.	Noise of light truck passing by (2x).
8	11:09 – 11:10 hrs.	Noise of talking persons at distance and noise of reverse alarm at distance.
9	11:10 – 11:11 hrs.	Noise of light truck passing by (1x).
10	11:11 – 11:12 hrs.	Noise of brushcutter at distance.
11	11:12 – 11:13 hrs.	Noise of closing office door at distance and noise of brushcutter at distance.
12	11:13 – 11:14 hrs.	Noise of brushcutter at distance.
13	11:14 – 11:15 hrs.	Noise of light truck driving away at distance and noise of brushcutter at distance.
14	11:15 – 11:16 hrs.	Noise of car passing by (1x) and noise of brushcutter at distance.
15	11:16 – 11:17 hrs.	Noise of dropping object at distance and noise of brushcutter at distance.
16	11:17 hrs.	Noise of brushcutter at distance.

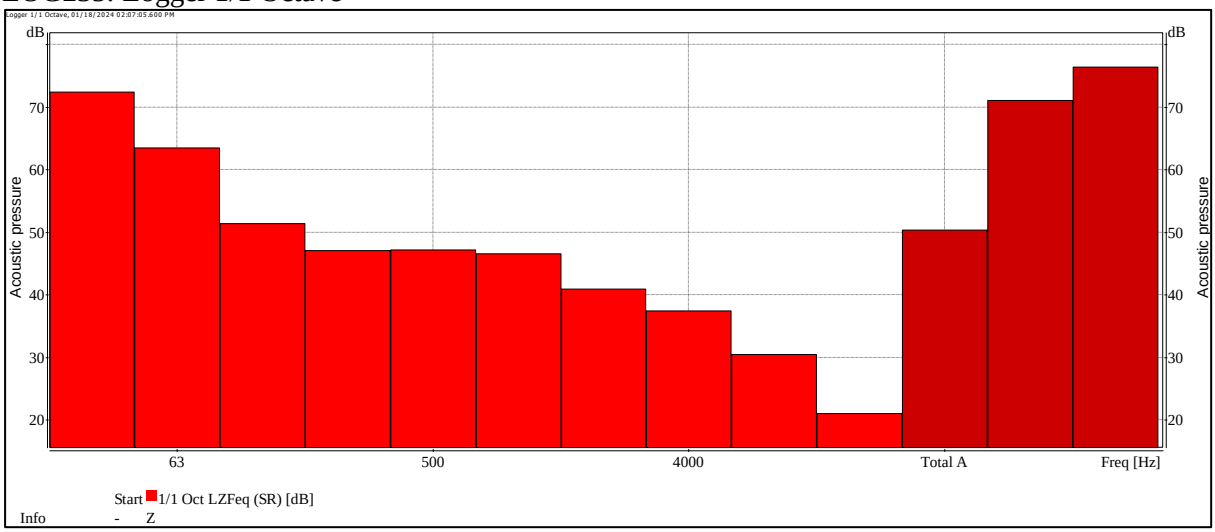
Location Jos-BN4

Log number:	LOG235
Date:	18 January 2024
Time:	13:57 – 14:07 hrs. (10 min)
Description of the location:	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 466 m west from the entrance of the Jossie treatment plant.
Observation during measurement:	Continuous noise of heaters at distance; birds; leaves rustling by the wind and transfer pumps at distance. Occasional hammering noise at distance, noise of light truck passing by, noise of zinc roof plate slamming against the roof and noise of barking dogs at distance. Wind speed: 3.3–5.5 m/s (Gentle breeze) Wind direction: North-East
Position of the noise meter:	The meter was placed approx. 3 m away from edge of the Jossiekreekweg and 1.5 m above surface level.

LOG235: Logger results



LOG235: Logger 1/1 Octave



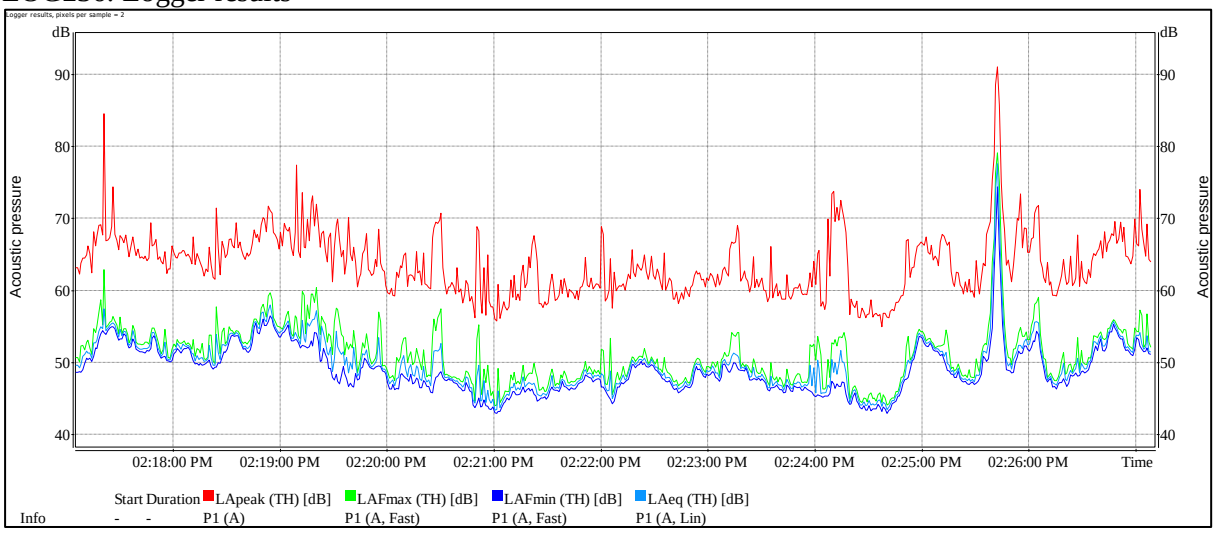
Causes of exceedance of the background level.

Nr.	Time	Cause
1	13:57 – 14:07 hrs.	Continuous noise of heaters at distance; birds; leaves rustling by the wind and transfer pumps at distance.
2	13:58 – 13:59 hrs.	Hammering noise at distance.
3	14:00 – 14:01 hrs.	Hammering noise at distance.
4	14:01 – 14:02 hrs.	Noise of light truck passing by (1x).
5	14:03 – 14:04 hrs.	Noise of zinc roof plate slamming against the roof.
6	14:04 – 14:05 hrs.	Hammering noise at distance.
7	14:05 – 14:06 hrs.	Noise of barking dogs at distance.
8	14:06 – 14:07 hrs.	Noise of barking dogs at distance.

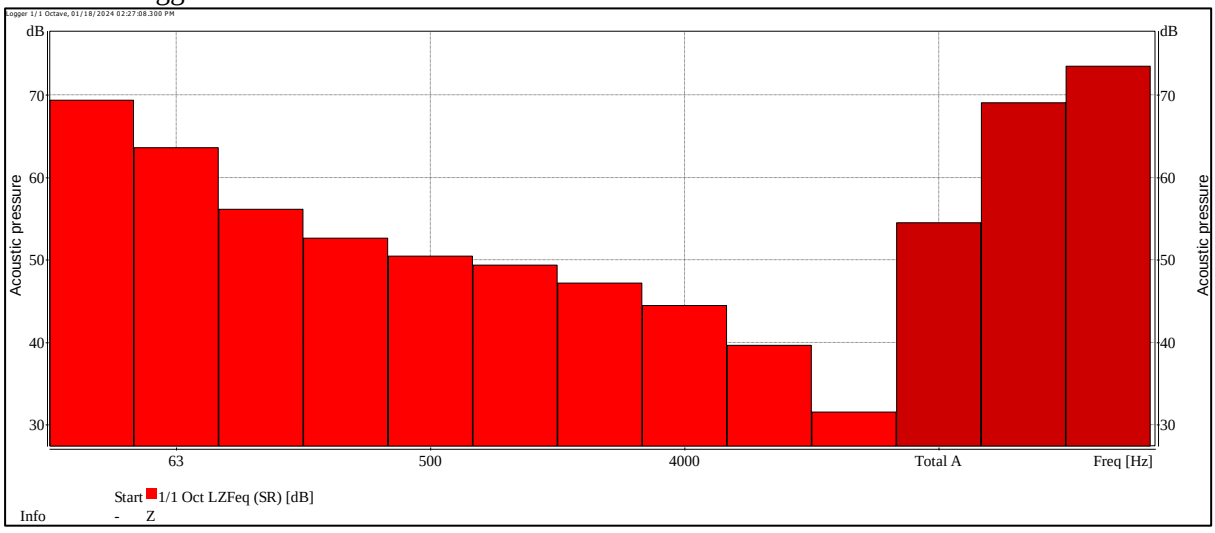
Location Jos-BN5

Log number:	LOG236
Date:	18 January 2024
Time:	14:17 – 14:27 hrs. (10 min)
Description of the location:	At the entrance of a resident, along the north berm of the Jossiekreekweg approx. 630 m west from the entrance of the Jossie treatment plant.
Observation during measurement:	Continuous noise of heaters at distance; birds; leaves rustling by the wind and transfer pumps at distance. Occasional noise of talking person at distance, noise of barking dogs at distance, noise of yelling baby at distance, noise of talking child at distance, noise of excavator in the background, noise of claxon at distance, noise of heavy truck passing by, noise of car passing by and noise of loose zinc plate slamming against the roof. Wind speed: 3.3–5.5 m/s (Gentle breeze) Wind direction: North-East
Position of the noise meter:	The meter was placed approx. 3 m away from edge of the Jossiekreekweg and 1.5 m above surface level.

LOG236: Logger results



LOG236: Logger 1/1 Octave



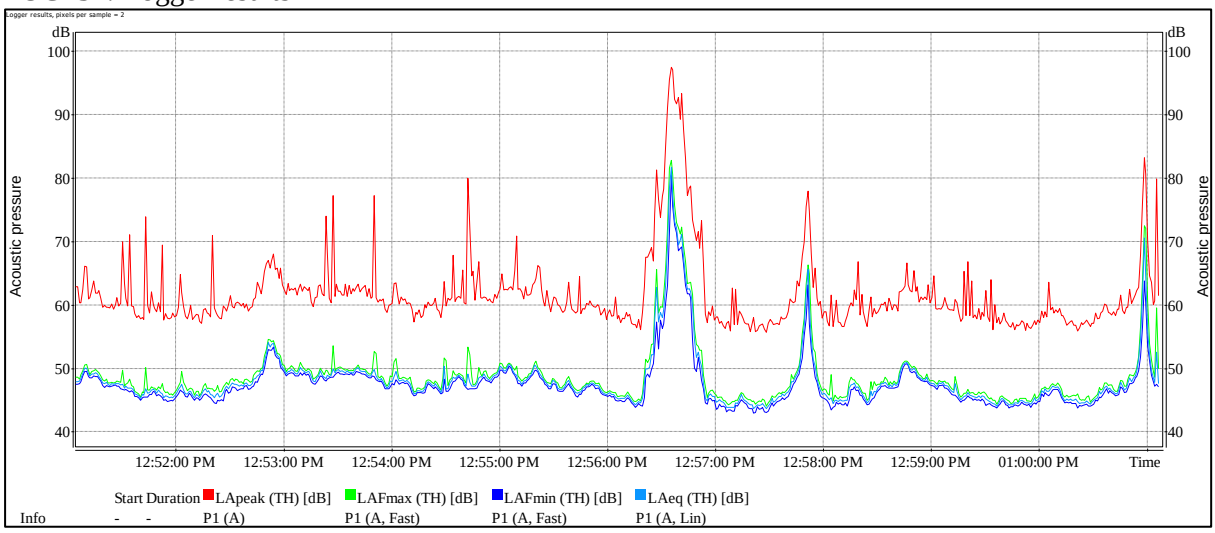
Causes of exceedance of the background level.

Nr.	Time	Cause
1	14:17 – 14:27 hrs.	Continuous noise of heaters at distance; birds; leaves rustling by the wind and transfer pumps at distance.
2	14:18 – 14:19 hrs.	Noise of talking person at distance and noise of barking dogs at distance.
3	14:19 – 14:20 hrs.	Noise of barking dogs at distance and noise of yelling baby at distance.
4	14:20 – 14:21 hrs.	Noise of barking dogs at distance.
5	14:23 – 14:24 hrs.	Noise of talking child at distance.
6	14:24 – 14:25 hrs.	Noise of excavator in the background.
7	14:25 – 14:26 hrs.	Noise of claxon at distance (1x); noise of heavy truck passing by (1x) and noise of car passing by (1x).
8	14:26 – 14:27 hrs.	Noise of loose zinc plate slamming against the roof.

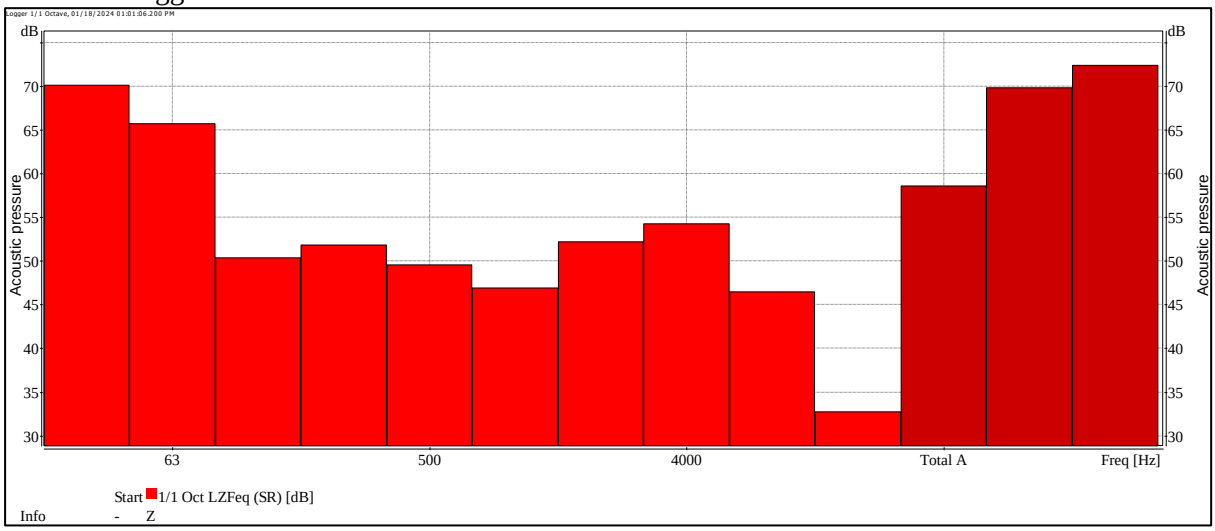
Location Jos-BN6

Log number:	LOG232
Date:	18 January 2024
Time:	12:51 – 13:00 hrs. (9 min)
Description of the location:	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 413 m east from the entrance of the Jossie treatment plant.
Observation during measurement:	Continuous noise of heaters at distance; birds; leaves rustling by the wind and insects. Occasional noise of moped passing by, noise of light truck passing by, noise of barking dogs at distance and noise of car passing by. Wind speed: 3.3–5.5 m/s (Gentle breeze) Wind direction: North-East
Position of the noise meter:	The meter was placed approx. 6 m away from axis of the Jossiekreekweg and 1.5 m above surface level.

LOG232: Logger results



LOG232: Logger 1/1 Octave



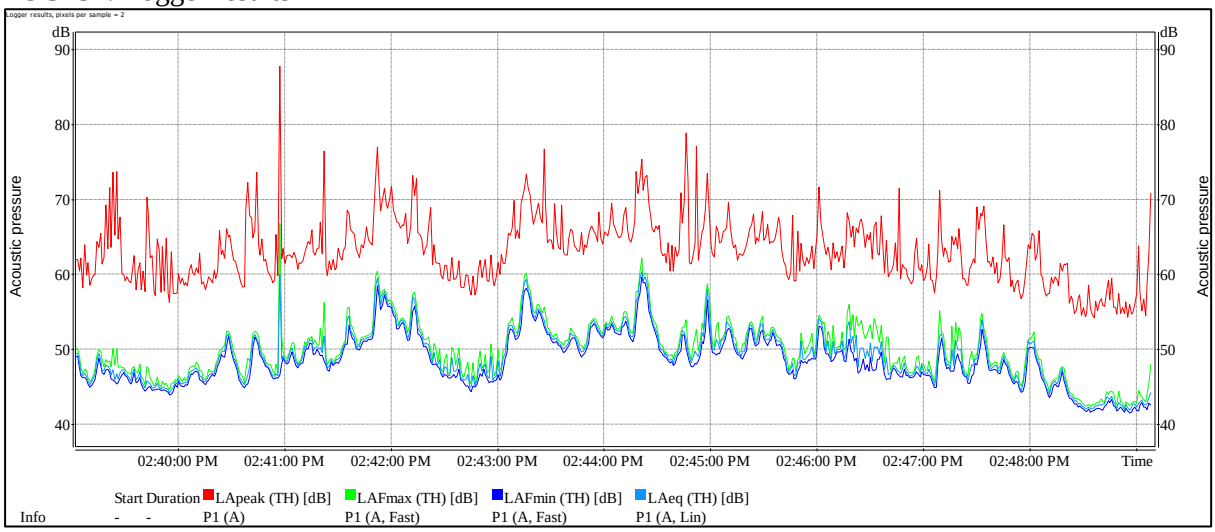
Causes of exceedance of the background level.

Nr.	Time	Cause
1	12:51 – 13:00 hrs.	Continuous noise of heaters at distance; birds; leaves rustling by the wind and insects.
2	12:56 – 12:57 hrs.	Noise of moped passing by (1x).
3	12:57 – 12:58 hrs.	Noise of light truck passing by (1x).
4	12:58 – 12:59 hrs.	Noise of barking dogs at distance.
5	13:00 hrs.	Noise of car passing by (1x).

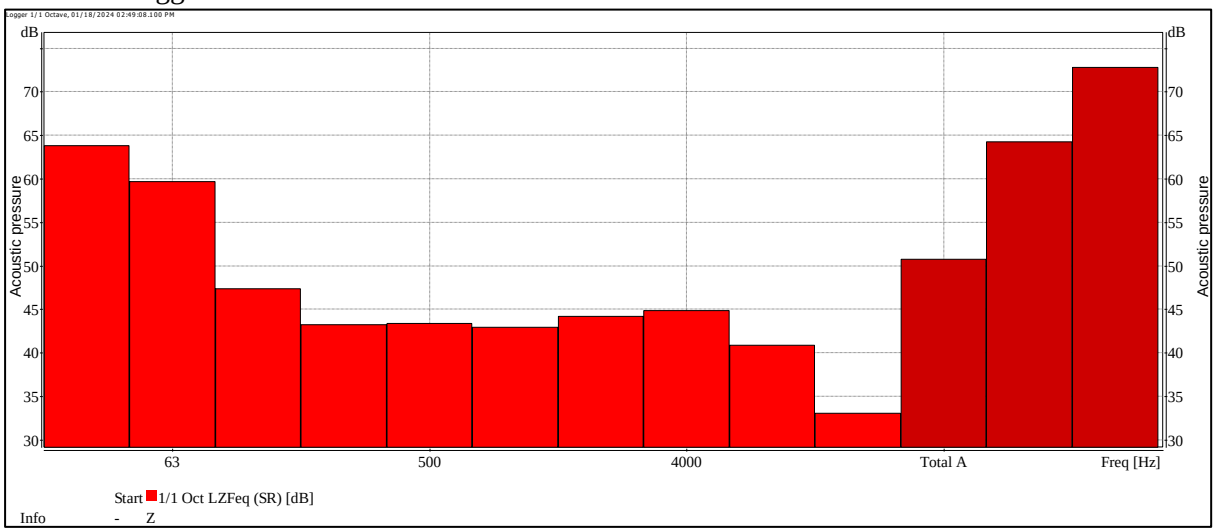
Location Jos-BN7

Log number:	LOG237
Date:	18 January 2024
Time:	14:39 – 14:49 hrs. (9 min)
Description of the location:	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 610 m east from the entrance of the Jossie treatment plant.
Observation during measurement:	Continuous noise of heaters at distance; birds and leaves rustling by the wind. Occasional noise of falling object at distance, noise of car passing by, unknown noise from the river side, noise of barking dogs at distance, noise of reverse alarm at distance and cracking noise of tree branch. Wind speed: 3.3–5.5 m/s (Gentle breeze) Wind direction: North-East
Position of the noise meter:	The meter was placed approx. 3 m away from edge of the Jossiekreekweg and 1.5 m above surface level.

LOG237: Logger results



LOG237: Logger 1/1 Octave



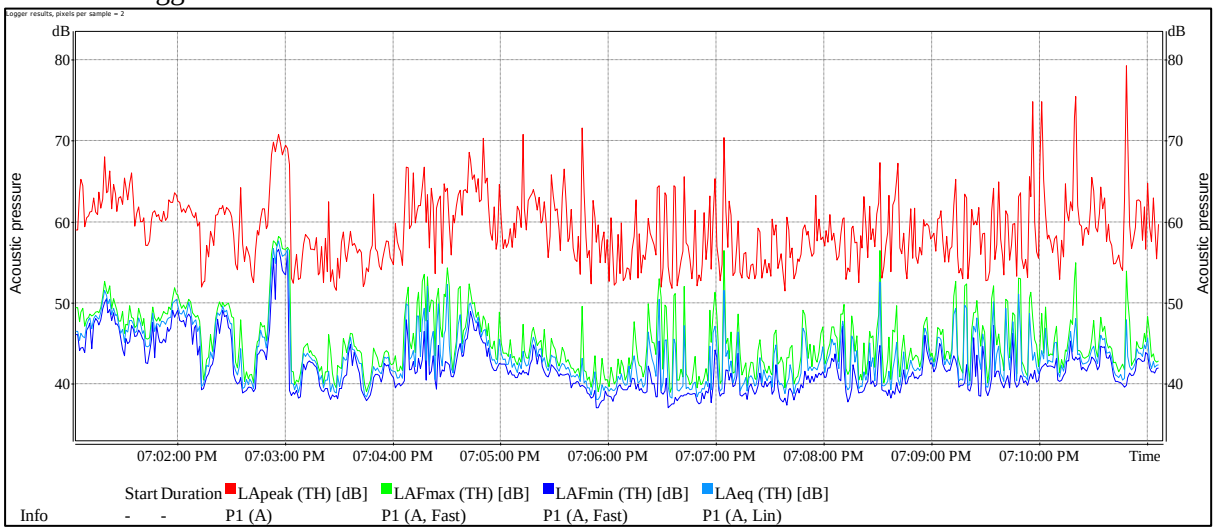
Causes of exceedance of the background level.

Nr.	Time	Cause
1	14:39 – 14:49 hrs.	Continuous noise of heaters at distance; birds and leaves rustling by the wind.
2	14:40 – 14:41 hrs.	Noise of falling object at distance.
3	14:41 – 14:42 hrs.	Cracking noise of tree branch.
4	14:45 – 14:46 hrs.	Noise of car passing by (1x) and unknown noise from the river side.
5	14:46 – 14:47 hrs.	Noise of barking dogs at distance and unknown noise from the river side.
6	14:49 hrs.	Noise of reverse alarm at distance.

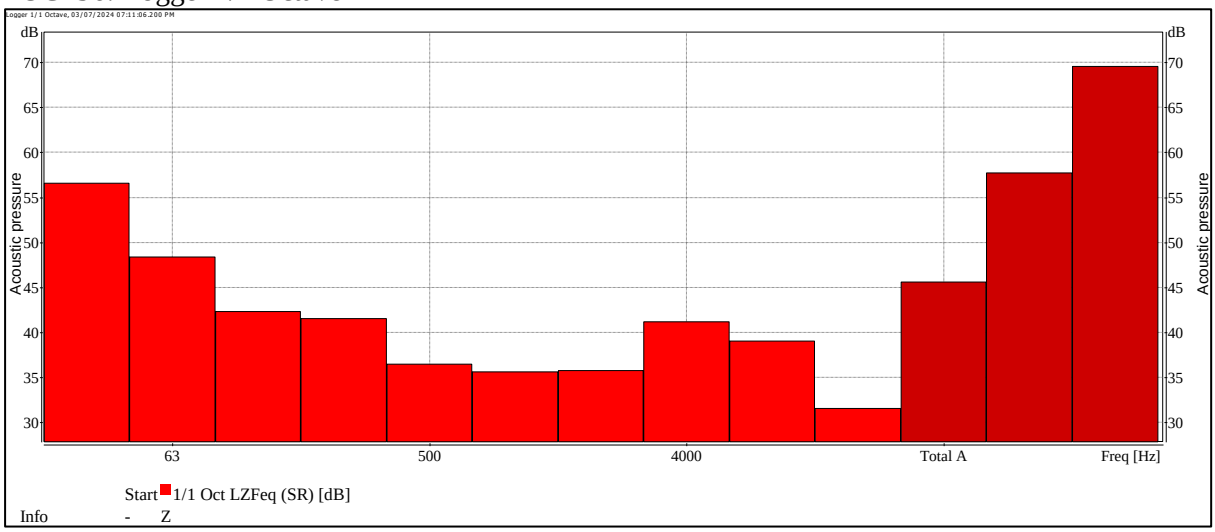
Location Jos-BN8

Log number:	LOG296
Date:	7 March 2024
Time:	19:01 – 19:10 hrs. (10 min)
Description of the location:	At the entrance of a resident, along the west berm of the Tambaredjoweg approx. 1.4 km southwest from the entrance of the Jossie treatment plant. Note: for the daytime the location is slightly shifted (approx. 83 m) from the previous location (of nighttime) due to obstacles.
Observation during measurement:	Continuous noise of transfer pumps at distance and insects in the background. Occasional noise of leaves rustling by the wind, noise of cow at distance, noise of birds at distance, noise of sheep at distance, noise of falling object at distance, noise of barking dog at distance, noise of moped at distance and ticking noise of zinc roof plate. Wind speed: 1.5–3.3 m/s (Gentle breeze) Wind direction: North-East
Position of the noise meter:	The meter was placed approx. 6 m away from axis of the Tambaredjoweg and 1.5 m above surface level.

LOG296: Logger results



LOG296: Logger 1/1 Octave



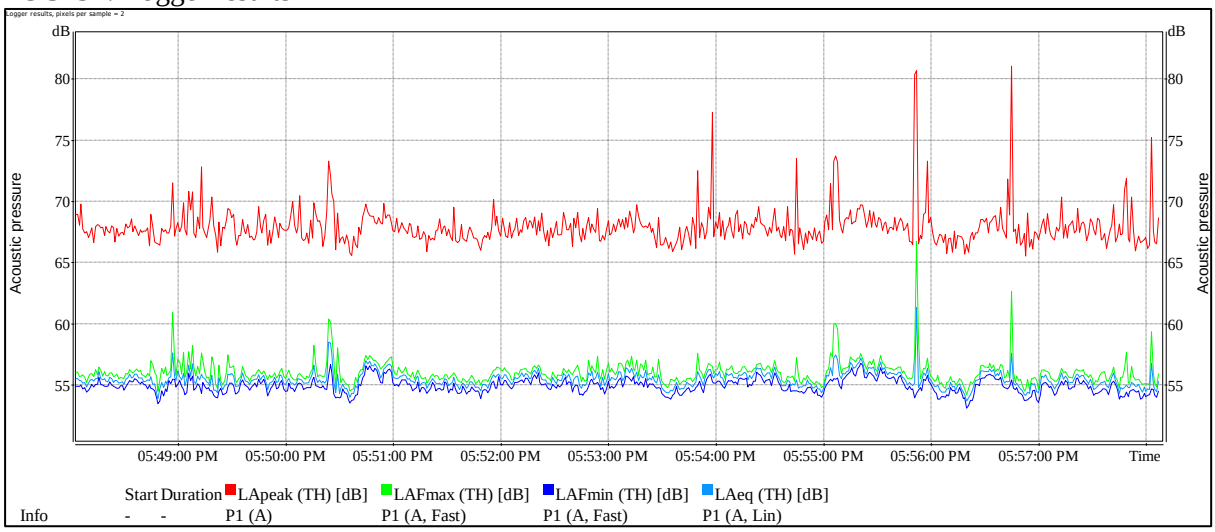
Causes of exceedance of the background level.

Nr.	Time	Cause
1	19:01 – 19:10 hrs.	Continuous noise of transfer pumps at distance and insects in the background.
2	19:01 – 19:02 hrs.	Noise of leaves rustling by the wind and noise of cow at distance.
3	19:02 – 19:03 hrs.	Noise of cow at distance; ticking noise on zinc roof plate and noise of birds at distance.
4	19:03 – 19:04 hrs.	Noise of sheep at distance; noise of leaves rustling by the wind and noise of falling object at distance.
5	19:04 – 19:05 hrs.	Noise of cow at distance; ticking noise on zinc roof plate and noise of leaves rustling by the wind.
6	19:05 – 19:06 hrs.	Noise of leaves rustling by the wind.
7	19:06 – 19:07 hrs.	Noise of moped (1x) at distance; noise of birds at distance and noise of cow at distance.
8	19:07 – 19:08 hrs.	Noise of cow at distance and noise of birds at distance.
9	19:08 – 19:09 hrs.	Noise of birds at distance; ticking noise on zinc roof plate and noise of barking dog at distance.
10	19:09 – 19:10 hrs.	Noise of cow at distance; noise of barking dog at distance and noise of birds at distance.
11	19:10 – 19:11 hrs.	Noise of moped (1x) at distance; noise of leaves rustling by the wind and noise of barking dog at distance.
12	19:11 hrs.	Noise of moped (1x) at distance.

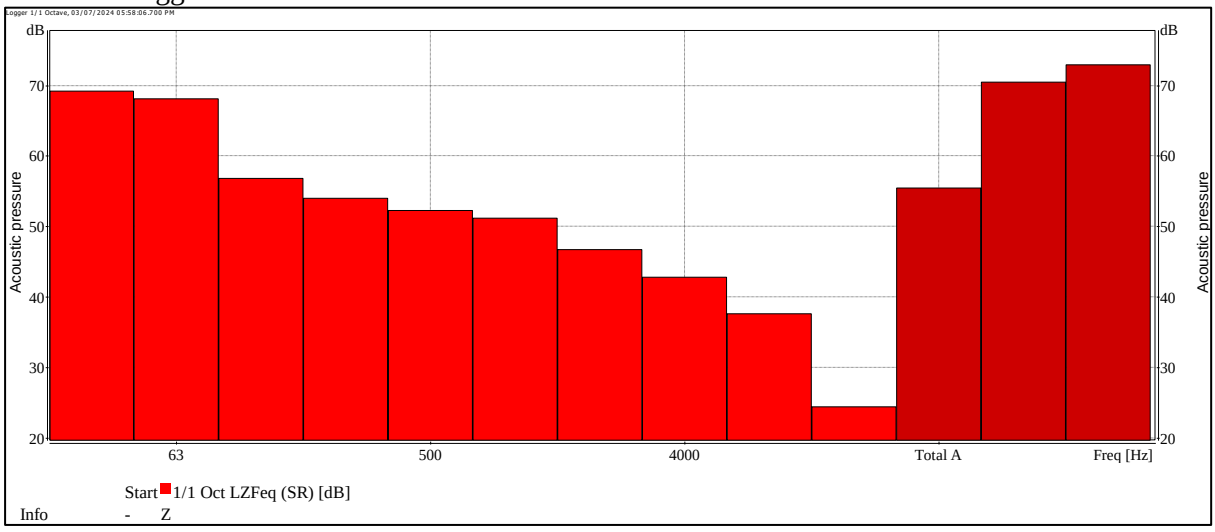
Location Jos-BN9

Log number:	LOG294
Date:	7 March 2024
Time:	17:48 – 17:58 hrs. (10 min)
Description of the location:	Near the residential house at the farm, approx. 127 m west from the entrance of the Jossie treatment plant.
Observation during measurement:	Continuous noise of transfer pumps (2x) at distance; noise of heaters (1x) at distance and noise of internal pump (1x) at distance. Occasional noise of leaves rustling by the wind, noise of pigs at distance, noise of birds at distance, noise of tree branch cracking at distance, noise of sheep at distance and noise of person sneezing. Wind speed: 1.5–3.3 m/s (Gentle breeze) Wind direction: North-East
Position of the noise meter:	The meter was placed approx. 7 m away from the wall of the house and 1.5 m above surface level.

LOG294: Logger results



LOG294: Logger 1/1 Octave



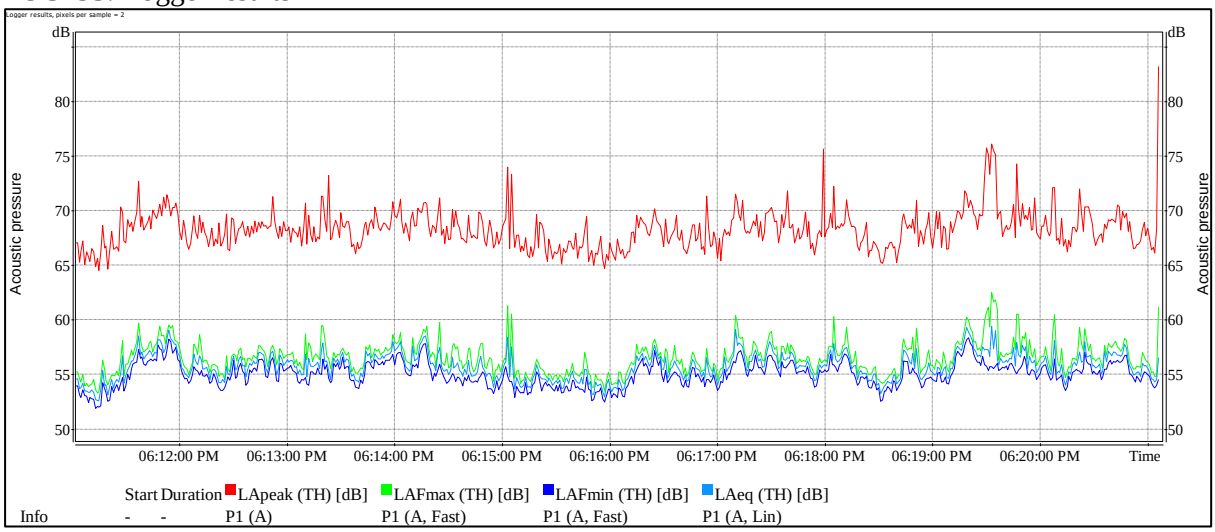
Causes of exceedance of the background level.

Nr.	Time	Cause
1	17:48 – 17:58 hrs.	Continuous noise of transfer pumps (2x) at distance; noise of heaters (1x) at distance and noise of internal pump (1x) at distance.
2	17:48 – 17:49 hrs.	Noise of pigs at distance.
3	17:49 – 17:50 hrs.	Noise of leaves rustling by the wind.
4	17:50 – 17:51 hrs.	Noise of leaves rustling by the wind; noise of birds at distance and noise of pigs at distance.
5	17:51 – 17:52 hrs.	Noise of leaves rustling by the wind and noise of birds at distance.
6	17:52 – 17:53 hrs.	Noise of leaves rustling by the wind; noise of tree branch cracking at distance; noise of birds at distance and noise of sheep at distance.
7	17:53 – 17:54 hrs.	Noise of sheep at distance and noise of birds at distance.
8	17:54 – 17:55 hrs.	Noise of birds at distance; noise of leaves rustling by the wind and noise of pigs at distance.
9	17:55 – 17:56 hrs.	Noise of birds at distance; noise of leaves rustling by the wind and noise of person sneezing.
10	17:56 – 17:57 hrs.	Noise of leaves rustling by the wind and noise of birds at distance.
11	17:57 – 17:58 hrs.	Noise of birds at distance; noise of sheep and pigs at distance.
12	17:58 hrs.	Noise of birds at distance.

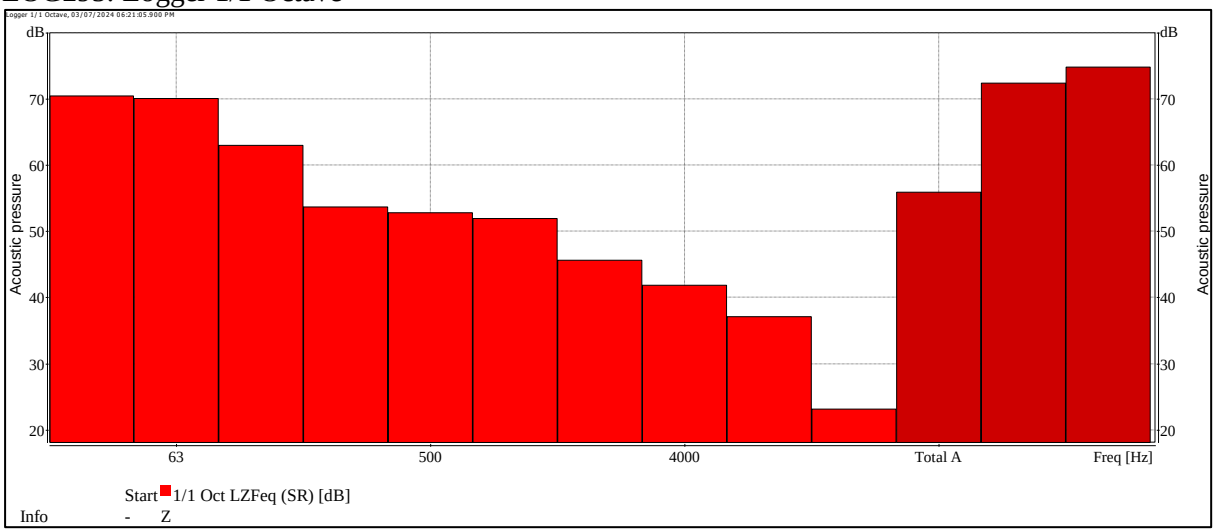
Location Jos-BN10

Log number:	LOG295
Date:	7 March 2024
Time:	18:11 – 18:21 hrs. (10 min)
Description of the location:	At the farm, approx. 165 m west from the entrance of the Jossie treatment plant.
Observation during measurement:	Continuous noise of transfer pumps (2x) at distance; noise of heaters (1x) at distance and noise of internal pump (1x) at distance. Occasional noise of leaves rustling by the wind, noise of sheep at distance, noise of pigs at distance, noise of birds at distance and noise of hydrophore engine at distance. Wind speed: 1.5–3.3 m/s (Gentle breeze) Wind direction: North-East
Position of the noise meter:	The meter was placed approx. 4 m away from the fence and 1.5 m above surface level.

LOG295: Logger results



LOG295: Logger 1/1 Octave



Causes of exceedance of the background level.

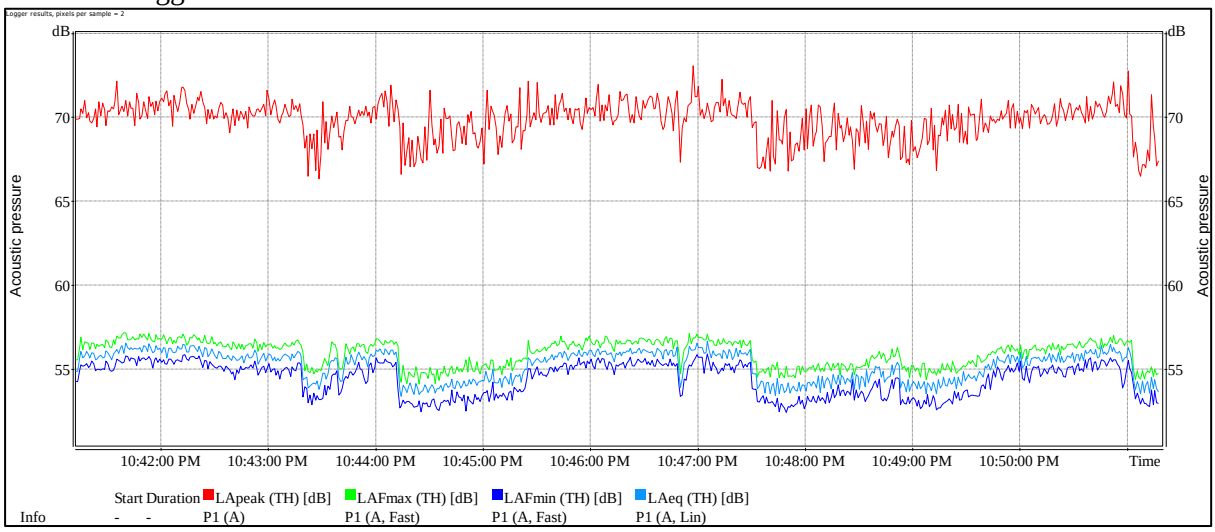
Nr.	Time	Cause
1	18:11 – 18:21 hrs.	Continuous noise of transfer pumps (2x) at distance; noise of heaters (1x) at distance and noise of internal pump (1x) at distance.
2	18:11 – 18:12 hrs.	Noise of leaves rustling by the wind; noise of sheep and pigs at distance.
3	18:12 – 18:13 hrs.	Noise of leaves rustling by the wind and noise of birds at distance.
4	18:13 – 18:14 hrs.	Noise of leaves rustling by the wind and noise of pigs at distance.
5	18:14 – 18:15 hrs.	Noise of sheep at distance; noise of birds at distance and noise of leaves rustling by the wind.
6	18:15 – 18:16 hrs.	Noise of pigs at distance; noise of birds at distance and noise of leaves rustling by the wind.
7	18:16 – 18:17 hrs.	Noise of birds at distance; noise of sheep and pigs at distance.
8	18:17 – 18:18 hrs.	Noise of birds at distance; noise of leaves rustling by the wind; noise of sheep and pigs at distance.
9	18:18 – 18:19 hrs.	Noise of birds at distance; noise of sheep and pigs at distance.
10	18:19 – 18:20 hrs.	Noise of birds at distance; noise of sheep and pigs at distance.
11	18:20 – 18:21 hrs.	Noise of sheep at distance; noise of hydrophore engine at distance and noise of leaves rustling by the wind.

Nighttime Baseline Noise Measurements
22:00 hrs. – 7:00 hrs.

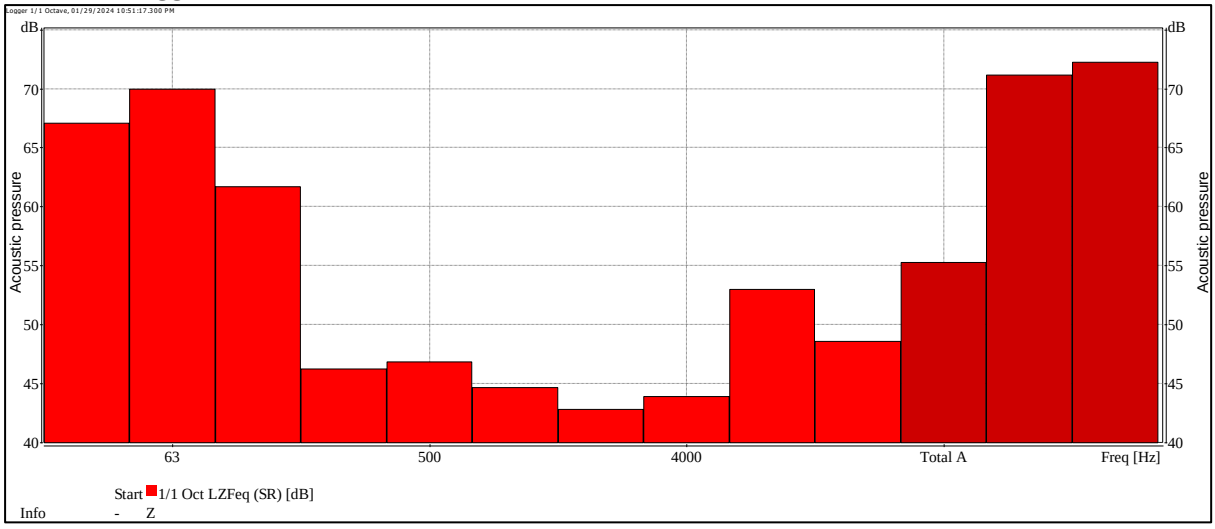
Location Jos-BN1

Log number:	LOG240
Date:	29 January 2024
Time:	22:41 – 22:51 hrs. (10 min)
Description of the location:	Along the south berm of the Jossiekreekweg, between the main entrance and parking space of the Jossie treatment plant.
Observation during measurement:	Continuous noise of heaters at distance; transfer pumps at distance and insects in the background. Wind speed: <0.3 m/s (Calm) Wind direction: –
Position of the noise meter:	The meter was placed approx. 3 m away from edge of the Jossiekreekweg and 1.5 m above surface level.

LOG240: Logger results



LOG240: Logger 1/1 Octave



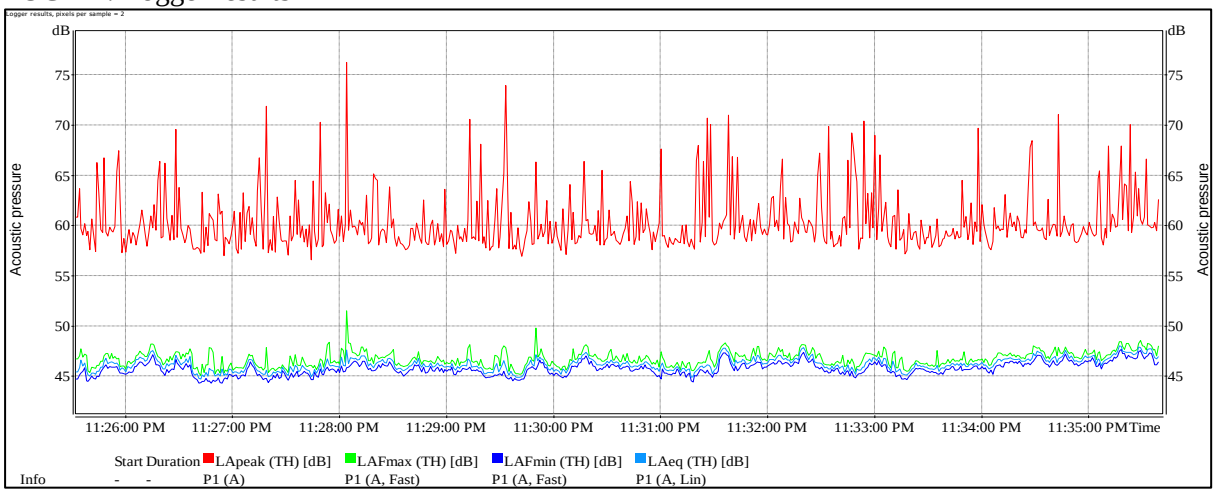
Causes of exceedance of the background level.

Nr.	Time	Cause
1	22:41 – 22:51 hrs.	Continuous noise of heaters at distance; transfer pumps at distance and insects in the background.

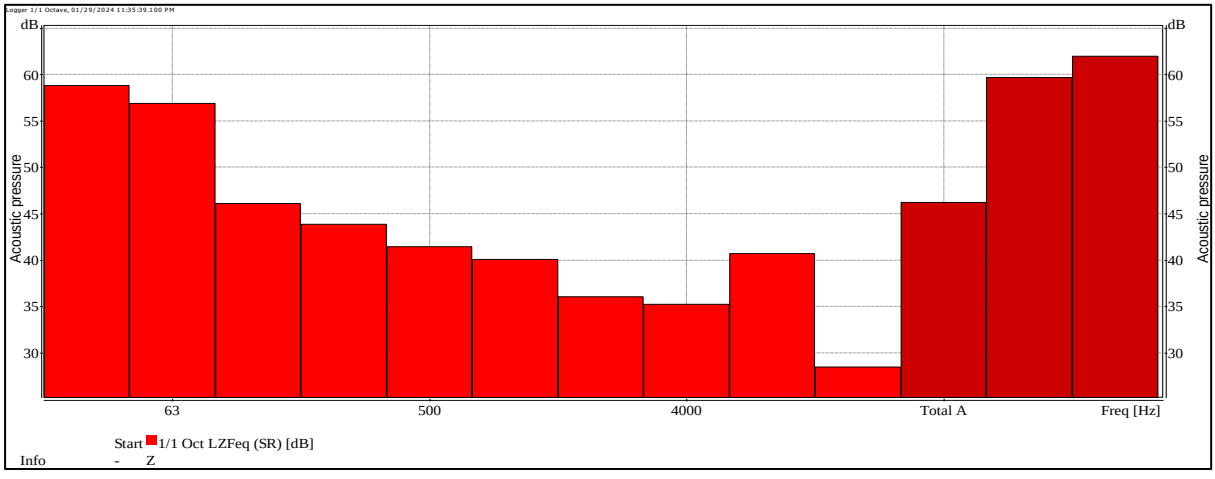
Location Jos-BN2

Log number:	LOG241
Date:	29 January 2024
Time:	23:25 – 23:35 hrs. (10 min)
Description of the location:	Along the Jossiekreekweg, in front of a local mosque, approx. 150 m west from the entrance of the Jossie treatment plant.
Observation during measurement:	Continuous noise of heaters at distance; transfer pumps at distance; insects and toads in the background. Occasional noise of bird at distance. Wind speed: <0.3 m/s (Calm) Wind direction: –
Position of the noise meter:	The meter was placed approx. 3 m away from edge of the Jossiekreekweg and 1.5 m above surface level.

LOG241: Logger results



LOG241: Logger 1/1 Octave



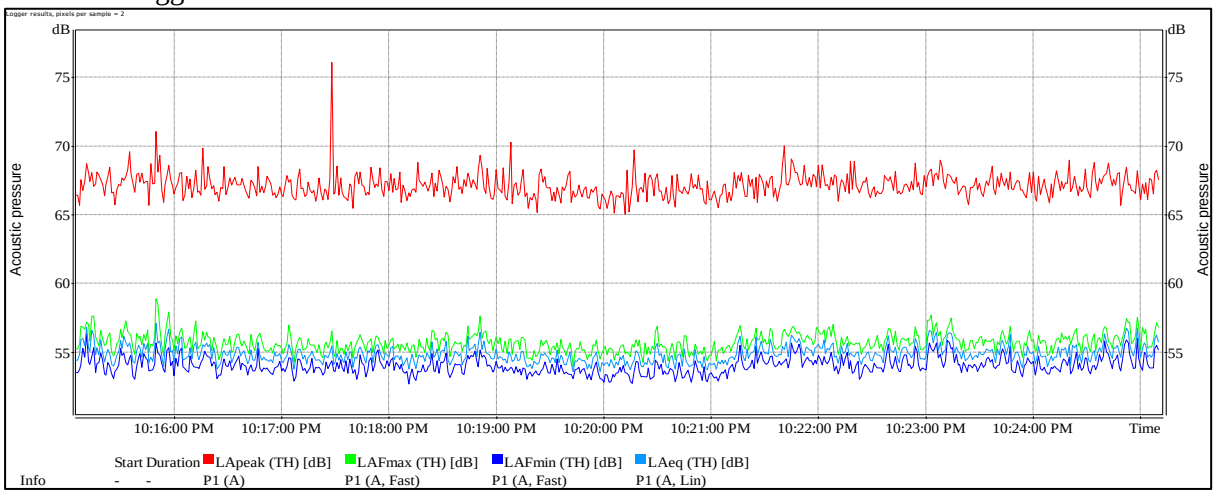
Causes of exceedance of the background level.

Nr.	Time	Cause
1	23:25 – 23:35 hrs.	Continuous noise of heaters at distance; transfer pumps at distance: insects and toads in the background.
2	23:34 – 23:35 hrs.	Noise of bird at distance.

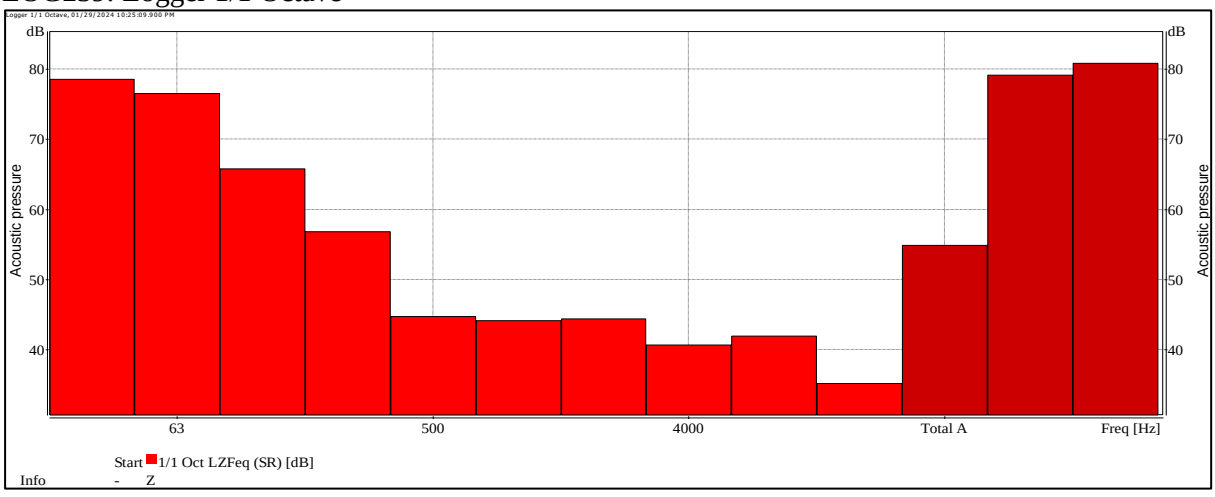
Location Jos-BN3

Log number:	LOG239
Date:	29 January 2024
Time:	22:15 – 22:30 hrs. (15 min)
Description of the location:	At the backyard of the treatment plant. The backyard consists of an office with several other building and a parking area.
Observation during measurement:	Continuous noise of heaters at distance (1x); transfer pumps at distance (2x) and insects in the background. Wind speed: <0.3 m/s (Calm) Wind direction: –
Position of the noise meter:	The meter was placed approx. 7 m away from axis of the road and 1.5 m above surface level.

LOG239: Logger results



LOG239: Logger 1/1 Octave



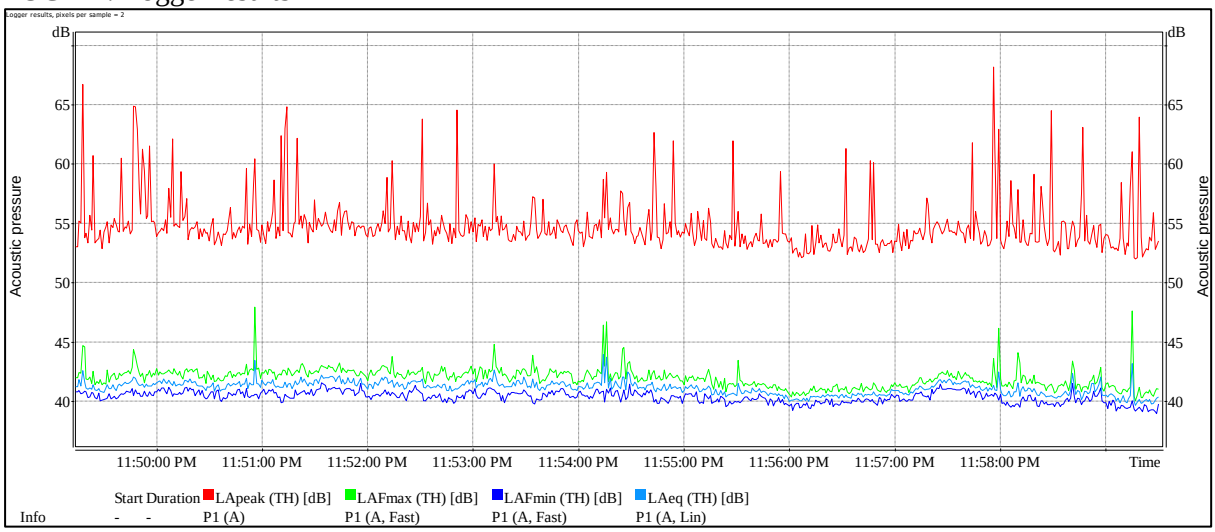
Causes of exceedance of the background level.

Nr.	Time	Cause
1	23:25 – 23:35 hrs.	Continuous noise of heaters at distance (1x); transfer pumps at distance (2x) and insects in the background.

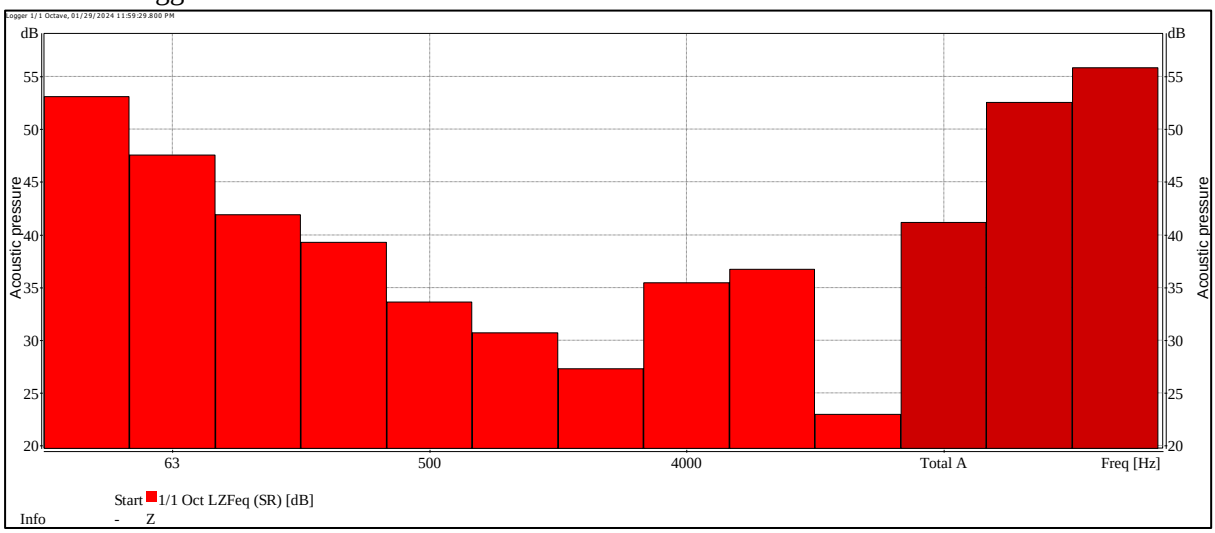
Location Jos-BN4

Log number:	LOG242
Date:	29 January 2024
Time:	23:49 – 23:59 hrs. (10 min)
Description of the location:	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 466 m west from the entrance of the Jossie treatment plant.
Observation during measurement:	Continuous noise of heaters at distance; transfer pumps at distance; insects and toads in the background. Occasional cracking noise of tree branch at distance, noise of cat at distance, noise of falling object on zinc roof plate and noise of falling object at distance. Wind speed: <0.3 m/s (Calm) Wind direction: –
Position of the noise meter:	The meter was placed approx. 3 m away from edge of the Jossiekreekweg and 1.5 m above surface level.

LOG242: Logger results



LOG242: Logger 1/1 Octave



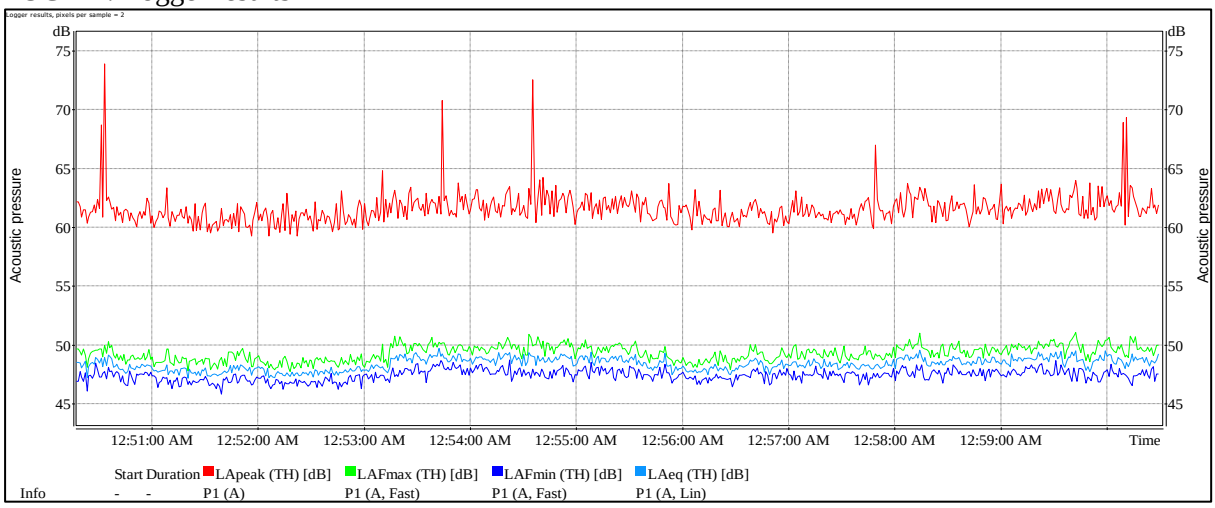
Causes of exceedance of the background level.

Nr.	Time	Cause
1	23:49 – 23:59 hrs.	Continuous noise of heaters at distance; transfer pumps at distance: insects and toads in the background.
2	23:51 – 23:52 hrs.	Cracking noise of tree branch at distance.
3	23:53 – 23:54 hrs.	Noise of cat at distance.
4	23:54 – 23:55 hrs.	Noise of cat at distance.
5	23:58 – 23:59 hrs.	Noise of cat at distance and noise of falling object on zinc roof plate.
6	23:59 hrs.	Noise of falling object at distance.

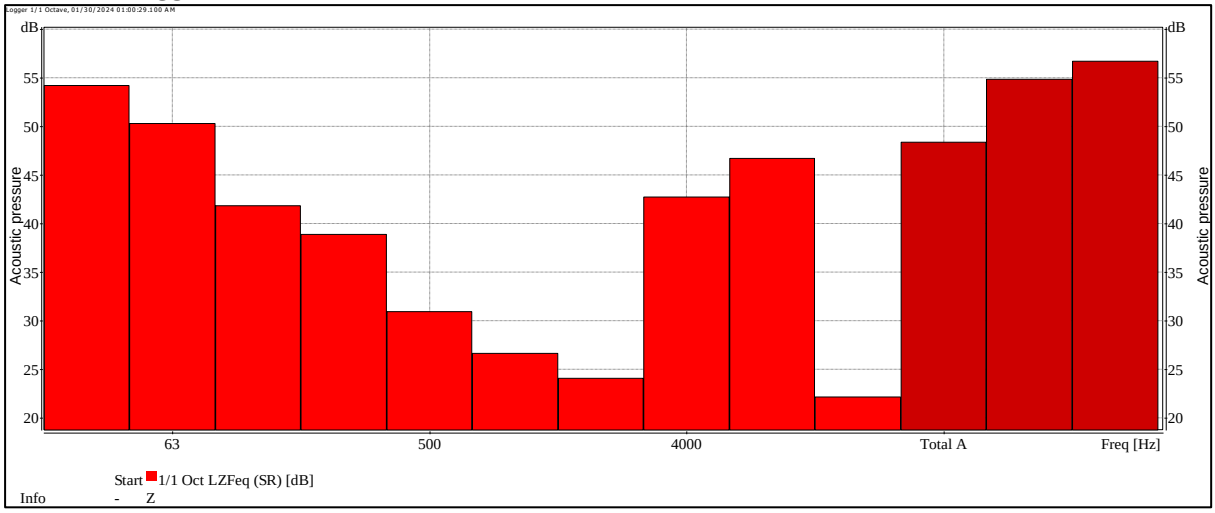
Location Jos-BN5

Log number:	LOG244
Date:	30 January 2024
Time:	00:50 – 01:00 hrs. (10 min)
Description of the location:	At the entrance of a resident, along the north berm of the Jossiekreekweg approx. 630 m west from the entrance of the Jossie treatment plant.
Observation during measurement:	Continuous noise of heaters at distance; transfer pumps at distance and insects and toads in the background. Occasional noise of falling object at distance. Wind speed: <0.3 m/s (Calm) Wind direction: –
Position of the noise meter:	The meter was placed approx. 3 m away from edge of the Jossiekreekweg and 1.5 m above surface level.

LOG244: Logger results



LOG244: Logger 1/1 Octave



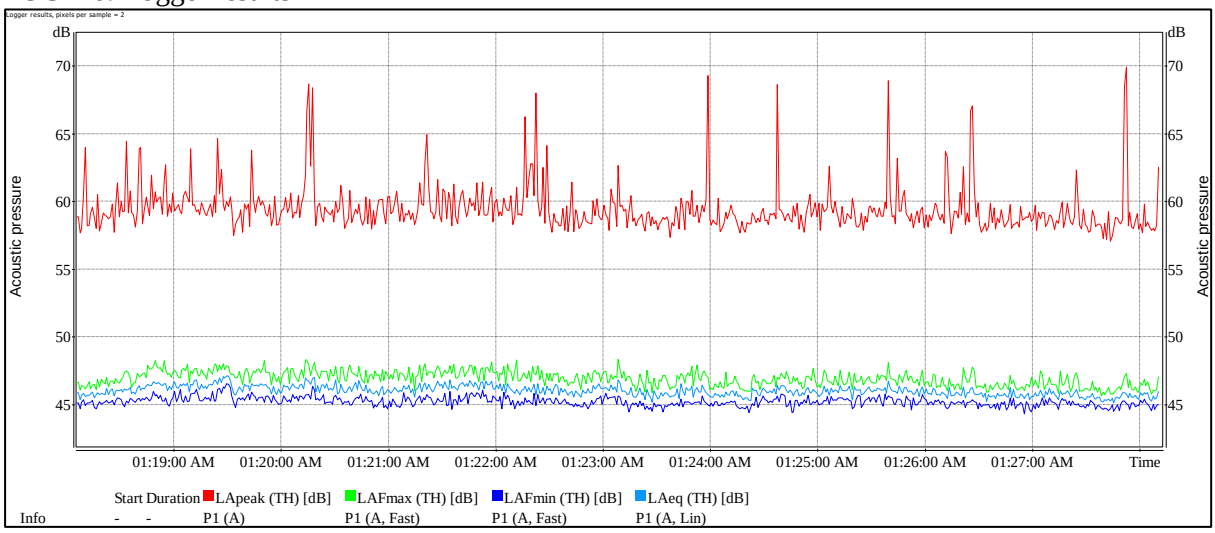
Causes of exceedance of the background level.

Nr.	Time	Cause
1	00:50 – 01:00 hrs.	Continuous noise of heaters at distance; transfer pumps at distance and insects and toads in the background.
2	00:55 – 00:56 hrs.	Noise of falling object at distance.
3	00:58 – 00:59 hrs.	Noise of falling object at distance.

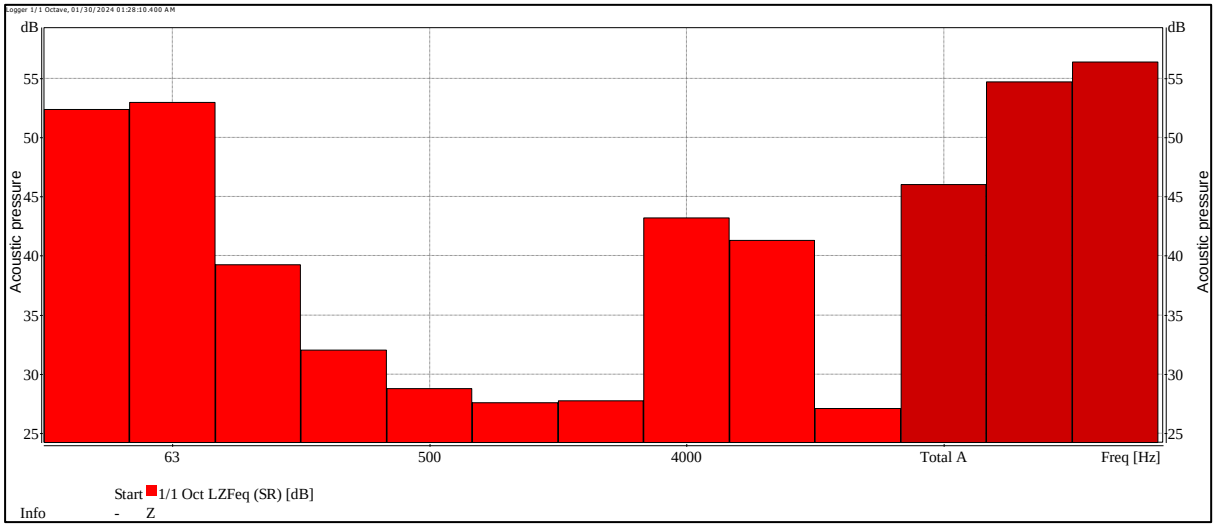
Location Jos-BN6

Log number:	LOG246
Date:	30 January 2024
Time:	01:18 – 01:28 hrs. (10 min)
Description of the location:	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 413 m east from the entrance of the Jossie treatment plant.
Observation during measurement:	Continuous noise of transfer pumps at distance; music at distance and insects and toads in the background. Occasional noise of falling object at distance. Wind speed: <0.3 m/s (Calm) Wind direction: –
Position of the noise meter:	The meter was placed approx. 6 m away from axis of the Jossiekreekweg and 1.5 m above surface level.

LOG246: Logger results



LOG246: Logger 1/1 Octave



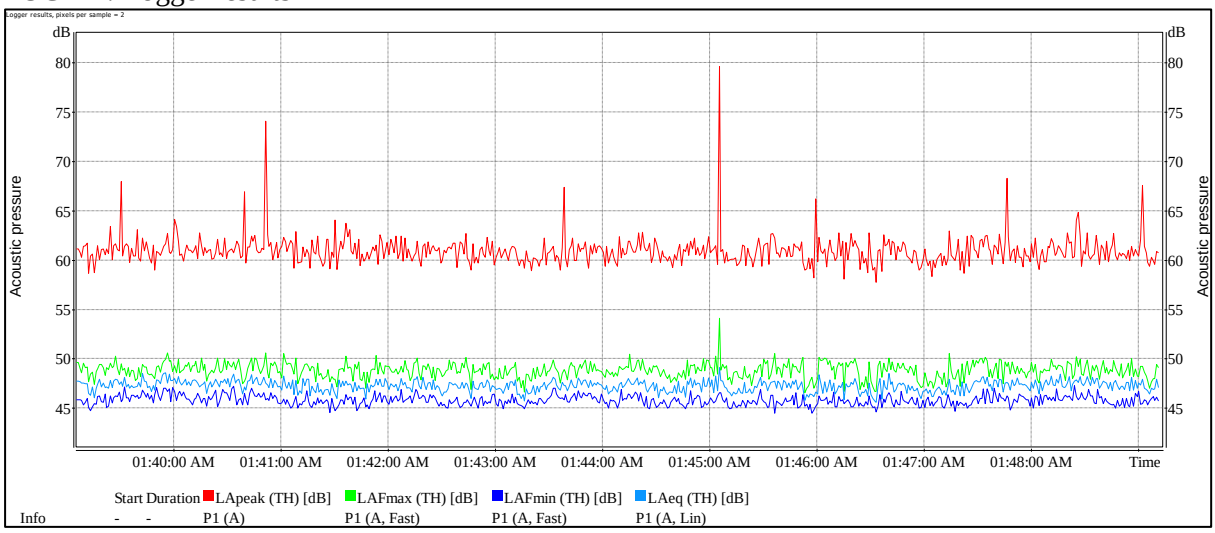
Causes of exceedance of the background level.

Nr.	Time	Cause
1	01:18 – 01:28 hrs.	Continuous noise of transfer pumps at distance; music at distance and insects and toads in the background.
2	01:25 – 01:26 hrs.	Noise of falling object at distance.
3	01:27 – 01:28 hrs.	Noise of falling object at distance.

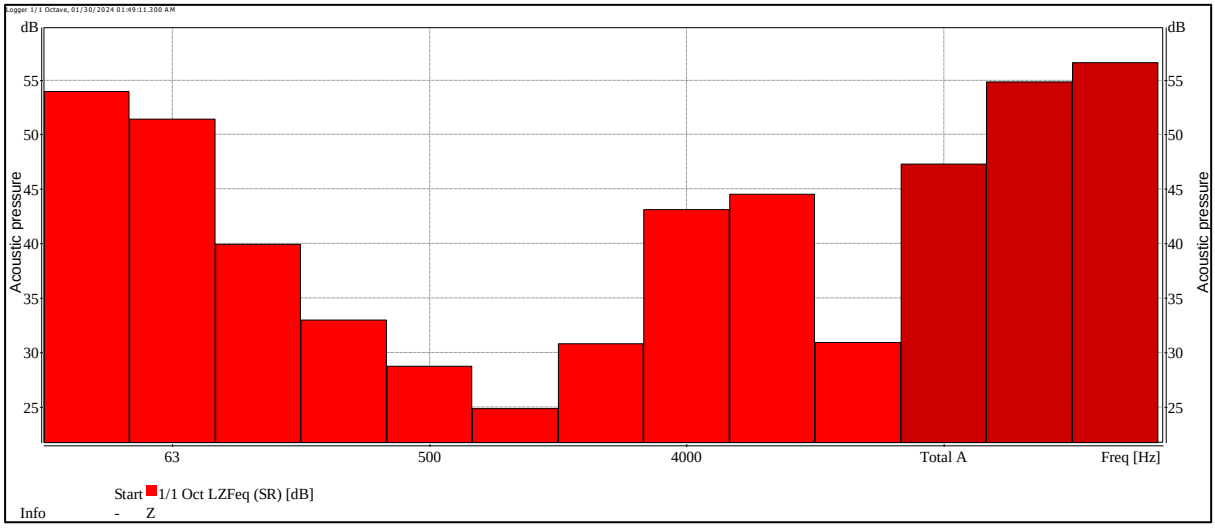
Location Jos-BN7

Log number:	LOG247
Date:	30 January 2024
Time:	01:39 – 01:49 hrs. (10 min)
Description of the location:	At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 610 m east from the entrance of the Jossie treatment plant.
Observation during measurement:	Continuous noise of transfer pumps at distance; Moyno pump in the background and insects and toads in the background. Frequent noise of birds at distance. Occasional cracking noise of tree branch at distance. Wind speed: <0.3 m/s (Calm) Wind direction: –
Position of the noise meter:	The meter was placed approx. 3 m away from edge of the Jossiekreekweg and 1.5 m above surface level.

LOG247: Logger results



LOG247: Logger 1/1 Octave



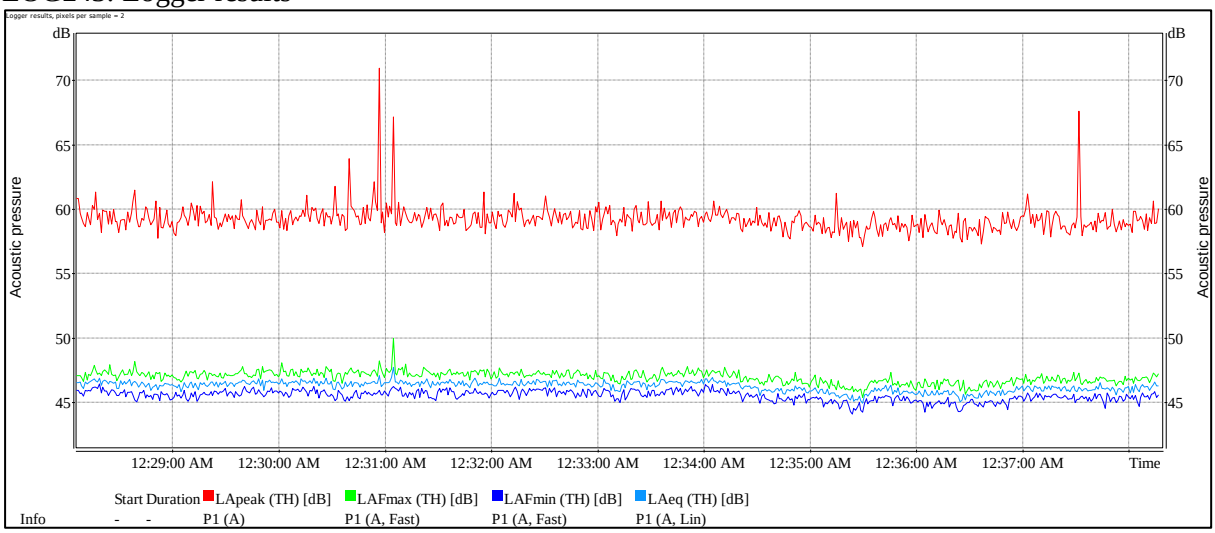
Causes of exceedance of the background level.

Nr.	Time	Cause
1	01:39 – 01:49 hrs.	Continuous noise of transfer pumps at distance; Moyno pump in the background and insects and toads in the background.
2	01:41 – 01:42 hrs.	Noise of birds at distance.
3	01:42 – 01:43 hrs.	Noise of birds at distance.
4	01:43 – 01:44 hrs.	Noise of birds at distance and cracking noise of tree branch at distance.
5	01:44 – 01:45 hrs.	Noise of tree branch cracking at distance.
6	01:45 – 01:46 hrs.	Noise of tree branch cracking at distance.
7	01:46 – 01:47 hrs.	Noise of birds at distance.
8	01:47 – 01:48 hrs.	Noise of birds at distance.
9	01:48 – 01:49 hrs.	Noise of birds at distance.

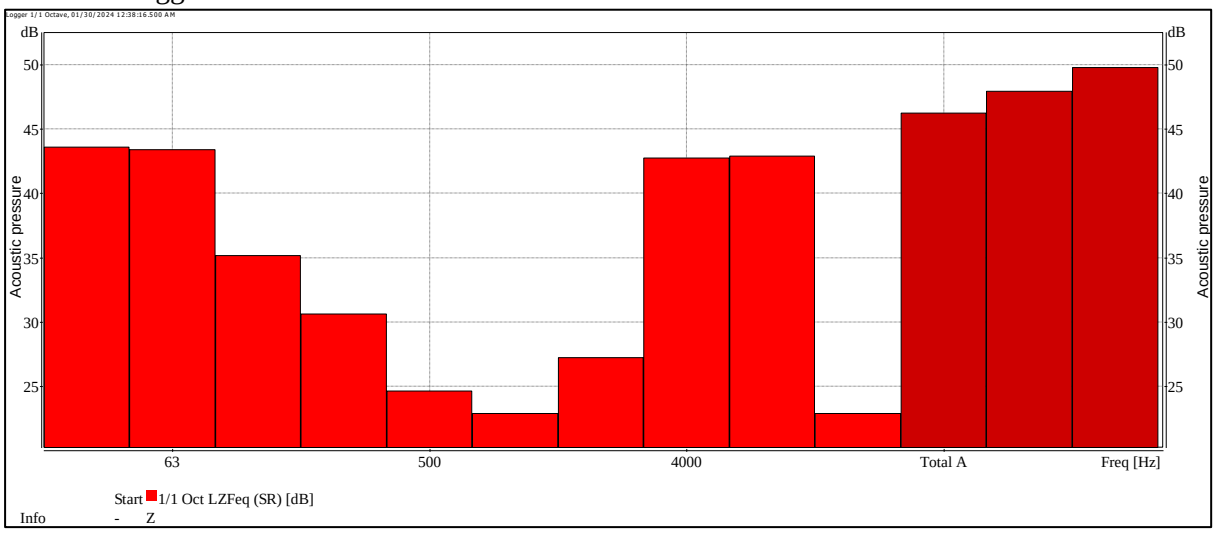
Location Jos-BN8

Log number:	LOG243
Date:	30 January 2024
Time:	00:28 – 00:38 hrs. (10 min)
Description of the location:	At the entrance of a resident, along the west berm of the Tambaredjoweg approx. 1.4 km southwest from the entrance of the Jossie treatment plant.
Observation during measurement:	Continuous noise of transfer pumps at distance and insects and toads in the background. Occasional noise of talking persons at distance; noise of traffic from the Oost-West Verbindingweg and noise of music at distance. Wind speed: <0.3 m/s (Calm) Wind direction: –
Position of the noise meter:	The meter was placed approx. 3 m away from edge of the Tambaredjoweg, approx. 6 m away from the axis of the Tambaredjoweg, 5 m away from the fence of the resident and 1.5 m above surface level.

LOG243: Logger results



LOG243: Logger 1/1 Octave



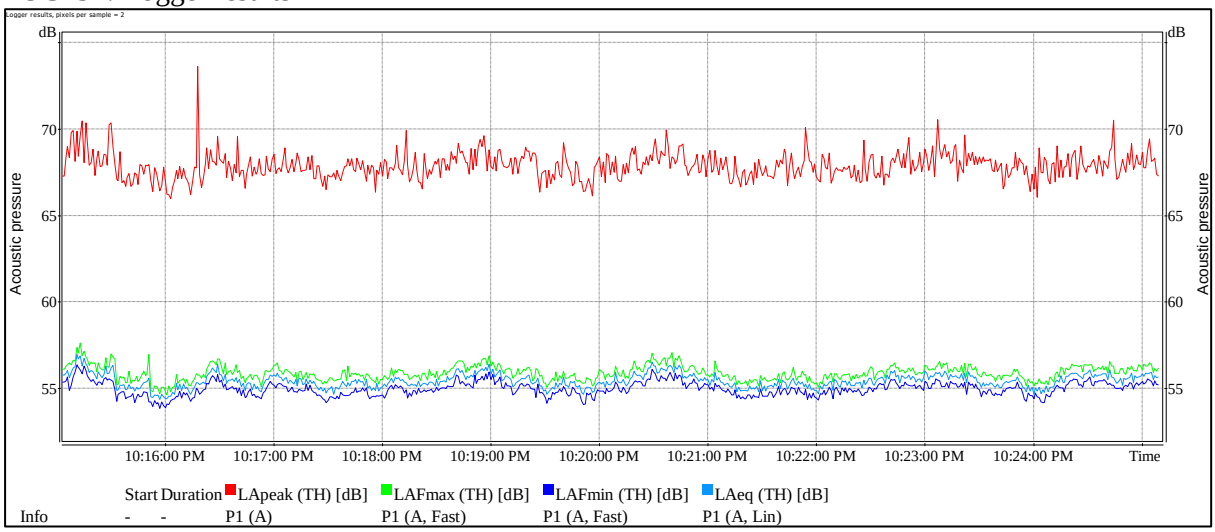
Causes of exceedance of the background level.

Nr.	Time	Cause
1	00:28 – 00:38 hrs.	Continuous noise of transfer pumps at distance; insects and toads in the background.
2	00:28 – 00:29 hrs.	Noise of talking persons at distance.
3	00:29 – 00:30 hrs.	Noise of talking persons at distance.
4	00:31 – 00:32 hrs.	Noise of talking persons at distance.
5	00:33 – 00:34 hrs.	Noise of traffic from the Oost-West Verbindingweg.
6	00:35 – 00:36 hrs.	Noise of talking person at distance.
7	00:36 – 00:37 hrs.	Noise of music at distance.

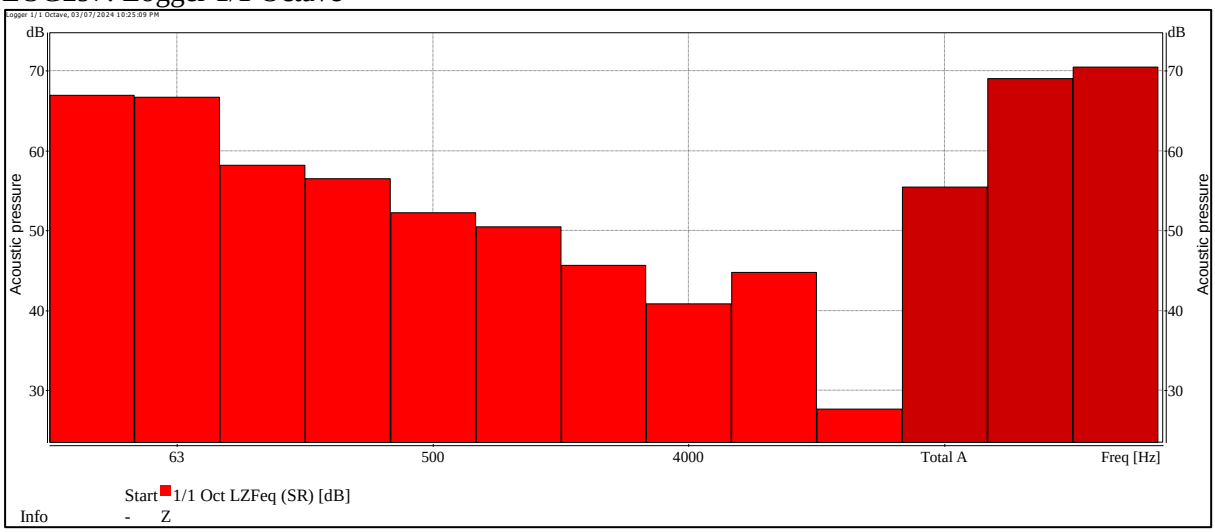
Location Jos-BN9

Log number:	LOG297
Date:	7 March 2024
Time:	22:15 – 22:25 hrs. (10 min)
Description of the location:	At the farm, approx. 127 m west from the entrance of the Jossie treatment plant.
Observation during measurement:	Continuous noise of transfer pumps (2x) at distance; noise of heaters (1x) at distance; noise of internal pump (1x) at distance; insects and toads in the background. Occasional noise of hydrophore engine at distance, noise of birds at distance and noise of leaves rustling by the wind. Wind speed: 0.3–1.5 m/s (Light air) Wind direction: North-East
Position of the noise meter:	The meter was placed approx. 7 m away from the wall of the house and 1.5 m above surface level.

LOG297: Logger results



LOG297: Logger 1/1 Octave



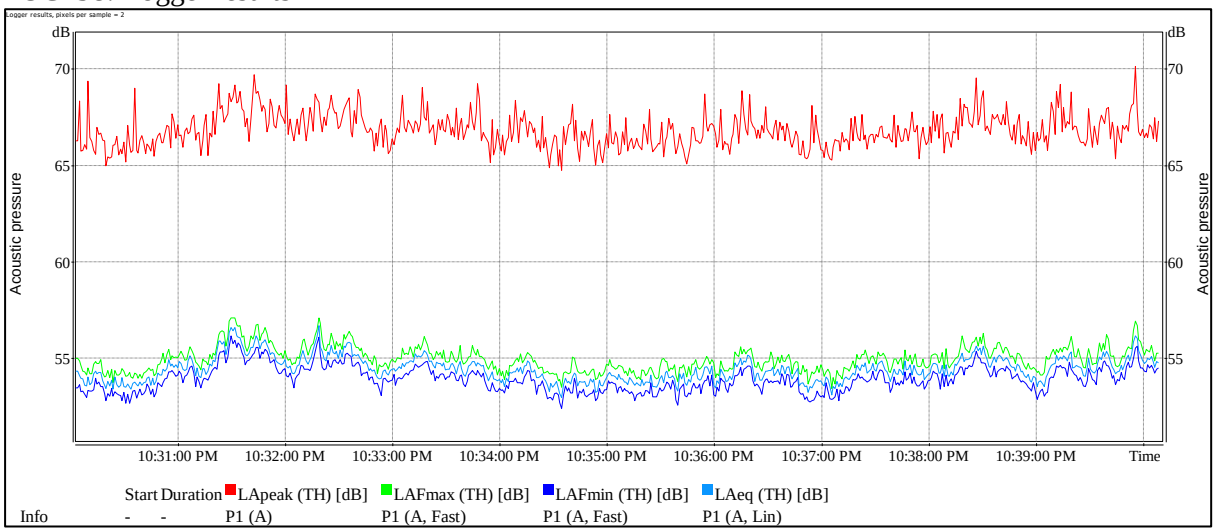
Causes of exceedance of the background level.

Nr.	Time	Cause
1	22:15 – 22:25 hrs.	Continuous noise of transfer pumps (2x) at distance; noise of heaters (1x) at distance; noise of internal pump (1x) at distance; insects and toads in the background.
2	22:15 – 22:16 hrs.	Noise of hydrophore engine at distance.
3	22:19 – 22:20 hrs.	Noise of hydrophore engine at distance.
4	22:20 – 22:21 hrs.	Noise of birds at distance and noise of leaves rustling by the wind.
5	22:22 hrs.	Noise of leaves rustling by the wind.

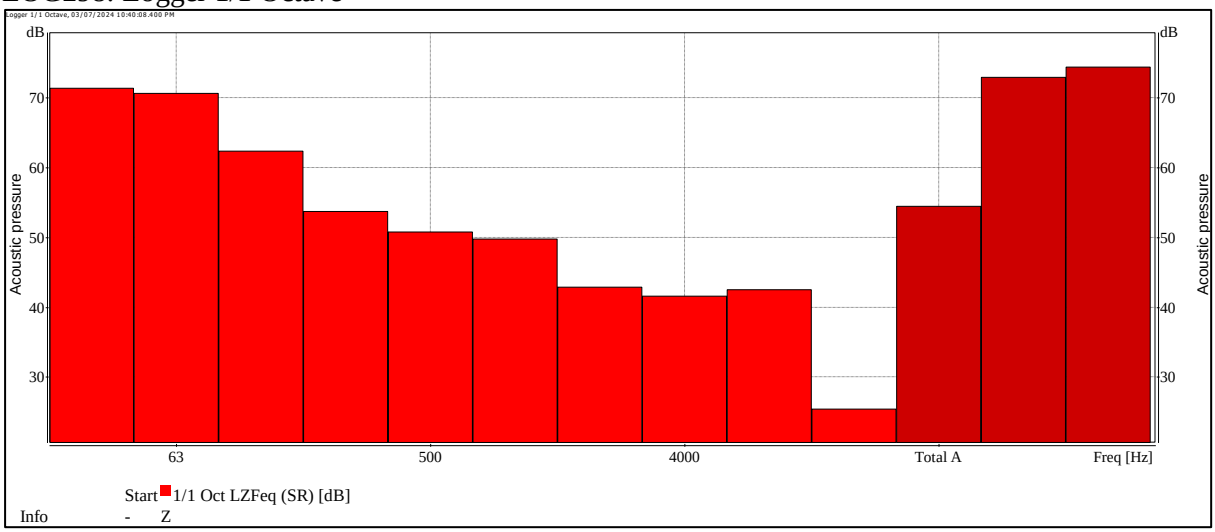
Location Jos-BN10

Log number:	LOG298
Date:	7 March 2024
Time:	22:30 – 22:40 hrs. (10 min)
Description of the location:	At the farm, approx. 165 m west from the entrance of the Jossie treatment plant.
Observation during measurement:	Continuous noise of transfer pumps (2x) at distance; noise of heaters (1x) at distance; noise of internal pump (1x) at distance; insects and toads in the background. Occasional noise of falling object on zinc roof plate, noise of chicken at distance, noise of tree branch cracking at distance and noise of leaves rustling by the wind. Wind speed: 0.3–1.5 m/s (Light air) Wind direction: North-East
Position of the noise meter:	The meter was placed approx. 4 m away from the fence and 1.5 m above surface level.

LOG298: Logger results



LOG298: Logger 1/1 Octave



Causes of exceedance of the background level.

Nr.	Time	Cause
1	22:30 – 22:40 hrs.	Continuous noise of transfer pumps (2x) at distance; noise of heaters (1x) at distance; noise of internal pump (1x) at distance; insects and toads in the background.
2	22:34 – 22:35 hrs.	Noise of falling object on zinc roof plate.
3	22:35 – 22:36 hrs.	Noise of chicken at distance.
4	22:38 – 22:39 hrs.	Noise of tree branch cracking at distance.
5	22:39 – 22:40 hrs.	Noise of leaves rustling by the wind.

Appendix 4D: Photo Report

Photo Report

Daytime Baseline Measurements (07:00- 22:00 hrs.)

<table>
<tr><th colspan="2">18th of January 2024 & 7th of March 2024</th></tr>
<tr><td> 
Jos-BN1: Along the south berm of the Jossiekreekweg, between the main entrance and parking space of the Jossie treatment plant.</td><td>  
Jos-BN2: Along the Jossiekreekweg, in front of a local mosque, approx. 150 m west from the entrance of the Jossie treatment plant.</td></tr>
<tr><td>  
Jos-BN3: At the backyard of the treatment plant. The backyard consists of an office with several other buildings and a parking area.</td><td>  
Jos-BN4: At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 466 m west from the entrance of the Jossie treatment plant.</td></tr>
</table>


Jos-BN6: At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 413 m east from the entrance of the Jossie treatment plant.

Jos-BN7: At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 610 m east from the entrance of the Jossie treatment plant.


Jos-BN8: At the entrance of a resident, along the west berm of the Tambaredjoweg approx. 1.4 km southwest from the entrance of the Jossie treatment plant. Note: for the daytime the location is slightly shifted (approx. 83 m) from the previous location (of nighttime) due to obstacles.


Jos-BN9: Near the residential house at the farm, approx. 127 m west from the entrance of the Jossie treatment plant.


Jos-BN10: At the farm, approx. 165 m west from the entrance of the Jossie treatment plant.

Nighttime Baseline Measurements (22:00- 07:00 hrs.)

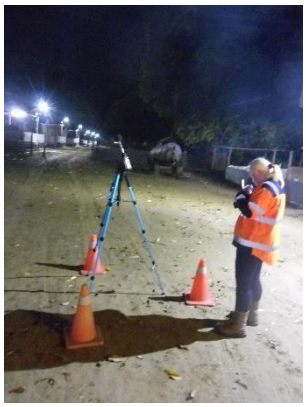
<table>
<tr><th colspan="2">29th, 30th of January 2024 & 7th of March 2024</th></tr>
<tr><td>  
Jos-BN1: Along the south berm of the Jossiekreekweg, between the main entrance and parking space of the Jossie treatment plant.</td><td>  
Jos-BN2: Along the Jossiekreekweg, in front of a local mosque, approx. 150 m west from the entrance of the Jossie treatment plant.</td></tr>
<tr><td> 
Jos-BN3: At the backyard of the treatment plant. The backyard consists of an office with several other buildings and a parking area.</td><td>  
Jos-BN4: At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 466 m west from the entrance of the Jossie treatment plant.</td></tr>
</table>

Jos-BN5: At the entrance of a resident, along the north berm of the Jossiekreekweg approx. 630 m west from the entrance of the Jossie treatment plant.

Jos-BN6: At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 413 m east from the entrance of the Jossie treatment plant.

Jos-BN7: At the entrance of a resident, along the south berm of the Jossiekreekweg approx. 610 m east from the entrance of the Jossie treatment plant.

Jos-BN8: At the entrance of a resident, along the west berm of the Tambaredjoweg approx. 1.4 km southwest from the entrance of the Jossie treatment plant.



Jos-BN9: Near the residential house at the farm, approx. 127 m west from the entrance of the Jossie treatment plant.

Jos-BN10: At the farm, approx. 165 m west from the entrance of the Jossie treatment plant.

Appendix 5: Stakeholder Consultation

Appendix 5A: Minutes of Meeting

Minutes of Meeting

Project:	Zelfstandig Milieu Management en Monitoring Plan (EMMP) voor de optimalisatie van de vloeistofverwerkingscapaciteit en efficiëntie van de Jossie ruwe-olie verwerkingsfaciliteit.
Project Code:	IS-446
Onderwerp:	Consultatie meeting district commissariaat Saramacca
Aanwezigen:	ILACO: Fortune M./ Karijoöetomo C. Commissariaat Saramacca: Vreedzaam A./ Jubitana S.
Locatie:	Commissariaat kantoor Saramacca
Datum:	31 Januari 2024
Tijd:	11:00 – 11:30
Opgesteld door:	Karijoöetomo C.

Onderwerp	**Discussie/Opmerkingen**
Agenda	- Opening en introductie - Project achtergrond - Aanpak en methode - Vragen en - Sluiting
Opening en introductie	Fortune M. van ILACO gaf een korte inleiding van het project en het doel van de bijeenkomst. Het doel van de consultatie: 1. De Districtscommissaris (DC) te informeren over de projectactiviteiten en 2. Om informatie en feedback te verzamelen over de huidige situatie in het projectgebied. Na de introductie hadden de vertegenwoordigers van de DC de mogelijkheid om vragen te stellen aan ILACO.
Vragen	**A.Vreedzaam (Commissariaat):** Heeft Staatsolie al een vergunning aangevraagd bij de desbetreffende instanties? **M. Fortune (ILACO)**: Staatsolie is bezig met de aanvraag van de vergunningen bij de desbetreffende instanties. Een van de vergunningen is de milieuvergunning die bij de NIMOS aangevraagd moet worden. Hiervoor moet er eerst milieuonderzoek worden verricht om na te gaan wat de huidige situatie (baseline) is in het gebied, worden er andere activiteiten in het gebied uitgevoerd en welke veranderingen kunnen we verwachten van het voorgestelde project zodat er maatregelen voorgesteld kunnen worden. Het onderzoek omvat het uitvoeren van geluidsmetingen en gesprekken met de bewoners in het gebied. In samenwerking met een bedrijf uit Zuid-Afrika wordt er geluid en luchtkwaliteit modelering uitgevoerd. **A.Vreedzaam (Commissariaat):** Het geluid van de pompen van de Jossie zijn tot op een afstand van ongeveer een half kilometer duidelijk hoorbaar. Zal het geluid meer of minder worden bij het plaatsen van grotere of moderne pompen? **M. Fortune (ILACO):** Het is nog niet bekend als het geluid zal toenemen of afnemen. Dit zal binnen het milieuonderzoek worden meegenomen. **A.Vreedzaam (Commissariaat):** De uitlaatgassen komen nu vrij bij een onbewoond milieu, maar er is aangegeven dat er een schoorsteen bijna langs de straat zal worden aangelegd. Wat voor gevolgen zal het hebben op de leefomgeving van de bewoners? Er moet rekening worden gehouden met de leefomgeving in het gebied. **M. Fortune (ILACO):** De twee aspecten namelijk geluid en luchtkwaliteit zullen worden meegenomen in het onderzoek. Hiervoor wordt er samengewerkt met Airshed, een bedrijf uit Zuid-Afrika, dat hierin gespecialiseerd is.

	M. Fortune (ILACO): Zijn er andere zaken waarmee rekening moeten worden gehouden? **A. Vreedzaam (Commissariaat):** Er wordt olie vanuit Jossie naar Tout Lui Faut gepompt via pijpleidingen. Zullen er aanpassingen getroffen worden aan de pijpleidingen bij het verhogen van de productiecapaciteit? **M. Fortune (ILACO):** Binnen dit project heeft Staatsolie niet aangegeven dat er aanpassingen zullen komen aan de transportleidingen, maar dit zal worden nagevraagd. **A.Vreedzaam (Commissariaat):** De pijpleidingen aan de Gangaram Pandayweg zijn door de jaren heen al verouderd, waardoor je in een jaar twee tot drie keren te kampen hebt met oil spills. Er kan misschien ook oil spills plaatsvinden die gevaarlijk is voor de woongemeenschap als je de productiecapaciteit wilt verhogen van de Jossie Plant, omdat de pijpleidingen ook een aantal jaren zijn aangelegd. De nieuwe projectactiviteiten moet geen schade hebben voor de leefgemeenschap van het gebied, zoals de kwaliteit van water, lucht en de bodemgesteldheid en ook de infrastructuur. **M. Fortune (ILACO):** Jossie gebied is een landbouwgebied. Is het bekend vanwaar de landbouwers water onttrekken voor hun landbouwactiviteiten? **A.Vreedzaam (Commissariaat):** De landbouwers halen water vanuit oude zandputten, maar bepaalde zandputten staan in verbinding met de Saramacca rivier door middel van duikers onder de weg. De Jossiekreekweg heeft op aantal locaties duikers onder de weg die in verbinding staan met de Saramacca rivier door middel van kreken of zelf gegraven kanalen. **M. Fortune (ILACO):** Heeft u eerder klachten ontvangen van bewoners omtrent wateroverlast tijdens de regentijd? Dit werd door een bewoner aangehaald tijdens gesprekken met de bewoners in het gebied. Het achter deel van zijn perceel, dat voor landbouw is bestemd, loopt onder water en het water stroomt heel langzaam weg. **A.Vreedzaam (Commissariaat):** We hebben geen klachten daarover gehad. Aan de zijde van de Smithfield is er wel een zand put die voor wateroverlast zorgt. Gezien het om een privé lozing van een bewoner gaat, is het probleem nog niet opgelost. Het commissariaat heeft dit al gerapporteerd bij de Ministerie van Openbare Werken. Aan het begin van de Jossiekreekweg zijn er wel meerdere bewoners die eigen kanalen hebben die in verbinding staan met de Saramacca rivier. **M. Fortune (ILACO):** Zijn jullie bekend met andere projecten die gepland zijn in het gebied? **A.Vreedzaam (Commissariaat):** Er zijn geen projecten die gepland zijn in het gebied. **M. Fortune (ILACO):** Zijn er eerder ook klachten gerapporteerd over geluid van de pompen op de Jossie Plant? **A.Vreedzaam (Commissariaat):** In het verleden zijn er wel klachten ontvangen. Naarmate de mensen gewend zijn geraakt met het geluid, zijn weinig klachten ontvangen. **M. Fortune (ILACO):** Wordt er nog aan zandafgravingen gedaan in het gebied? **A.Vreedzaam (Commissariaat):** Er wordt niet meer aan zandafgravingen gedaan.
Sluiting	M. Fortune (ILACO) sluit de meeting met een dankwoord en geeft aan dat de aandachtspunten in het onderzoek worden meegenomen.

Minutes of Meeting

Project:	Zelfstandig Milieu Management en Monitoring Plan (EMMP) voor de optimalisatie van de vloeistofverwerkingscapaciteit en efficiëntie van de Jossie ruwe-olie verwerkingsfaciliteit.
Project Code:	IS-446
Onderwerp:	Consultatie meeting met LVV Groningen
Aanwezigen:	ILACO: Naigi A. Ministerie van Landbouw Veeteelt en Visserij (LVV): Dhr. Poeran R.
Platform:	Telefonisch
Datum:	27 februari 2024
Tijd:	10.00 – 10.45
Opgesteld door:	Naigi A.

Onderwerp	**Discussie/Opmerkingen**
Agenda	- Opening en introductie - Achtergrondinformatie Upgrade Jossie Plant - Achtergrondinformatie EMMP-studie - Vragen en - Sluiting
Opening en introductie	A.Naigi van ILACO geeft een korte inleiding en het doel van het gesprek. Het doel van de consultatie: 1. LVV Groningen te informeren over de projectactiviteiten en 2. Om informatie en feedback te verzamelen over de huidige situatie in het projectgebied. Na de introductie is er door middel van een vragenlijst, input en feedback ontvangen van de stakeholder.
Vragen	**A.Naigi (ILACO):** Welke activiteiten voert LVV uit in het voorgestelde projectgebied? **R.Poeran:** Momenteel voert LVV geen activiteiten uit in het gebied. **A.Naigi (ILACO):** Doet LVV zelf ook onderzoek in het gebied en zo ja, welk type? Zijn er resultaten beschikbaar van deze onderzoeken? **R.Poeran (LVV):** We werken dagelijks met landbouwers in het district, dus er wordt wel onderzoek gedaan. Voor beschikbare data verwijs ik u naar het hoofdkantoor van LVV. **A.Naigi (ILACO):** Welke landbouwgewassen worden er verbouwd in het gebied, gezien de schaal van landbouwactiviteiten die u beschrijft? **R.Poeran (LVV):** Ja, er zijn uitgebreide landbouwactiviteiten. De gewassen die worden verbouwd zijn voornamelijk kool, tomaat, boulanger en bladgroenten. Ook wordt er bananenteelt gedaan, maar niet op grote schaal. **A.Naigi (ILACO):** Zijn er ook veeteeltactiviteiten in het gebied? **R.Poeran (LVV):** Ja, er zijn veeteeltactiviteiten, maar niet op grote schaal. Dit omvat koeien en kippenkwekerij in het klein. **A.Naigi (ILACO):** Los van landbouwactiviteiten, wordt er ook gevist in het gebied? Zo ja, waar zijn de vislocaties en welke vissoorten worden er gevangen?

	R.Poeran (LVV): Er wordt wel gevist, maar niet op grote schaal. Het is meer een recreatieve activiteit voor een groep mensen. Tilapia's zijn de voornaamste vissoort die wordt gevangen. **A.Naigi (ILACO):** Wat zijn de geplande projectontwikkelingen in de nabije omgeving van Jossiekreek? **R.Poeran (LVV):** Daar heb ik geen informatie over. **A.Naigi (ILACO):** Hoe is de communicatie en relatie tussen Staatsolie en LVV? **R.Poeran (LVV):** Kan hier niet veel over zeggen, maar als er iets is, worden de landbouwers wel op de hoogte gesteld. **A.Naigi (ILACO):** Zijn er klachten ontvangen van bewoners over voorgaande projecten van Staatsolie? **R.Poeran (LVV):** De LVV ontvangt geen klachten, dat gebeurt via het districtskantoor (DC). **A.Naigi (ILACO):** Hoe worden klachten behandeld en opgelost? **R.Poeran (LVV):** LVV geeft alleen advies aan landbouwers, bijvoorbeeld om geen vervuild water te gebruiken voor aanplant, en biedt alternatieven aan om de situatie te verbeteren. **A.Naigi (ILACO):** Zijn er zorgen over de geplande booractiviteiten van Staatsolie? **R.Poeran (LVV):** Er zijn geen zorgen over. **A.Naigi (ILACO):** Zijn er klachten ontvangen over wateroverlast tijdens de regentijd? **R.Poeran (LVV):** We hebben geen klachten ontvangen over wateroverlast. Vroeger misschien wel, maar nu zit het goed met de afwatering. **A.Naigi (ILACO):** Wordt er nog zandafgraving uitgevoerd in de omgeving? **R.Poeran (LVV):** Nee, er wordt niet meer aan zandafgraving gedaan.
Sluiting	A.Naigi (ILACO) sluit de meeting met een dankwoord en geeft aan dat de zorgpunten in het onderzoek meegenomen zullen worden.

Minutes of Meeting

Project:	Zelfstandig Milieu Management en Monitoring Plan (EMMP) voor de optimalisatie van de vloeistofverwerkingscapaciteit en efficiëntie van de Jossie ruwe-olie verwerkingsfaciliteit.
Project Code:	IS-446
Onderwerp:	Consultatie meeting met eigenaar veeteeltbedrijf naast de Jossie Plant
Aanwezigen:	ILACO: Fortune M., Naigi A. Stakeholder: Dhr. Soerdien
Locatie:	ILACO kantoor
Datum:	22 februari 2024 en 7 maart 2024
Tijd:	09:00 – 10:00
Opgesteld door:	Fortune M.

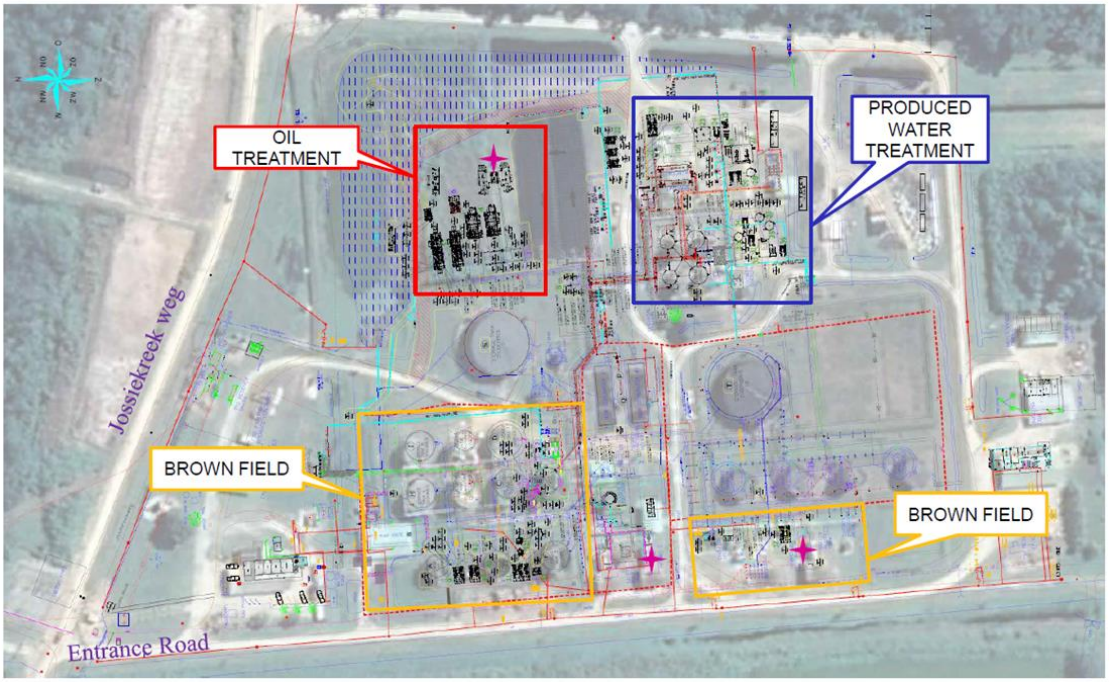
Onderwerp	**Discussie/Opmerkingen**
Agenda	- Opening en introductie - Achtergrondinformatie Upgrade Jossie Plant - Achtergrondinformatie EMMP-studie - Vragen en Sluiting
Opening en introductie	Mw. Fortune M. van ILACO opende de bijeenkomst, gevolg door een introductie over de upgrade van de Jossie Plant en het milieu en sociale analyse die hiervoor uitgevoerd wordt. Na de introductie is er door middel van een vragenlijst, input en feedback ontvangen van de stakeholder.
Samenvatting besproken punten	**Zorgpunten van Dhr. Soerdien** • Er zijn bestaande problemen die aangepakt dienen te worden, namelijk geluidsoverlast, geur van zwavel afkomstig vanuit Staatsolie, aanwezigheid van olie in het water en het neerslaan van deeltjes afkomstig van de uitstootgassen. • Op zijn terrein is er naast werkruimten ook woonhuizen waar de werknemers verblijven. Er geen geluidsmetingen op zijn terrein zijn uitgevoerd. Er moeten additionele geluidsmetingen worden uitgevoerd op zijn terrein. • Staatsolie is bekend met de bestaande klachten over geluidsoverlast. Na de laatste communicatie twee (2) jaren geleden, heeft hij geen nadere feedback ontvangen. Zijn veeteelt activiteiten zorgde voor een vliegenplaag en Staatsolie had toen aandacht hiervoor gevraagd. De vliegenplaag heeft hij momenteel onder controle. **Ontwikkelingen in het gebied** Dhr. Soerdien gaf aan dat hij zijn activiteiten wil gaan uitbreiden met visverwerking en garnalen teelt. Hiervoor zal water van de aangrenzende meren en de Jossiekreek worden onttrokken. Dit is de reden waarom hij aandacht vraagt voor mogelijke effect van de geplande bedrijfsactiviteiten op de Jossie Plant op de waterkwaliteit van de Jossiekreek. **Overige opmerkingen** Dhr. Soerdien informeerde als de resultaten van de milieustudie beschikbaar zal worden gesteld. Hierbij heeft Fortune M. de verschillende inzage perioden (publieke meeting en publieke inzage via het NIMOS) toegelicht.
Opmerking (telefonisch op 7 maart 2024)	Op 7 maart heeft ILACO de additionele geluidsmetingen uitgevoerd op het terrein van Dhr. Soerdien. Telefonisch gaf dhr. Soerdien aan dat zijn werknemers (die op locatie waren tijdens de metingen) aangeven dat de pompen niet maximaal in operatie waren tijdens de uitgevoerde geluidsmetingen.

Appendix 5B: BID Document

Informatie Brochure

Zelfstandig Milieu Management en Monitoring Plan (EMMP) voor de optimalisatie van de vloeistofverwerkingscapaciteit en efficiëntie van de Jossie ruwe-olie verwerkingsfaciliteit

januari 2024



Samengesteld ten behoeve van Staatsolie Maatschappij Suriname N.V.

door

ILACO

ISO 9001:2015 certified

Inleiding

De Upstream-operatie van Staatsolie Maatschappij Suriname N.V. (Staatsolie) ontwikkelt beschikbare reserves in de olievelden door productieputten te boren die vervolgens in gebruik worden genomen. Om te voldoen aan de specificaties van de interne klant (Raffinaderij) worden de geproduceerde vloeistoffen uit deze olievelden voor verwerking via pijpleidingen vervoerd naar drie (3) ruwe-olie verwerkingsfaciliteiten (Crude Treatment Plants), waaronder TA-58, Catharina Sophia en Jossiekreek,. Staatsolie Upstream heeft als een van de strategische doelen het vinden van nieuwe en aanvullende ruwe-olievoorraden om het productiedoel te handhaven. Om de productie te optimaliseren, is het noodzakelijk om verbeterde oliewinningstechnieken (Enhanced Oil Recovery (EOR) en Improve Oil Recovery (IOR)) toe te passen naast het boren van nieuwe putten.

Sinds april 2022 wordt de EOR-techniek, Polymer Flooding (polymeren injecties) toegepast om meer olie richting de productieputten te verplaatsen. De geproduceerde vloeistof uit de productieputten wordt geleid naar de Jossie verwerkingsfaciliteit, wat resulteert in een toename van de hoeveelheid geproduceerde vloeistof. De toename van de geproduceerde vloeistof zal in het jaar 2023 de bestaande capaciteit voor vloeistofverwerking en waterbehandeling van de Jossie verwerkingsfaciliteit overschrijden. Bovendien zal de faciliteit ook de geproduceerde vloeistof ontvangen met teruggewonnen polymeer.

De huidige procesapparatuur die wordt gebruikt voor vloeistofverwerking voldoet niet aan de vereiste specificaties voor de behandeling van de geproduceerde vloeistof afkomstig van de toepassing van Polymer Flooding techniek (Polymer Flood Produced Water- PFPW). Eerdere studies met betrekking tot polymeren injecties hebben aangetoond dat het teruggewonnen polymeer mogelijk invloed kan hebben op de scheidings-efficiëntie van olie en water en de efficiëntie van waterbehandeling kan verminderen. Verder worden er tijdens de behandeling van ruwe olie gassen via de verwarmingssystemen (heater treaters) en verschillende tanks naar de atmosfeer geleid.

Gezien de eerdergenoemde uitdagingen en Staatsolie wil voldoen aan haar HSEQ-beleid (Health, Safety, Environmental, and Quality) , heeft Staatsolie het voornemen om de faciliteit te verbeteren. Het doel hiervan is het optimaliseren van de vloeistofverwerkingscapaciteit en efficiëntie, het verminderen van de risico's verbonden aan teruggewonnen polymeer als gevolg van het lopende Polymer Flood-project, en het veilig afvoeren van gassen vanaf een gecentraliseerde locatie naar de atmosfeer om gezondheidsrisico's te verminderen.

Volgens de procedure is er voor een dergelijk project een Milieu- en Sociale Effectenbeoordeling of -analyse (Environmental and Social Impact Assessment, ESIA) vereist. In het genoemde projectgebied zijn echter al meerdere ESIA-studies verricht. Het Nationaal Instituut voor Milieu en Ontwikkeling in Suriname (NIMOS) heeft besloten dat er in dit geval kan worden volstaan met een Milieu Management- en Monitoringsplan (Environmental Management and Monitoring Plan, EMMP).

Voor de samenstelling hiervan is het advies- en ingenieursbureau ILACO Suriname N.V. (ILACO) aangetrokken. Deze brochure verschaft informatie over het project en de samenstelling van het EMMP ten behoeve van de stakeholders.

Korte project beschrijving

De huidige vloeistofverwerkingscapaciteit van de Jossie faciliteit is 25.000 vaten per dag. Staatsolie heeft de ambitie om de capaciteit te verhogen naar 38.000 vaten per dag. Om dit te bereiken en tegelijkertijd de efficiëntie te vergroten en het risico van teruggewonnen polymeer te verminderen, is een upgrade van de faciliteit nodig. Het omvat de volgende activiteiten:

- Verbetering oliebehandelingsproces
- Verbetering waterbehandelingsproces
- Behandeling van slopolie (nieuw proces)
- Behandeling van slib (nieuw proces)
- Gecentraliseerd koud ventilatiesysteem voor afvoer van gassen indien nodig (nieuw proces)

De nieuwe installaties zullen worden geïntegreerd in de bestaande faciliteit. Sommige bestaande elementen blijven onveranderd (statisch), terwijl andere aanpassingen zullen ondergaan.

De planning is om de constructie en installatie activiteiten uit te voeren tussen juli 2024 en juni 2025.

Korte beschrijving van het studiegebied

De Jossie ruwe-olie verwerkingsfaciliteit bevindt zich langs de Jossiekreekweg, in het ressort Groningen in het district Saramacca. De faciliteit is ongeveer 5 km verwijderd van de Oost-Westverbinding. De Jossiekreekweg is een lokale weg die voornamelijk wordt gebruikt door lokaalverkeer en verkeer dat naar de faciliteit gaat.

De faciliteit bevindt zich in een gebied met verspreide tuinbouwvelden waar de gebruikers langs de weg wonen. Het grootste deel van het gebied rondom de faciliteit is bedekt met secundair bos met hier en daar verlaten schelpenputten die nu zijn overstroomd. Tijdens een oriëntatie bezoek in het studiegebied in maart 2022 werden de volgende aspecten waargenomen (ILACO, 2023):

- In de nabije omgeving bevinden zich ongeveer zes huizen (binnen een straal van 500 m), waarvan het dichtstbijzijnde zich op ongeveer 300 m van het centrum van de faciliteit bevindt.
- Aan de westkant van de faciliteit is een varkensboerderij aanwezig binnen 100 m van de westelijke grens.
- Gevoelige receptoren in het gebied zijn een moskee en een school, respectievelijk op 150 m en 555 m ten westen van de ingang van de faciliteit.

Figuur 1 geeft een overzicht van het studiegebied en de dichtstbijzijnde receptoren.

Figuur 1: Overzicht studiegebied

De Milieu en Sociale Analyse

Voor de samenstelling van het EMMP zal ILACO gebruikmaken van voorgaande studies die betrekking hebben op het projectgebied:

1. Milieu en Sociale Effectenanalyse voor de Jossiekreek Development Project (P-all Projects Supply Suriname N.V., 2015).
2. Beperkte Milieu en Sociale Effectenanalyse voor de Polymer Flooding Enhanced Oil Recovery in het Tambaredjo-olieveld in Saramacca (SRK Consulting, 2019).
3. Basisbeoordeling van luchtemissies, omgevingsluchtkwaliteit en geluid voor de Upstream Operaties van Staatsolie (ILACO, 2023)

Naast de voorgaande studies zal er ook additionele data in het veld worden verzameld ter controle van de reeds beschikbare informatie. De activiteiten omvatten:

- Geluidsmetingen in de omgeving; en
- Stakeholder consultaties met bewoners en andere relevante partijen in het studiegebied (stakeholders).

Verder zullen er specialistische studies worden uitgevoerd voor geluid en luchtkwaliteit (inclusief modelering). Vervolgens zullen de effecten en voorgestelde maatregelen uit de verschillende studies worden geëvalueerd om eventuele tekortkomingen te identificeren en waar nodig bijwerken. Uiteindelijk zullen de resultaten worden gebruikt voor opmaak van het EMMP. Het doel van dit EMMP is om de beheer- en monitoringmaatregelen vast te stellen die nodig zijn om de mogelijke milieueffecten tijdens alle projectfasen te minimaliseren.

Inspraak van, en overleg met het publiek en de relevante autoriteiten is fundamenteel voor het EMMP-proces. Hierbij worden belanghebbenden en geïnteresseerde partijen in de gelegenheid gesteld om onduidelijkheden en bezorgdheden over het project naar voren te brengen. Na het indienen van het conceptrapport zullen de resultaten worden gepresenteerd in een publieke vergadering. Op basis van de feedback, ontvangen tijdens de publieke vergadering, zal het concept aangepast worden en vervolgens ingediend worden bij het NIMOS ter verkrijging van een advies voor de uitvoering van het project.

Voor nadere informatie kunt u altijd contact opnemen met:

ILACO Suriname N.V.
S.V. Voorwaartslaan 18-Paramaribo
Tel no: +597-431270
Email: **info@ilaconv.com**

Appendix 5C: Questionnaires

Vragen voor de DC:

Algemeen:

- Welke landgebruiken zijn bekend in de gebieden nabij het projectgebied?
- Wordt er nog aan zandafgravingen gedaan in het Jossiekreekweg?
- Welke significante ontwikkelingen zijn er geweest in het voorgestelde projectgebied in de afgelopen jaren?
- Zijn er significante projectontwikkelingen gepland nabij de projectlocatie?
- Er is een update van de Districtsplan van Saramacca (laatste versie: 2022)?
- Hoe is de relatie en communicatie tussen Staatsolie en het commissariaat? En met de bewoners?

Klachten uit het gebied:

- Zijn er in het verleden klachten ontvangen van de bewoners over voorgaande projecten van Staatsolie in de nabije gebieden? Zo ja, welke klachten zijn er ontvangen?
- Hoe is er omgegaan met de ontvangen klachten, m.a.w. welke procedure wordt er gehanteerd voor het aanhoren en oplossen van klachten en bezorgdheden van de bewoners?

Zorgpunten en feedback t.a.v. dit project:

- Zijn er zorgpunten over de geplande projectactiviteiten van Staatsolie (locatie en aard van de activiteiten)? Zo ja, welke?
- Zijn er zaken waarmee rekening gehouden moet worden/ meegenomen moet worden bij het EMMP-studie?

Vragen voor LVV:

Algemeen:

- Wat is de betrokkenheid/rol van LVV in het voorgestelde projectgebied?
- Welke activiteiten voert LVV uit in het voorgesteld projectgebied?
- Doet LVV zelf ook onderzoek in het gebied en welke type? Indien wel, zijn er resultaten beschikbaar?
- Zijn er significante projectontwikkelingen gepland nabij de projectlocatie?
- Zijn er nieuwe landbouwactiviteiten gepland en waar?
- Welke gewassen worden voornamelijk verbouwd in het nabije projectgebied?
- Wordt er ook aan veeteelt gedaan in de omgeving? Welke vee wordt er voornamelijk gekweekt?
- Wordt er gevist in het gebied, zijn er visvangst locaties? Welke soorten?
- Hoe is de relatie en communicatie tussen Staatsolie en LVV?

Klachten uit het gebied:

- Zijn er in het verleden klachten ontvangen van de bewoners over de voorgaande projecten van Staatsolie in de nabije gebieden? Zo ja, welke klachten zijn er ontvangen?
- Hoe is er omgegaan met de ontvangen klachten, m.a.w. welke procedure wordt er gehanteerd voor het aanhoren en oplossen van klachten en bezorgdheden van de bewoners?

Zorgpunten en feedback t.a.v. dit project:

- Zijn er zorgpunten over de geplande projectactiviteiten van Staatsolie (locatie en aard van de activiteiten)? Zo ja, welke?
- Zijn er zaken waarmee rekening gehouden moet worden/ meegenomen moet worden bij het EMMP-studie?

Vragenlijst Residents Survey

Naam:

Contact gegevens:

Algemeen

1. Bent u al op de hoogte van het geplande uitbreidingsproject van de Jossie faciliteit voor ruwe-olieverwerking?

2. Hoelang woont u al hier?

3. Uit hoeveel mensen bestaat uw huishouden?

4. Wat is uw beroep?

5. Doet u ook aan andere activiteiten, zoals landbouw of veteelt?

6. Welke ontwikkelingen zijn er geweest in de omgeving de afgelopen jaren? Wordt er nog aan zandafgraving gedaan in het gebied?

7. Welke andere economische activiteiten worden uitgevoerd in het gebied? Ben u bekend van grote (significante) nieuwe projecten in het gebied?

Klachten en bezorgheden bestaande operatie en gepland project

8. Heeft u bestaande klachten als gevolg van de huidige activiteiten op de Jossie plant (geluid, geur, stof, etc.)?

- Indien ja, wanneer heeft u voornamelijk last (overdag/ avond)?

9. Heeft u de klachten doorgegeven en aan wie (Staatsolie, DC, anders)?

10. Zijn de klachten (naar tevredenheid) behandeld?

11. (Indien niet doorgegeven aan SO) Bent u bekend met het klachten mechanisme van Staatsolie?

12. Heeft u zorgpunten of speciale verzoeken omtrent het voorgesteld project (uitbreiding Jossie)?

    a. …..

    b. Leefomgeving (uw dagelijks leven en routines)?

    c. Veiligheid?

Communicatie

13. Wat vind u van de communicatie en informatie verstekking vanuit Staatsolie?

14. Heeft u suggesties voor het verbeteren van de communicatie en relatie tussen SO en de bewoners te Jossie?

Appendix 6: Environmental Noise Impact Assessment

ENVIRONMENTAL NOISE IMPACT ASSESSMENT:

Staatsolie: Optimised Fluid Handling Capacity and Efficiency at the Jossie Crude Treatment Facility

Project done in conjunction with **ILACO Suriname NV**

Report Compiled By:
Nick Grobler

Report No: 23ILC02 NIA | **Date:** April 2024

Address: 480 Smuts Drive, Halfway Gardens | Postal: P O Box 5260, Halfway House, 1685
Tel: +27 (0)11 805 1940 | Fax: +27 (0)11 805 7010
www.airshed.co.za

Report Details

Project Name	Environmental Noise Impact Assessment: Staatsolie: Optimised Fluid Handling Capacity and Efficiency at the Jossie Crude Treatment Facility
Client	Staatsolie Maatschappij Suriname NV
Report Number	23ILC02 NIA
Report Version	Revision 1
Date	April 2024
Prepared by	Nick Grobler, BEng (Chem), BEng (Hons) (Env) (University of Pretoria)
Reviewed by	
Notice	Airshed Planning Professionals (Pty) Ltd is a consulting company located in Midrand, South Africa, specialising in all aspects of air quality, ranging from nearby neighbourhood concerns to regional air pollution impacts as well as noise impact assessments. The company originated in 1990 as Environmental Management Services, which amalgamated with its sister company, Matrix Environmental Consultants, in 2003.
Declaration	Airshed is an independent consulting firm with no interest in the project other than to fulfil the contract between the client and the consultant for delivery of specialised services as stipulated in the terms of reference.
Copyright Warning	Unless otherwise noted, the copyright in all text and other matter (including the manner of presentation) is the exclusive property of Airshed Planning Professionals (Pty) Ltd. It is a criminal offence to reproduce and/or use, without written consent, any matter, technical procedure and/or technique contained in this document.

Revision Record

Version	Date	Section(s) Revised	Summary Description of Revision(s)
Draft	April 2024	All	Draft report for client review
Rev1	April 2024	All	Revised based on client feedback

Abbreviations

Airshed	Airshed Planning Professionals (Pty) Ltd
ASG	Atmospheric Studies Group
dB	decibel
EC	European Commission
EHS	Environmental, Health, and Safety
IEC	International Electro technical Commission
IFC	International Finance Corporation
ISO	International Standards Organization
mamsl	Metres above mean sea level
NSR	Noise Sensitive Receptor
SABS	South African Bureau of Standards
SANS	South African National Standards
SO	Staatsolie Maatschappij Suriname NV
SLM	Sound Level Meter
USGS	United States Geological Survey
WHO	World Health Organisation

Glossary

A-weighting	As human hearing is not equally sensitive to all frequencies, a 'filter' has been developed to simulate human hearing. The 'A-weighting' filter simulates the human hearing characteristic, which is less sensitive to sounds at low frequencies than at high frequencies
dB	"Decibel" is the descriptor that is used to indicate 10 times a logarithmic ratio of quantities that have the same units, in this case sound pressure.
dBA	"dBA" is the descriptor that is used to indicate 10 times a logarithmic ratio of quantities, that have the same units (in this case sound pressure) that has been A-weighted to simulate human hearing.
L_{Aeq} (T)	The A-weighted equivalent sound pressure level, where T indicates the time over which the noise is averaged (calculated or measured).
L_{AFmax}	The A-weighted maximum sound pressure level recorded during the measurement period.
L_{AFmin}	The A-weighted minimum sound pressure level recorded during the measurement period.
L_{A90}	The A-weighted 90% statistical noise level, i.e., the noise level that is exceeded during 90% of the measurement period. It is a very useful descriptor which provides an indication of what the LAeq could have been in the absence of noisy single events and is considered representative of background noise levels.

EXECUTIVE SUMMARY

Airshed Planning Professionals (Pty) Ltd was appointed by ILACO Suriname NV (ILACO) to conduct an environmental noise impact assessment for the Optimised Fluid Handling Capacity and Efficiency at the Jossie Crude Treatment Facility of Staatsolie Upstream Operations Project ("the project"). The Jossie Crude Treatment Facility ("the Jossie plant") is located along the Josikreekweg to the south of the Saramacca River, approximately 5 km away from the Oost-Westverbinding.

The current fluid handling capacity of Jossie Crude Treatment Plant is 25,000 Barrels per day (BFPD). Staatsolie aims to increase the capacity to 38,000 BFPD. To increase the fluid handling capacity and efficiency of the plant and mitigate the risk associated with back produced polymer, upgrade of the current oil and water treatment process is required. This project includes the following activities:

- Upgrade Oil Treatment part
- Upgrade Water Treatment part
- Slop Oil Handling (new)
- Sludge Handling (new)
- Centralized Cold Vent System (new)

These activities will be located inside the current Jossie Treatment Plant, on the eastern side (Figure 1).

Current noise generating sources at the Jossie Treatment Plant include the transfer pumps (for pumping oil to the refinery), internal transfer pumps, the heater treaters, several smaller pumps and vehicle traffic. Noise generating sources that form part of the project include numerous pumps, motors, centrifuges and compressors, as well as a boiler for steam raising.

Propagation modelling results indicate that the proposed project will result in a ***negligibly low*** impact on the acoustic climate throughout the study area. The change in sound pressure levels due to the project will be imperceptible at all nearby noise sensitive receptor locations.

The acoustic climate around the Jossie Treatment Plant, both currently and in the future, is dominated by the current noise sources at the Jossie Treatment Plant, most notably the heater treaters and the transfer pumps.

Both measurement results as well as modelling results indicate that these sources result in noise levels at the closest sensitive receptor locations that are slightly (between 1 and 3 dBA) in exceedance of the IFC night-time guideline of 45 dBA. For a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level is not detectable. It is therefore unlikely that these sources are disturbing to nearby residents.

It is recommended that a noise complaints register be kept on site, and that all nearby sensitive receptors be encouraged to report any noise related complaints. Complaints should be investigated and ad-hoc noise measurements undertaken if necessary. If complaints are received regarding the existing (or future) noise sources, most notably the heater treaters and transfer pumps, consideration should be given to source based mitigation measures, such as sound cladding, earth berms or vegetation screens, to minimise the impact of the Jossie Treatment Plant on the acoustic climate at residential locations.

A noise survey campaign should be undertaken once the project is operational (consideration should be given to a similar campaign during the construction phase as well) to assess the change from baseline levels measured during the 2022 and 2024 campaigns and to verify the noise propagation simulation results.

TABLE OF CONTENTS

List of Tables

List of Figures

1 INTRODUCTION

Airshed Planning Professionals (Pty) Ltd was appointed by ILACO Suriname NV to conduct an environmental noise impact assessment for the Optimised Fluid Handling Capacity and Efficiency at the Jossie Crude Treatment Facility of Staatsolie Upstream Operations Project ("the project"). The Jossie Crude Treatment Facility ("the Jossie plant") is located along the Josikreekweg to the south of the Saramacca River, approximately 5 km away from the Oost-Westverbinding.

The current fluid handling capacity of Jossie Crude Treatment Plant is 25,000 Barrels per day (BFPD). Staatsolie aims to increase the capacity to 38,000 BFPD. To increase the fluid handling capacity and efficiency of the plant and mitigate the risk associated with back produced polymer, upgrade of the current oil and water treatment process is required. This project includes the following activities:

- Upgrade Oil Treatment part
- Upgrade Water Treatment part
- Slop Oil Handling (new)
- Sludge Handling (new)
- Centralized Cold Vent System (new)

These activities will be located inside the current Jossie Treatment Plant, on the eastern side (Figure 1).

Current noise generating sources at the Jossie Treatment Plant include the transfer pumps (for pumping oil to the refinery), internal transfer pumps, the heater treaters, several smaller pumps and vehicle traffic. Noise generating sources that form part of the project include numerous pumps, motors, centrifuges and compressors, as well as a boiler for steam raising.

Baseline noise sampling was conducted by ILACO in 2022 and 2024 and is discussed in full detail the separate baseline reports by ILACO (ILACO, 2023 and ILACO 2024). This report details the results and conclusions from the Noise Impact Assessment of the project, based on propagation simulations conducted for the noise generating sources that form part of the project.

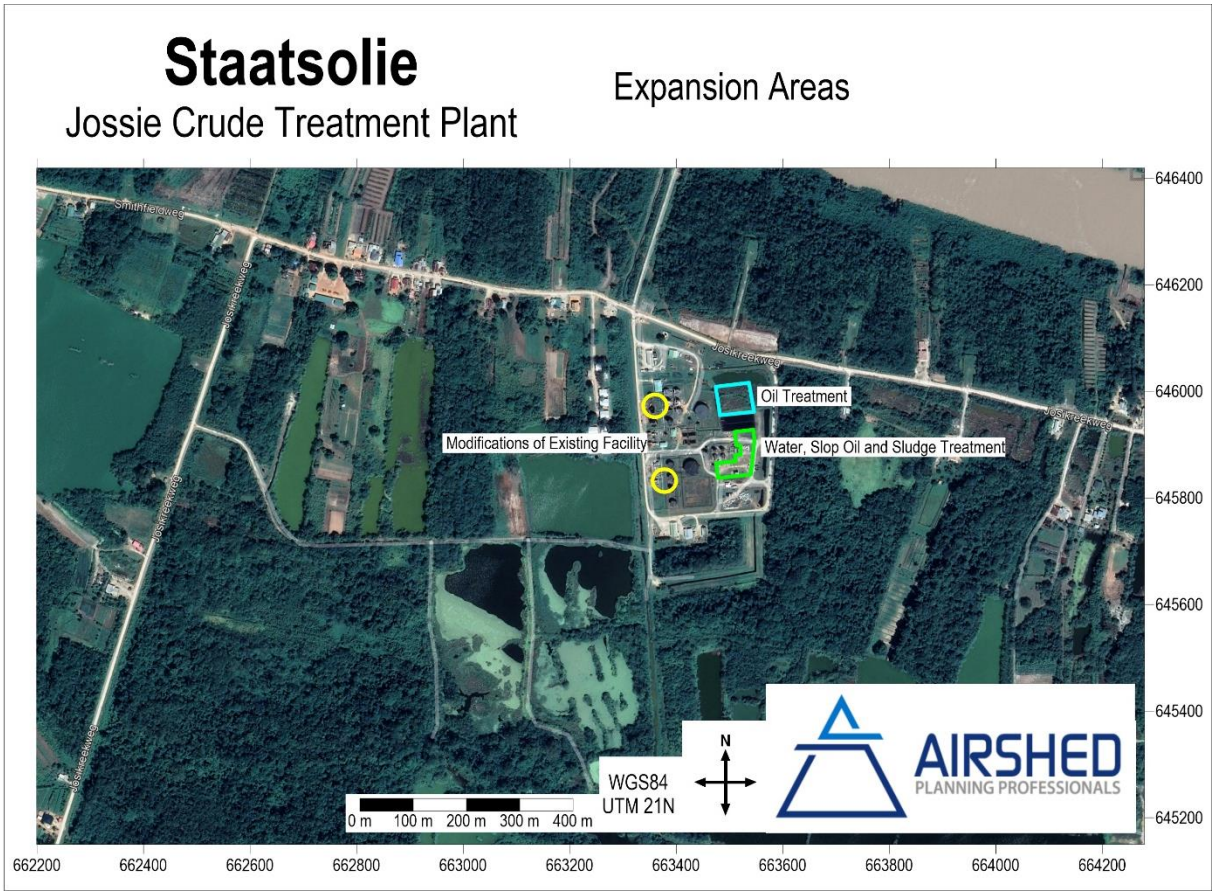


Figure 1: Project Layout

1.1 Scope of Work

The following tasks were included in the scope of work:

- A review of legal requirements and environmental noise level guidelines.
- A desktop analysis and assessment of existing (baseline) sources of noise, based on environmental noise survey campaigns conducted by ILACO Suriname NV.
- The establishment of a noise source inventory for the operation of the project.
- Noise propagation simulations using CadnaA software for industrial applications.
- Impact screening assessment based on simulation results in comparison to International Finance Corporation (IFC) guidelines.
- Identification of suitable mitigation and management measures.
- A specialist noise impact assessment report.

1.2 Background to Environmental Noise and the Assessment Thereof

Before more details regarding the approach and methodology adopted in the assessment is given, the reader is provided with some background, definitions and conventions used in the measurement, calculation and assessment of environmental noise.

Noise is generally defined as unwanted sound transmitted through a compressible medium such as air. Sound in turn, is defined as any pressure variation that the ear can detect. Human response to noise is complex and highly variable as it is

subjective rather than objective. And, as the ear responds logarithmically rather than linearly to stimuli, it is more practical to express acoustic parameters as a logarithmic ratio of the measured value to a reference value. This logarithmic ratio is called a decibel or dB. The advantage of using dB can be clearly seen in Figure 2. Here, the linear scale with its large numbers is converted into a manageable scale from 0 dB at the threshold of hearing (20 micro-pascals (µPa)) to 130 dB at the threshold of pain (~100 Pa) (Brüel & Kjær Sound & Vibration Measurement A/S, 2000).

As explained, noise is reported in dB. "dB" is the descriptor that is used to indicate 10 times a logarithmic ratio of quantities that have the same units, in this case sound pressure. The relationship between sound pressure and sound pressure level is illustrated in this equation.

$$L_p = 20 \cdot \log_{10}\left(\frac{p}{p_{ref}}\right)$$

Where:

L_p *is the sound pressure level in dB;*

p *is the actual sound pressure in Pa; and*

p_{ref} *is the reference sound pressure (p_{ref} in air is 20 µPa)*

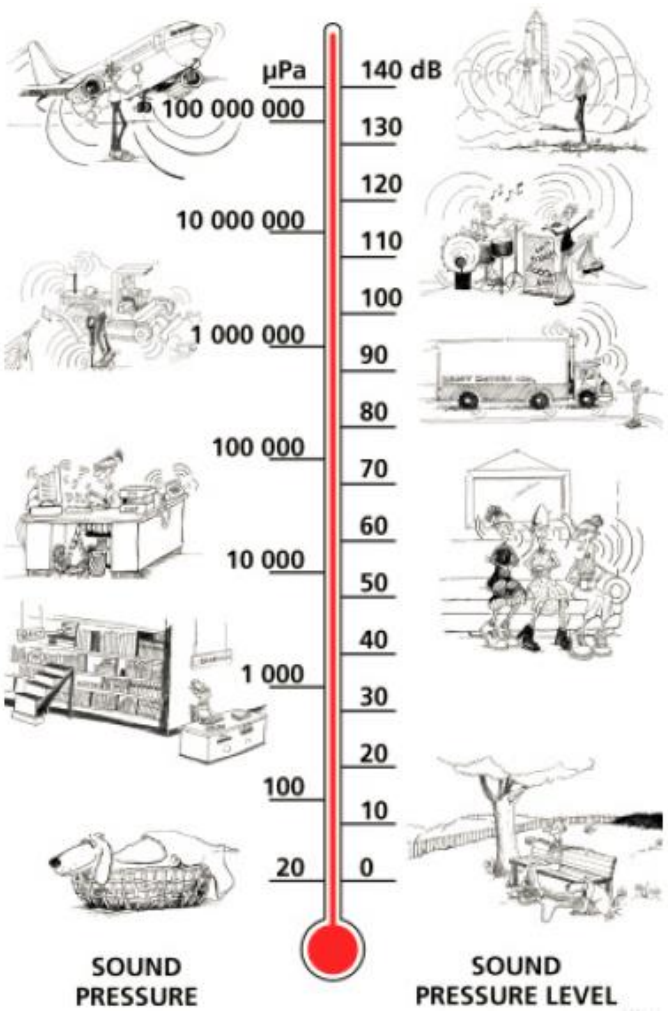


Figure 2: The decibel scale and typical noise levels (Brüel & Kjær Sound & Vibration Measurement A/S, 2000)

1.2.1 Perception of Sound

Sound has already been defined as any pressure variation that can be detected by the human ear. The number of pressure variations per second is referred to as the frequency of sound and is measured in hertz (Hz). The hearing of a young, healthy person ranges between 20 Hz and 20 000 Hz.

In terms of L_P, audible sound ranges from the threshold of hearing at 0 dB to the pain threshold of 130 dB and above. Even though an increase in sound pressure level of 6 dB represents a doubling in sound, an increase of 8 to 10 dB is required before the sound subjectively appears to be significantly louder. Similarly, the smallest perceptible change is about 1 dB (Brüel & Kjær Sound & Vibration Measurement A/S, 2000).

1.2.2 Frequency Weighting

Since human hearing is not equally sensitive to all frequencies, a 'filter' has been developed to simulate human hearing. The 'A-weighting' filter simulates the human hearing characteristic, which is less sensitive to sounds at low frequencies than at high frequencies (Figure 3). "dBA" is the descriptor that is used to indicate 10 times a logarithmic ratio of quantities, that have the same units (in this case sound pressure) that has been A-weighted.

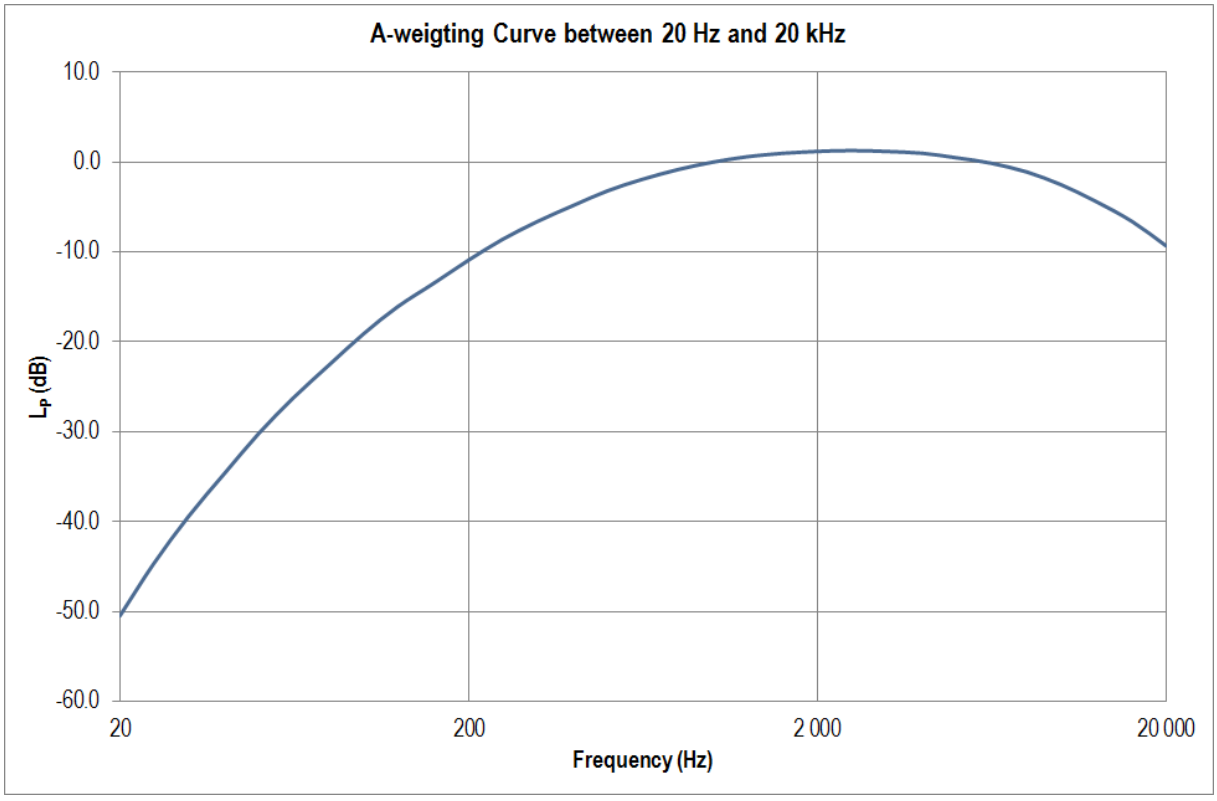


Figure 3: A-weighting curve

1.2.3 Adding Sound Pressure Levels

Since sound pressure levels are logarithmic values, the sound pressure levels as a result of two or more sources cannot just simply be added together. To obtain the combined sound pressure level of a combination of sources, individual sound pressure levels must be converted to their linear values and added using:

$$L_{p\_combined} = 10 \cdot \log\left(10^{\frac{L_{p1}}{10}} + 10^{\frac{L_{p2}}{10}} + 10^{\frac{L_{p3}}{10}} + \cdots 10^{\frac{L_{pi}}{10}}\right)$$

This implies that if the difference between the sound pressure levels of two sources is nil the combined sound pressure level is 3 dB more than the sound pressure level of one source alone. Similarly, if the difference between the sound pressure levels of two sources is more than 10 dB, the contribution of the quietest source can be disregarded (Brüel & Kjær Sound & Vibration Measurement A/S, 2000).

1.2.4 Environmental Noise Propagation

Many factors affect the propagation of noise from source to receiver. The most important of these are:

- The type of source and its sound power (L_W);
- The distance between the source and the receiver;
- Atmospheric conditions (wind speed and direction, temperature and temperature gradient, humidity etc.);
- Obstacles such as barriers or buildings between the source and receiver;
- Ground absorption; and
- Reflections

To arrive at a representative result from either measurement or calculation, all these factors must be taken into account (Brüel & Kjær Sound & Vibration Measurement A/S, 2000).

1.2.5 Environmental Noise Indices

In assessing environmental noise either by measurement or calculation, reference is made to the following indices:

- **L_{Aeq} (T)** – The A-weighted equivalent sound pressure level, where T indicates the time over which the noise is averaged (calculated or measured). The International Finance Corporation (IFC) provides guidance with respect to L_{Aeq} (1 hour), the A-weighted equivalent sound pressure level, averaged over 1 hour.
- **L_{A90}** – The A-weighted 90% statistical noise level, i.e. the noise level that is exceeded during 90% of the measurement period. It is a very useful descriptor which provides an indication of what the L_{Aeq} could have been in the absence of noisy single events and is considered representative of background noise levels.
- **L_{A10}** – The A-weighted 10% statistical noise level, i.e. the noise level that is exceeded during 10% of the measurement period. It is a very useful descriptor which provides an indication of noise levels of noisy single events.
- **L_{AFmax}** – The maximum A-weighted noise level measured with the fast time weighting. It's the highest level of noise that occurred during a sampling period.
- **L_{AFmin}** – The minimum A-weighted noise level measured with the fast time weighting. It's the lowest level of noise that occurred during a sampling period.

1.3 Approach and Methodology

The assessment included a study of the legal requirements pertaining to noise impacts, a study of the physical environment of the area surrounding the project and analyses of background noise levels in the area, sampled by ILACO Suriname NV in 2022 and 2024. The impact assessment focused on the estimation of L_W's (noise 'emissions') and L_P's (noise impacts) associated with the proposed operations. The findings of the assessment components informed recommendations of management measures, including mitigation and monitoring. Individual aspects of the noise impact assessment methodology are discussed in more detail below.

1.3.1 Information Review

ILACO Suriname NV supplied, for inclusion in the assessment, the following information:

- Maps and site layouts;
- The process descriptions;
- A list of rotary equipment and their power requirements;
- The baseline noise survey reports (ILACO, 2023 and ILACO, 2024).

1.3.2 Review of Assessment Criteria

In the absence of detailed noise assessment criteria in Suriname, reference was made to the IFC General EHS Guidelines of 2007 (IFC, 2007). These guidelines are in line with those published by the World Health Organisation (WHO) Guidelines for community noise (WHO, 1999).

In addition to the above reference is also made to very useful indicators of likely community response to an intruding industrial noise as set out by the South African Bureau of Standards' (SABS) South African National Standard (SANS) 10103 of 2008 (SANS 10103, 2008).

1.3.3 Study of the Receiving Acoustic Environment

Noise sensitive receptors (NSRs) generally include private residences, community buildings such as schools, hospitals and any publicly accessible areas outside the facility's property. These were identified from Google Earth imagery and the field survey conducted by ILACO Suriname NV in 2022 and 2024.

The ability of the environment to attenuate noise as it travels through the air was studied by considering local meteorology, land use and terrain. Atmospheric attenuation potential was described based on Weather Research and Forecasting Model (WRF) weather data for the site for the period 2021 to 2023. Readily available terrain and land cover data was obtained from the Atmospheric Studies Group (ASG) via the United States Geological Survey (USGS) web site.

The extent of noise impacts as a result of an intruding noise depends largely on existing noise levels in the project area. Higher ambient noise levels will result in less noticeable noise impacts and a smaller impact area. The opposite also holds true. Increases in noise will be more noticeable in areas with low ambient noise levels. Representative background noise levels were sampled by ILACO Suriname NV in 2022 and 2024.

1.3.4 Source Inventory

Sound power levels for all current and future equipment were calculated using the Sound Power Level Predictions for Industrial Machinery as given in the Handbook of Acoustics (Crocker et al, 1998).

1.3.5 Noise Propagation Modelling

The propagation of noise from proposed activities was simulated with the DataKustic CadnaA software. Use was made of the International Organisation for Standardization's (ISO) 9613 module for outdoor noise propagation from industrial noise sources.

ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation outdoors to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions favourable to propagation from sources of known sound emission. These conditions are for downwind propagation or, equivalently, propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs at night.

The method also predicts an average A-weighted sound pressure level. The average A-weighted sound pressure level encompasses levels for a wide variety of meteorological conditions. The method specified in ISO 9613 consists specifically of octave-band algorithms (with nominal mid-band frequencies from 63 Hz to 8 kHz) for calculating the attenuation of sound which originates from a point sound source, or an assembly of point sources. The source (or sources) may be moving or stationary. Physical effects are represented in the model by the following specific terms:

$$L_P = L_W - \sum [K_1, K_2, K_3, K_4, K_5, K_6]$$

Where;

L_P *is the sound pressure level at the receiver*
L_W *is the sound power level of the source*
K_1 *is the correction for geometrical divergence*
K_2 *is the correction for atmospheric absorption*
K_3 *is the correction for the effect of ground surface*
K_4 *is the correction for reflection from surfaces*
K_5 *is the correction for screening by obstacles*

This method is applicable in practice to a great variety of noise sources and environments. It is applicable, directly or indirectly, to most situations concerning road or rail traffic, industrial noise sources, construction activities, and many other noise sources.

To apply the method of ISO 9613, several parameters need to be known with respect to the geometry of the source and of the environment, the ground surface characteristics, and the source strength in terms of octave-band sound power levels for directions relevant to the propagation.

If the dimensions of a noise source are small compared with the distance to the listener, it is called a point source. All sources of noise at the project were quantified as point sources, areas represented by point sources or moving point sources. The sound energy from a point source spreads out spherically, so that the sound pressure level is the same for all points at the same distance from the source, and decreases by 6 dB per doubling of distance. This holds true until ground and air attenuation noticeably affect the level. The impact of an intruding ground level noise on the environment will therefore rarely extend over more than 5 km from the source and is therefore always considered “local” in extent.

The propagation of noise was calculated over an area of 2 km east-west by 1.5 km north-south with the proposed project located centrally and all nearby NSRs included in the modelling domain. The area was divided into a grid matrix with a 50 m resolution. The model calculates L_P’s at each grid point at a height of 1.5 m above ground level.

1.3.6 Presentation of Results

Noise impacts are presented as isopleth plots of the cumulative impact due to the proposed project together with baseline noise levels. An isopleth is a line on a map connecting points at which a given variable (in this case L_P) has a specified constant value. This is analogous to contour lines on a map showing terrain elevation. In the assessment of environmental noise, isopleths present lines of constant noise level as a function of distance.

To assess annoyance at nearby places of residence, the increase in noise levels above the baseline at NSRs were calculated and compared to guidelines published by the IFC as well as the levels published in SANS 10103 for assessing annoyance.

2 LEGAL REQUIREMENTS AND NOISE LEVEL GUIDELINES

2.1 IFC Guidelines on Environmental Noise

As far as could be ascertained, Suriname does not have local environmental noise guidelines. Reference is therefore made to the noise guidelines provided by the World Health Organisation (WHO) published by the International Finance Corporation (IFC) in their '*General Environmental, Health, and Safety (EHS) Guidelines'* (IFC, 2007). The World Bank and many other financiers have adopted this guideline.

The IFC General Environmental Health and Safety Guidelines on noise address impacts of noise beyond the property boundary of the facility under consideration and provides noise level guidelines.

The IFC states that noise impacts **should not exceed the levels presented in Table 1**, or result in a maximum **increase above baseline levels of 3 dBA** at the nearest receptor location off-site (IFC, 2007). For a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level is not detectable. Δ = 3 dBA is, therefore, a useful significance indicator for a noise impact.

Table 1: IFC noise level guidelines

IFC Noise Level Guidelines		
Area	**One Hour L_{Aeq} (dBA) 07:00 to 22:00**	**One Hour L_{Aeq} (dBA) 22:00 to 07:00**
Industrial receptors	70	70
Residential, institutional and educational receptors	55	45

2.2 SANS 10103 Guidance on Estimating Community Response

SANS 10103 (2008) provides a useful guideline for estimating community response to an increase in the general ambient noise level caused by intruding noise. If Δ is the increase in noise level, the following criteria are of relevance:

- $\Delta \leq 0$ dB: There will be no community reaction;
- 0 dB < $\Delta \leq$ 10 dB: There will be 'little' reaction with 'sporadic complaints';
- 5 dB < $\Delta \leq$ 15 dB: There will be a 'medium' reaction with 'widespread complaints'. Δ = 10 dB is subjectively perceived as a doubling in the loudness of the noise;
- 10 dB < $\Delta \leq$ 20 dB: There will be a 'strong' reaction with 'threats of community action'; and
- 15 dB < Δ: There will be a 'very strong' reaction with 'vigorous community action'.

The categories of community response overlap because the response of a community does not occur as a stepwise function, but rather as a gradual change.

3 DESCRIPTION OF THE RECEIVING ENVIRONMENT

This chapter provides details of the receiving acoustic environment in terms of:

- Local NSRs;
- The local environmental noise propagation and attenuation potential; and
- Sampled noise levels as provided in the Baseline Noise Reports (ILACO, 2023 and ILACO, 2024).

3.1 Noise Sensitive Receptors

The Jossie plant is located along the Josikreekweg to the south of the Saramacca River, approximately 5 km away from the Oost-Westverbinding. The Josikreekweg is a local road with predominantly local traffic and traffic for the Jossie plant.

This plant is located in an area with scattered horticultural fields of which the users live along the road. Most of the area around the plant is covered by secondary forest with spots of abandoned shell excavation pits, now flooded. A pig farm is located approximately 100 m from the western border of the plant. Noise sensitive receptors (NSR's) in the area include a mosque (during services) 150 m to the west and a school (during school class hours) approximately 550 m west from the entrance of the Jossie plant. Other sensitive receptors include residences along Josikreekweg, as shown in Figure 4. The area surrounding the Jossie plant can be classified as rural.

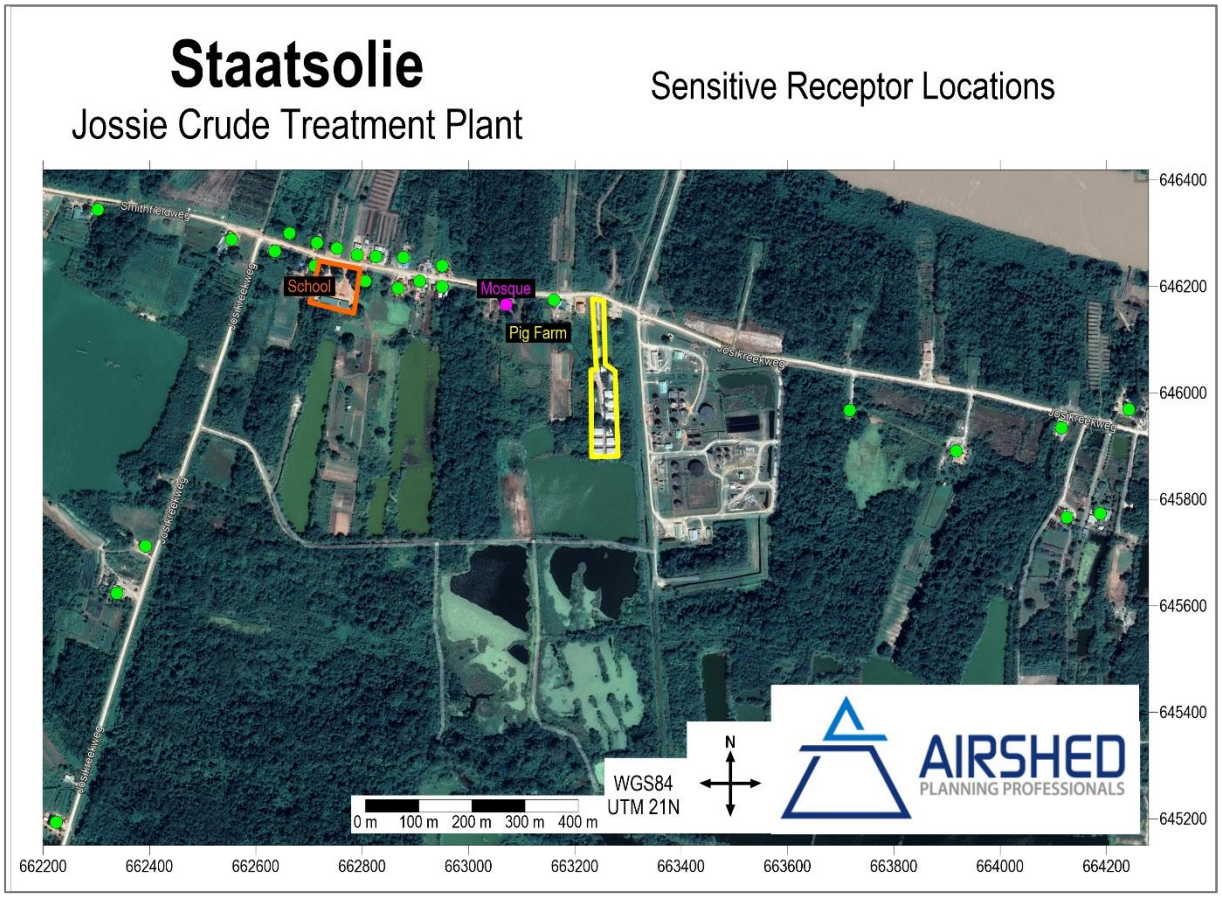


Figure 4: Noise sensitive receptor locations

3.2 Environmental Noise Propagation and Attenuation Potential

3.2.1 Atmospheric Absorption and Meteorology

The main meteorological parameters affecting the propagation of noise include wind speed, wind direction and temperature. These along with other parameters such as relative humidity, air pressure, solar radiation and cloud cover affect the stability of the atmosphere and the ability of the atmosphere to absorb sound energy.

Wind speed increases with altitude. This results in the 'bending' of the path of sound to 'focus' it on the downwind side and creating a 'shadow' on the upwind side of the source. Depending on the wind speed, the downwind level may increase by a few dB but the upwind level can drop by more than 20 dB (Brüel & Kjær Sound & Vibration Measurement A/S, 2000). It should be noted that at wind speeds of more than 5 m/s, ambient noise levels are mostly dominated by wind generated noise.

Temperature gradients in the atmosphere create effects that are uniform in all directions from a source. On a sunny day with no wind, temperature decreases with altitude and creates a 'shadowing' effect for sounds. On a clear night, temperatures may increase with altitude thereby 'focusing' sound on the ground surface. Noise impacts are therefore generally more notable during the night (Figure 4).

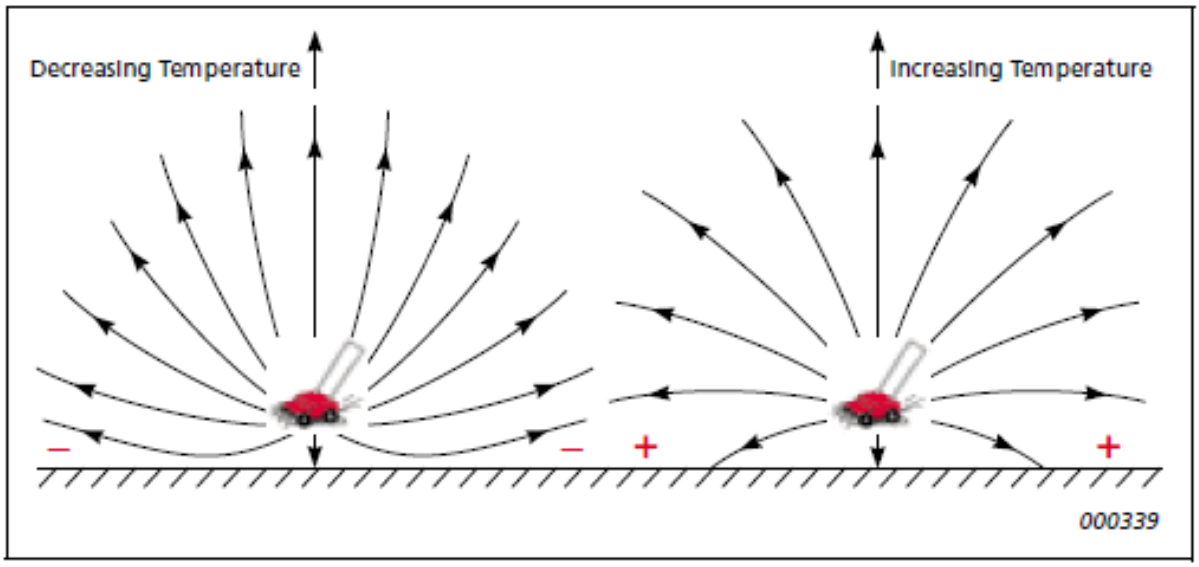


Figure 5: Bending the path of sound during typical day time conditions (image provided on the left) and night-time conditions (image provided on the right)

The wind field of an area can be presented using wind roses. Wind roses represent wind frequencies for the 12 wind directions (this is frequently represented for 16 directions, but the CadnaA model that is used for noise propagation simulations requires the data in 12 directions, hence it is presented as 12 directions in this report). Frequencies are indicated by the length of the shaft when compared to the circles drawn to represent a frequency of occurrence. Wind speed classes are assigned to illustrate the frequencies with high and low winds occurring for each wind vector. The frequencies of calms, defined as periods for which wind speeds are below 1 m/s, are also indicated.

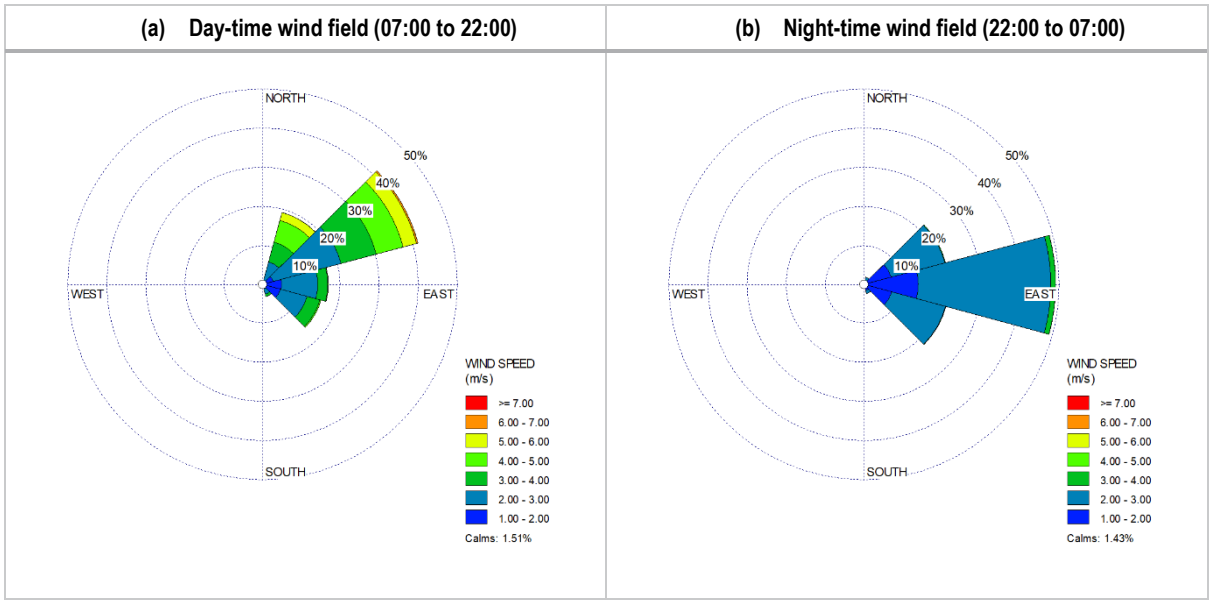


Figure 6: Day- and night-time wind field showing dominant northerly winds (WRF, 2021 to 2023)

Weather research and forecasting (WRF) modelled data for the study area indicates a wind field dominated by winds from the northeast during the day, with wind more dominant from east during the night (Figure 6). Day- and night-time average wind speeds are 2.95 m/s and 2.08 m/s respectively. Calm conditions occur for 1.5% of time during the day and 1.43% during the night. The average temperature in the study area over the three-year period was 25.3°C and the average humidity 88.7%. Noise impacts are expected to be slightly more notable to the west and southwest of the project activities during the night and to the southwest during the day.

3.2.2 Terrain, Ground Absorption and Reflection

Noise reduction caused by a barrier (i.e. natural terrain, installed acoustic barrier, building) feature depends on two factors namely the path difference of the sound wave as it travels over the barrier compared with direct transmission to the receiver and the frequency content of the noise (Brüel & Kjær Sound & Vibration Measurement A/S, 2000). Terrain data was included in the simulations. The topography of the study area is shown in Figure 7. Use was made of Shuttle Radar Topography Mission (SRTM) (30 m, 1 arc-sec) data. The topography in the vicinity of the project is relatively flat, with no topographical features between the project and the closest NSRs.

It should be noted that while some topographical features with elevations up to 20 m are observed in Figure 7, some of these are dense forests picked up by the SRMT satellites as topographical features. NASA conducted the SRTM mission in the early 2000s, and some of these forests have since been cleared.

There are no significant natural or man-made features with the local study area that may act as acoustic barriers between the operations and NSRs. Dense vegetation, however, can provide natural noise attenuation.

Sound reflected by the ground interferes with the directly propagated sound. The effect of the ground is different for acoustically hard (e.g., concrete or water), soft (e.g., grass, trees or vegetation) and mixed surfaces. Ground attenuation is often calculated in frequency bands to take into account the frequency content of the noise source and the type of ground between the source and the receiver (Brüel & Kjær Sound & Vibration Measurement A/S, 2000). Surrounding land-use is agricultural, forests or open vegetation, with the Saramacca river to the north and several flooded shell excavation pits scattered thorough the area.

With the exception of the Sarramacca River and the flooded shell excavation pits, which is considered acoustically reflective, ground cover of the area was therefore assumed to be acoustically absorbent due to the prevalence of vegetation.

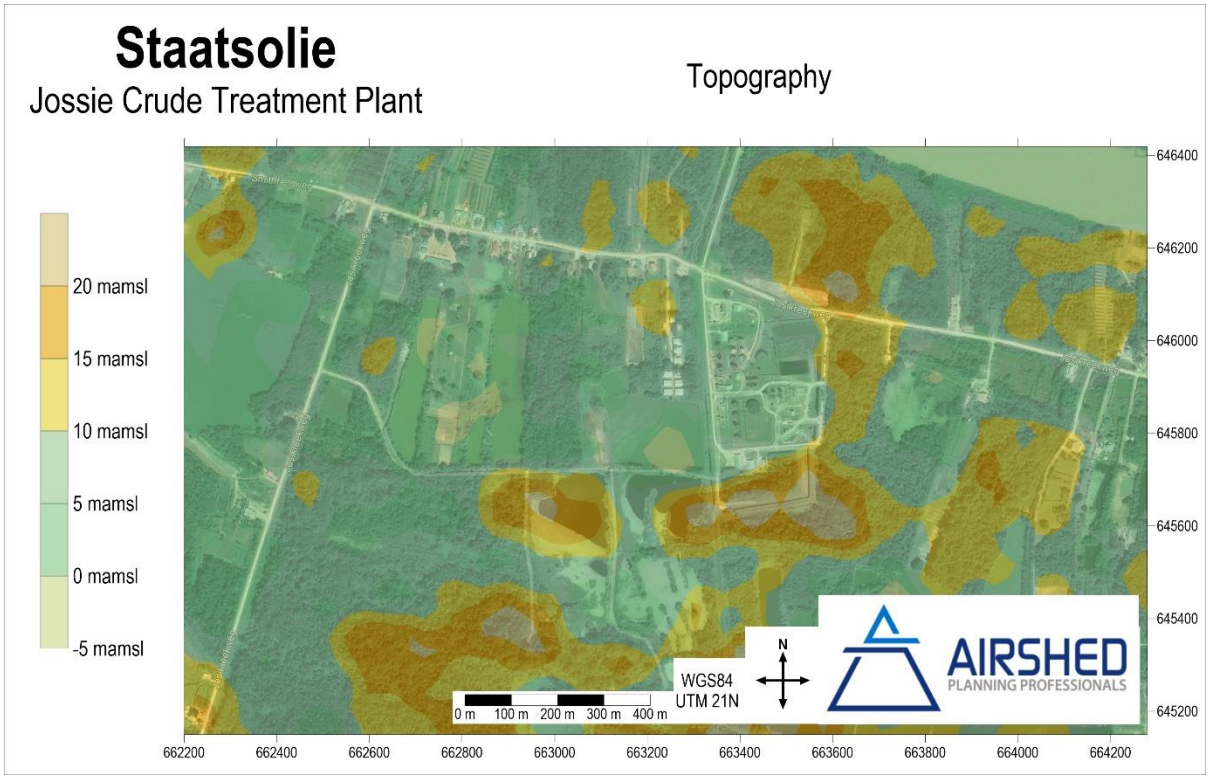


Figure 7: Study Area Topography

3.3 Sampled Baseline and Background Noise Levels

Baseline noise levels were sampled by ILACO Suriname NV at three locations (Jos-BN1 to Jos-BN3) in 2022 (ILACO, 2023) and at ten locations in 2024 (ILACO, 2024) (Figure 4) representative of the study area and the closest noise sensitive receptors. Sampling was conducted to assess baseline day- and night-time noise levels. The current acoustic climate in the study area is dominated by noise generated by the Jossie Plant at the closest sampling locations, by vehicle traffic along Josikreekweg and by natural and community noise, such as birds, insects, wind rustling of leaves and people talking, dogs barking and claxons and alarms.

The small difference between logged average noise levels (L_{Aeq}) and 10th percentile (L_{A90}) noise levels at Jos-BN1, Jos-BN2 and Jos-BN3 together with similar day and night-time noise levels, means that background noise from the heater treaters, transfer pumps and / or internal pumps is constant at these locations as well as at the closest sensitive receptors. While it was noted on the log sheets that the heaters are audible at the other locations, singular noise events, such as vehicles passing or dogs barking, lead to L_{Aeq} levels that could be significantly higher than background noise. At these locations, there is also a larger difference between day and night-time noise levels, indicative that during times with lower vehicle traffic, noise levels are significantly lower.

For further information regarding the sampling locations, equipment, site photographs, measurement log sheets and methodology employed during the baseline noise survey campaign, please refer to the baseline noise sampling reports (ILACO, 2023 and ILACO, 2024).

Table 2: Broadband Noise Sampling Results

Location ID	Type	Measured Sound Pressure Level (dBA)						Description
		Day			Night			
		L_{Aeq}	L_{10}	L_{90}	L_{Aeq}	L_{10}	L_{90}	
2022								
Jos-BN1	Industrial	56.5	56.9	51.7	49.3	50.8	47.4	Along the south berm of the Josikreekweg, between the main entrance and parking space of the Jossie treatment plant.
Jos-BN2	Non-residential (mosque)	60.3	59.5	44.8	46.2	47.3	45.1	Along the Josikreekweg, in front of a local mosque, approx. 150 m west from the entrance of the Jossie treatment plant.
Jos-BN3	Industrial	**72.6**	74.7	52.5	54.3	55.7	52.5	At the backyard of the treatment plant. The backyard consists of an office with several other building and a parking area.
2024								
Jos-BN1	Industrial	55.2	56.4	52.5	55.3	56.4	53.6	Along the south berm of the Josikreekweg, between the main entrance and parking space of the Jossie treatment plant.
Jos-BN2	Non-residential (mosque)	48.7	49.6	46.4	46.2	47.1	45.2	Along the Josikreekweg, in front of a local mosque, approx. 150 m west from the entrance of the Jossie treatment plant.
Jos-BN3	Industrial	56.6	58.7	53.3	54.9	55.9	53.7	At the backyard of the treatment plant. The backyard consists of an office with several other building and a parking area.
Jos-BN4	Residential	50.4	50.0	43.8	41.2	42.2	40.0	At the entrance of a resident, along the south berm of the Josikreekweg approx. 466 m west from the entrance of the Jossie treatment plant.
Jos-BN5	Residential	54.5	54.2	45.8	**48.4**	49.6	47.1	At the entrance of a resident, along the north berm of the Josikreekweg approx. 630 m west from the entrance of the Jossie treatment plant.
Jos-BN6	Residential	**58.6**	50.6	44.7	**46.0**	47.0	45.0	At the entrance of a resident, along the south berm of the Josikreekweg approx. 413 m east from the entrance of the Jossie treatment plant.
Jos-BN7	Residential	50.8	53.5	44.8	**47.3**	48.9	45.4	At the entrance of a resident, along the south berm of the Josikreekweg approx. 610 m east from the entrance of the Jossie treatment plant.
Jos-BN8	Residential	45.6	48.5	39.3	**46.3**	47.1	45.3	At the entrance of a resident, along the west berm of the Tambaredjoweg approx. 1.4 km southwest from the entrance of the Jossie treatment plant.
Jos-BN9	Industrial / Agricultural	55.5	56.2	54.4	55.5	56.1	54.7	Near the residential house at the farm, approx. 127 m west from the entrance of the Jossie treatment plant.
Jos-BN10	Industrial / Agricultural	56.0	57.4	54.0	54.5	55.4	53.4	At the pig farm, approx. 165 m west from the entrance of the Jossie treatment plant.

At the residential locations, measured levels exceeded the IFC guideline during the day only at Jos-BN6, due to vehicle traffic on Jossiekreekweg and natural noise. Although it was noted that the heaters are audible at this location, low recorded L_{90} values at this location indicate that Jossie Plant noise sources are not expected to be a significant contributor to noise at this location. The night-time IFC guideline of 45 dBA was slightly exceeded at 4 of the 5 residential sampling locations (as well as at the Mosque, but there are no services during this time period), but noise levels were below 50 dBA at all of these locations. The IFC guideline for industrial areas of 70 dBA was not exceeded at any of the sampling locations during the 2024 survey, but was exceeded at Jos-BN3 (the on-site sampling location) during the 2022 survey.

There is little variation between both day- and night-time noise levels as well as statistical 90th and 10th percentile noise levels at the nearby pig farm (Jos-BN9 and Jos-BN10), indicative that noise generated by the transfer pumps and heaters result in a consistent "hum" at the pig farm, but with very few singular noise events that could startle the animals. Average noise levels at the pig farm are well below the IFC guideline for industrial areas of 70 dBA (day and night) and only slightly exceeds the day-time residential guideline of 55 dBA.

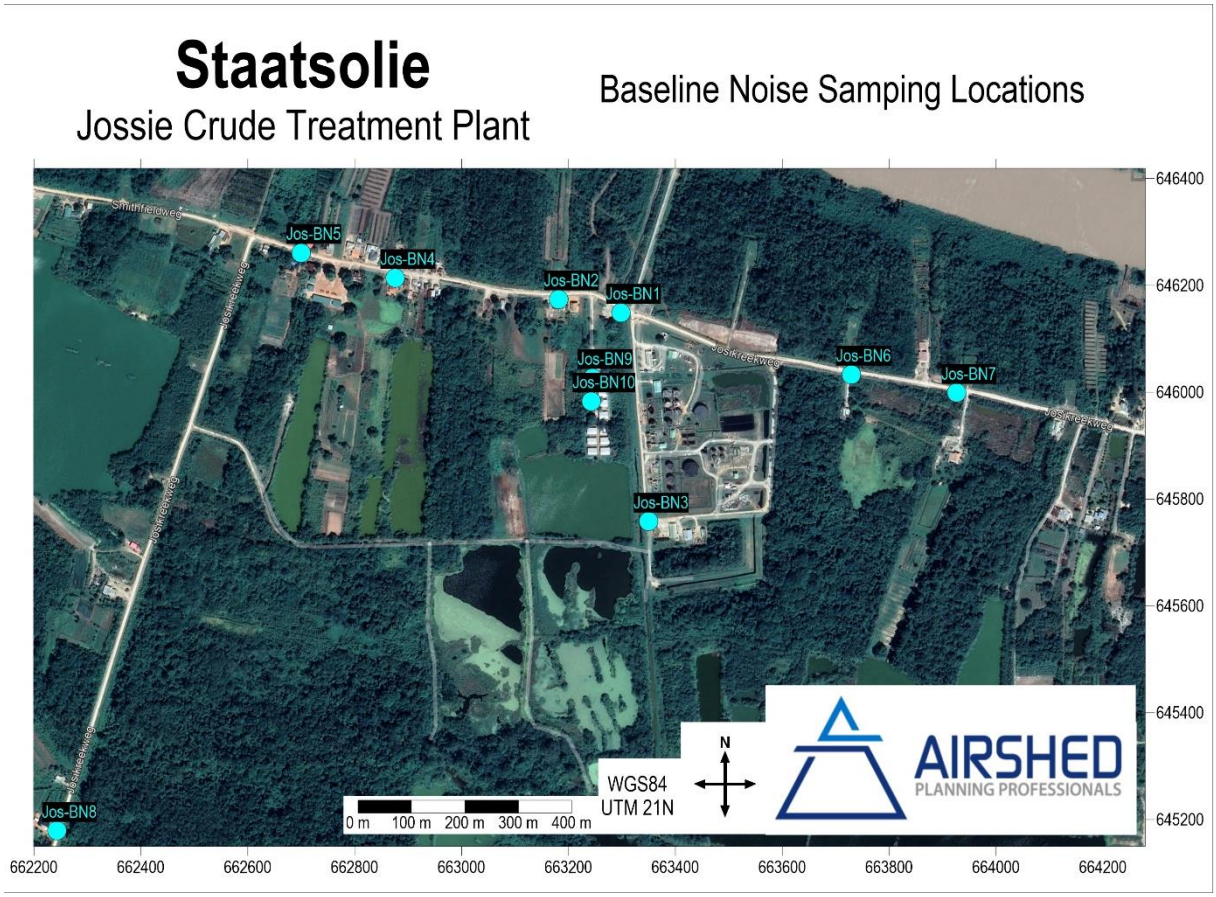


Figure 8: Baseline Noise Sampling Locations

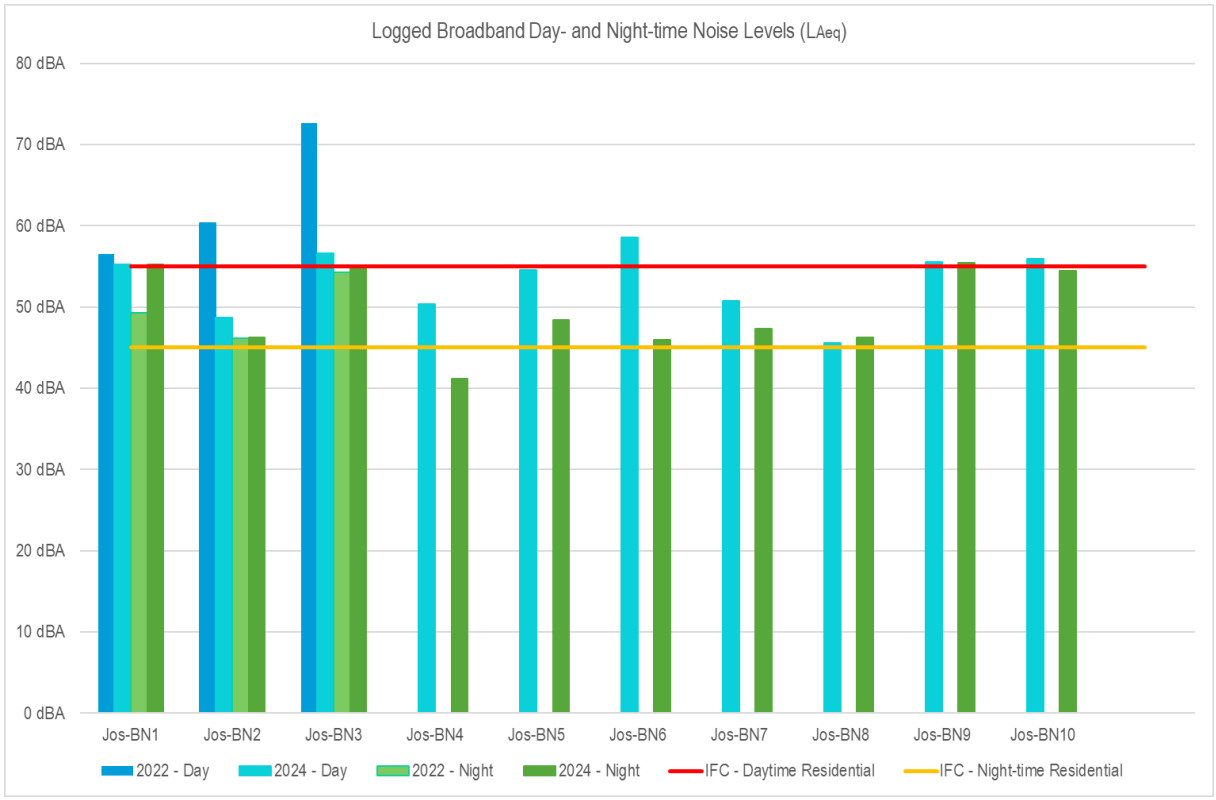


Figure 9: Logged Broadband Day and Night-time Noise Levels (L_{Aeq})

4 IMPACT ASSESSMENT

The noise source inventory, noise propagation simulations and results are discussed in Section 4.1 and Section 4.2.

4.1 Noise Sources and Sound Power Levels

The summarised source inventory for the project is included in Table 4 together with octave band frequency spectra L_W's for each area. The complete source list and sound power levels is given in Appendix A.

The reader is reminded of the non-linearity in the addition of L_W's. If the difference between the sound power levels of two sources is nil the combined sound power level is 3 dB more than the sound pressure level of one source alone. Similarly, if the difference between the sound power levels of two sources is more than 10 dB, the contribution of the quietest source can be disregarded (Brüel & Kjær Sound & Vibration Measurement A/S, 2000). Therefore, although some sources of noise were perhaps not quantified, the incremental contributions of such sources are expected to be minimal given that the majority of significant sources are considered in the source inventory.

Sound power levels for all current and future equipment were calculated using the Sound Power Level Predictions for Industrial Machinery as given in the Handbook of Acoustics (Crocker et al, 1998). The following equations were used in the calculation of sound power levels of equipment:

For Biolers:

$$L_W = 84 + 15 \log \mathrm{MW}$$

Where: MW is the power rating of the boiler.

For Pumps and other motors:

$$L_W = 70 + 10 \log \mathrm{kW} + 10 \log A$$

Where kW is the nameplate motor rating of the motor driven pump and A is the conformal surface area at 1 m from the pump

For Transformers:

$$L_W = 55 + 12 \log MV(A)$$

The octave band sound power levels were calculated by subtracting the values in (Table 3) from calculated LW's.

Table 3: Octave Band Corrections

Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000
Pumps	13	12	11	9	9	6	9	13	19
Boilers	4	5	10	16	17	19	21	21	21
Transformers	-3	3	5	0	0	-6	-11	-16	-23

Table 4: Noise source inventory for the Project

Area / Operation	LW (dB)	LWA (dBA)	L_W octave band frequency (Hz) spectra (dB)								
			31.5	63	125	250	500	1000	2000	4000	8000
Existing Operations											
Main Transfer Pumps	113.4	104.4	100.4	101.4	102.4	104.4	104.4	107.4	104.4	100.4	94.4
Internal Feed Pumps	104.7	95.7	91.7	92.7	93.7	95.7	95.7	98.7	95.7	91.7	85.7
Other Pumps	97.3	88.3	84.3	85.3	86.3	88.3	88.3	91.3	88.3	84.3	78.3
Heater Treaters	131.9	119.8	126.8	126.8	125.2	122.2	118.0	113.2	108.2	103.1	103.1
Future Operations											
Oil Treatment	102.9	93.9	89.9	90.9	91.9	93.9	93.9	96.9	93.9	89.9	83.9
Steam Boiler	94.5	92.0	90.5	89.5	84.5	78.5	77.5	75.5	73.5	73.5	73.5
Water Treatment	104.7	95.7	91.7	92.7	93.7	95.7	95.7	98.7	95.7	91.7	85.7
Slop Oil Treatment	98.0	89.0	85.0	86.0	87.0	89.0	89.0	92.0	89.0	85.0	79.0
Sludge Treatment	100.9	91.9	87.9	88.9	89.9	91.9	91.9	94.9	91.9	87.9	81.9
Modification of Existing Facility	88.7	79.7	75.7	76.7	77.7	79.7	79.7	82.7	79.7	75.7	69.7

4.2 Noise Propagation and Simulated Noise Levels

The propagation of noise generated by current and future sources was calculated with CadnaA in accordance with ISO 9613. Meteorological and site-specific acoustic parameters as discussed in Section 3.2 along with source data discussed in 4.1, were applied in the model. Table 5 provides a summary of measured and simulated noise levels at baseline sampling locations for current and future operations, as well as the simulated incremental change in noise levels from current to future operations. Results are also presented in isopleth form (Figure 10 to Figure 17). An average day-time background noise level of 53 dBA and average night-time baseline level of 44.6 dBA was taken into account for the calculation of cumulative impacts for the isopleth plots. Baseline noise levels as measured and reported by ILACO (2023 & 2024) were used in the calculation of cumulative impacts at Baseline Sampling Locations.

Modelled sound pressure levels at sampling locations correlate well with measured levels at the closest sampling locations (BN1, BN2, BN3, BN9 and BN10), but it can be seen on Table 5 that the model is underpredicting noise levels at receptors further from the Jossie Operations (BN4 to BN8). This is because the model only takes into account Jossie Plant noise sources, and does not account for other singular noise events, such as vehicles passing, dogs barking etc but only takes into account "background noise", such as birds, insects, or other continuous noise sources, described by L_{90}, at these sampling locations.

Modelling results indicate that the current operations at Jossie (Figure 10) are not expected to result in exceedance of the IFC guideline of 55 dBA at any of the closest NSRs during the day, which is confirmed by sampling results, where no exceedances of the IFC guideline were recorded at residential locations during the day (apart from BN6, where a level of 58.6 dBA was recorded, presumably due to local noise sources and traffic on Josikreekweg and BN1, BN9 and BN10, where levels below 56 dBA were recorded). However, modelling results indicate that current operations at Jossie results in exceedances of the night-time IFC guideline of 45 dBA at the closest sensitive receptor locations (Figure 14), confirming that some of the exceedances recorded during the baseline survey, as described in Section 3.3 (such as at BN1, BN9 and BN10), are a result of noise generated by the current Jossie operations.

Modelling results indicate that the proposed expansion, however, is expected to have a negligible impact on the acoustic climate in the study area, both during the day (Figure 11) and night (Figure 15) and have an insignificant impact on noise levels at sensitive receptor locations (Table 5). The current day- and night-time impact of the Jossie operations on noise levels at the nearby sensitive receptor locations is expected to remain the same.

Table 5: Simulated Noise Levels at Baseline Sampling Locations

Receptor	Measured Baseline Sound Pressure Levels (LAeq in dBA)		Modelled Sound Pressure Levels - Current Operations (LAeq in dBA)		Modelled Sound Pressure Levels - All Future Operations (LAeq in dBA)		Incremental Change from Current to Future (ΔLAeq in dBA)	
	Day	Night	Day	Night	Day	Night	Day	Night
BN1	**55.2**	**55.3**	**55.7**	**56.4**	**55.8**	**56.5**	+0.1	+0.1
BN2	48.7	**46.2**	48.7	**48.1**	48.7	**48.1**	0	+0.1
BN3	**56.6**	**54.9**	**58.2**	**58.2**	**58.3**	**58.2**	+0.1	0
BN4	50.4	41.2	45.5	43.4	45.5	43.4	0	0
BN5	54.5	**48.4**	46.3	**47.5**	46.3	**47.5**	0	+0.1
BN6	**58.6**	**46.0**	45.7	**45.8**	45.7	**45.8**	+0.1	+0.1
BN7	50.8	**47.3**	45.2	**45.7**	45.2	**45.7**	0	+0.1
BN8	45.6	**46.3**	39.7	**45.4**	39.7	**45.4**	+0.1	+0.1
BN9	**55.5**	**55.5**	58.4	58.6	58.4	58.6	0	0
BN10	**56.0**	**54.5**	58.2	58.2	58.2	58.2	0	0

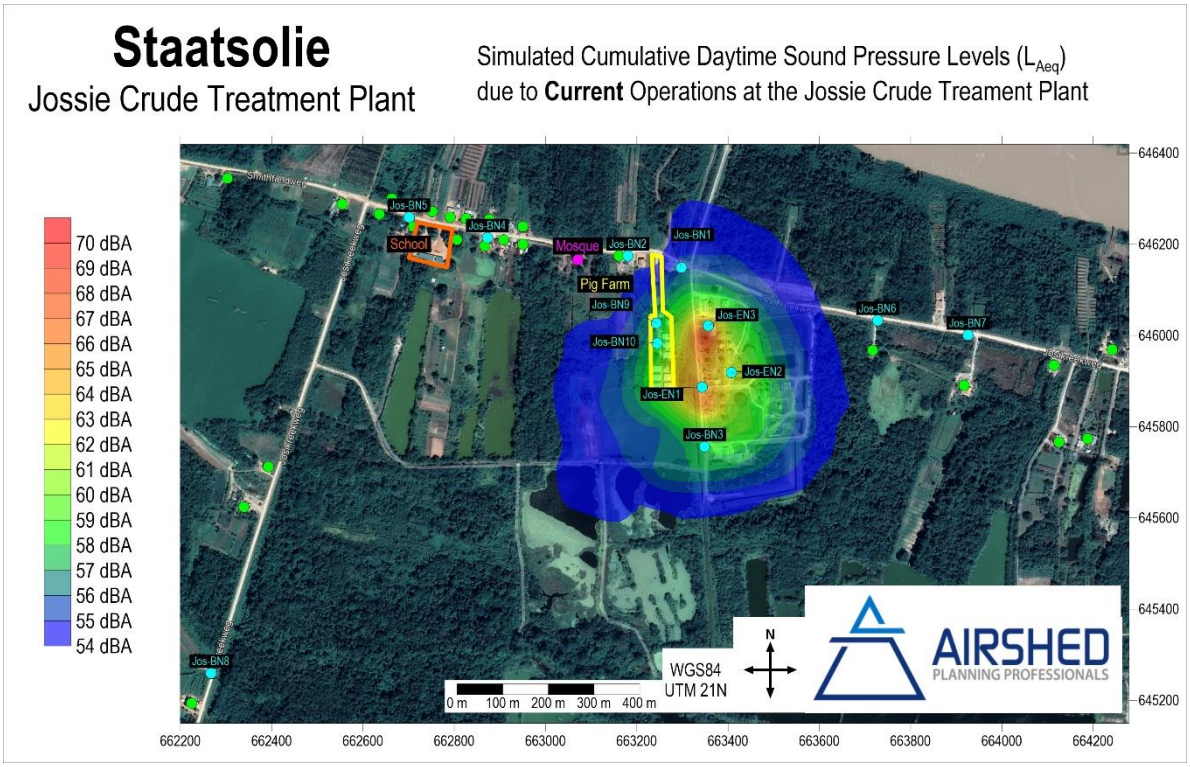


Figure 10: Simulated equivalent continuous day-time rating level ($L_{Aeq,d}$) due to Current Operations

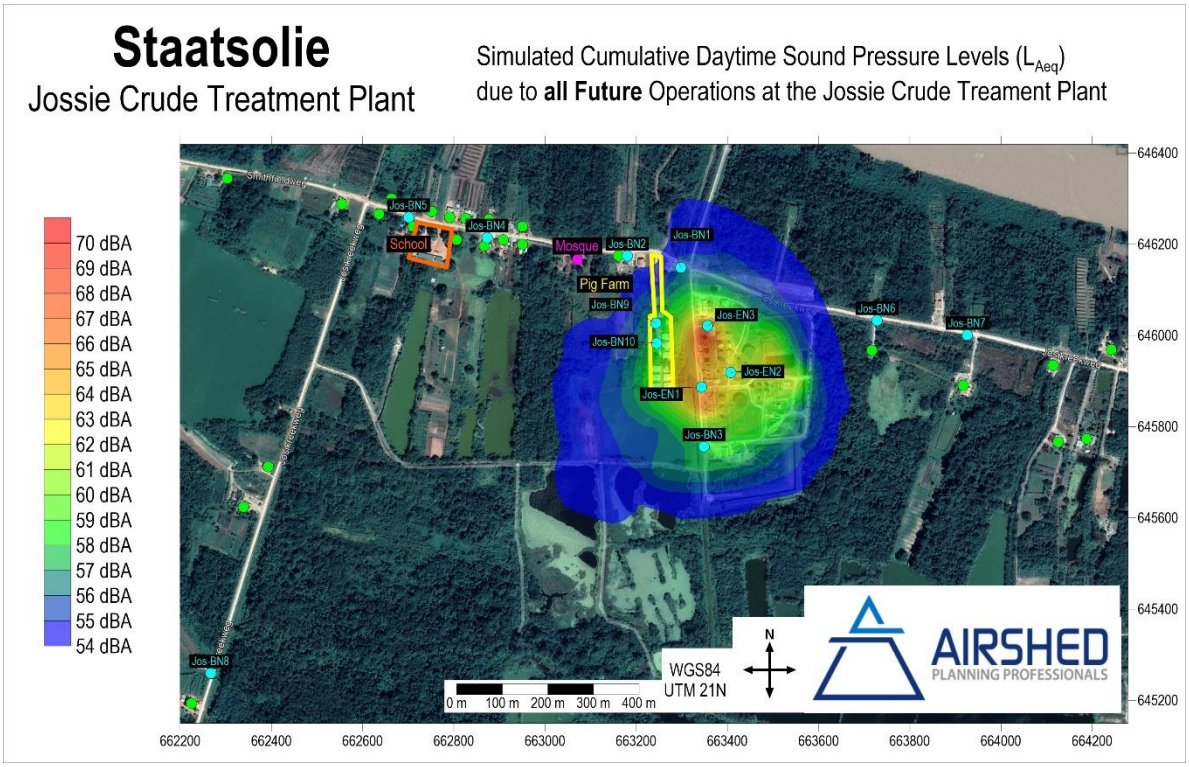


Figure 11: Simulated equivalent continuous day-time rating level ($L_{Aeq,d}$) due to all Future Operations

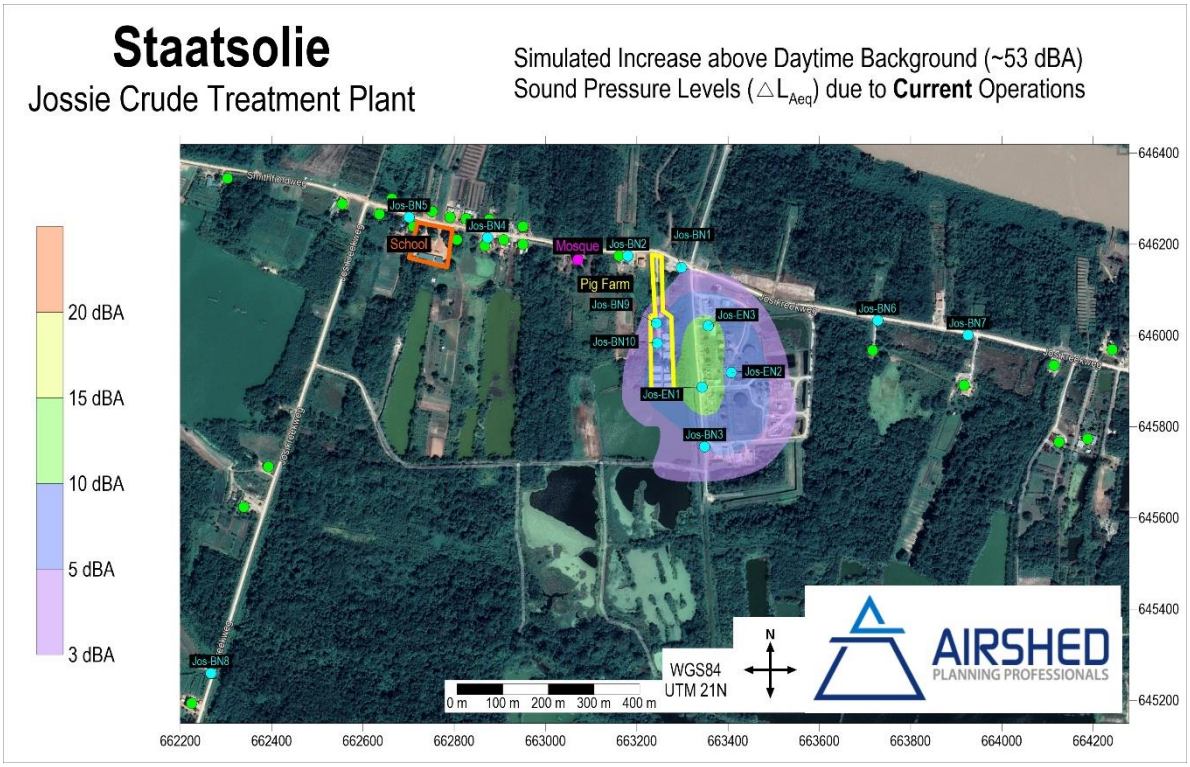


Figure 12: Simulated increase above background daytime rating levels ($\Delta L_{Aeq,d}$) due to Current Operations

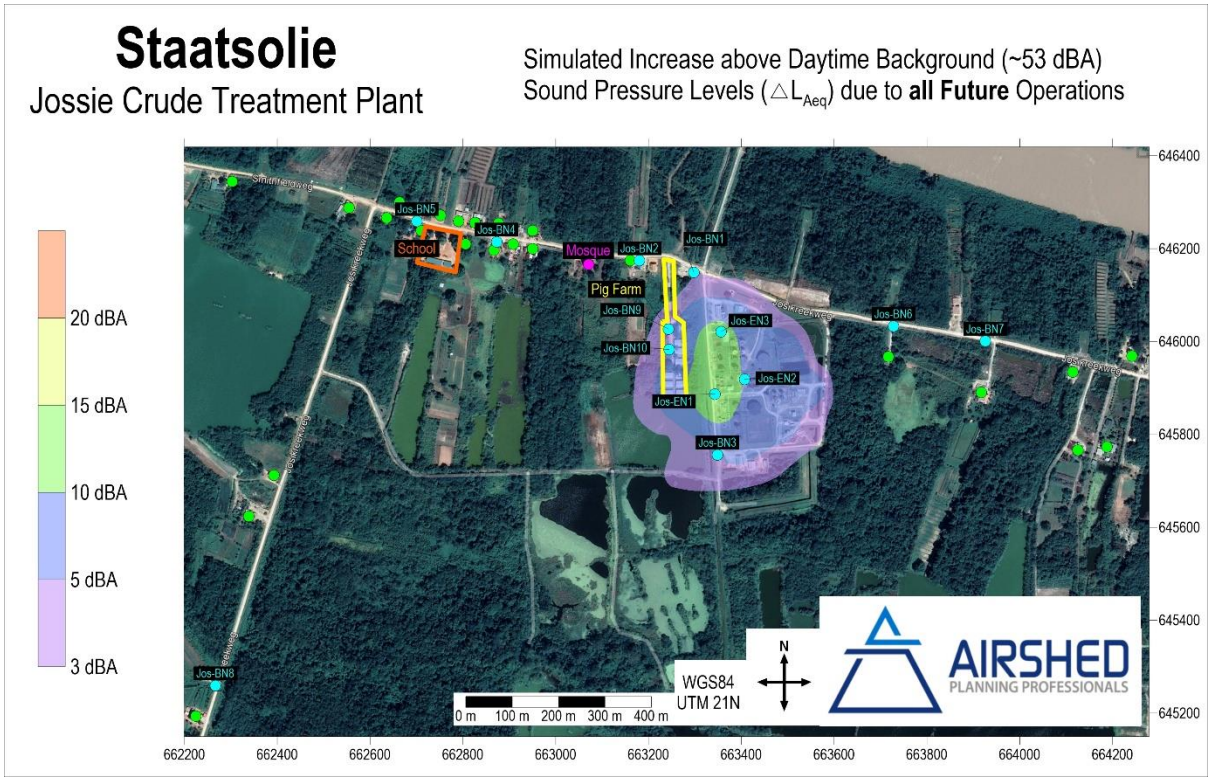


Figure 13: Simulated increase above background daytime rating levels ($\Delta L_{Aeq,d}$) due to all Future Operations

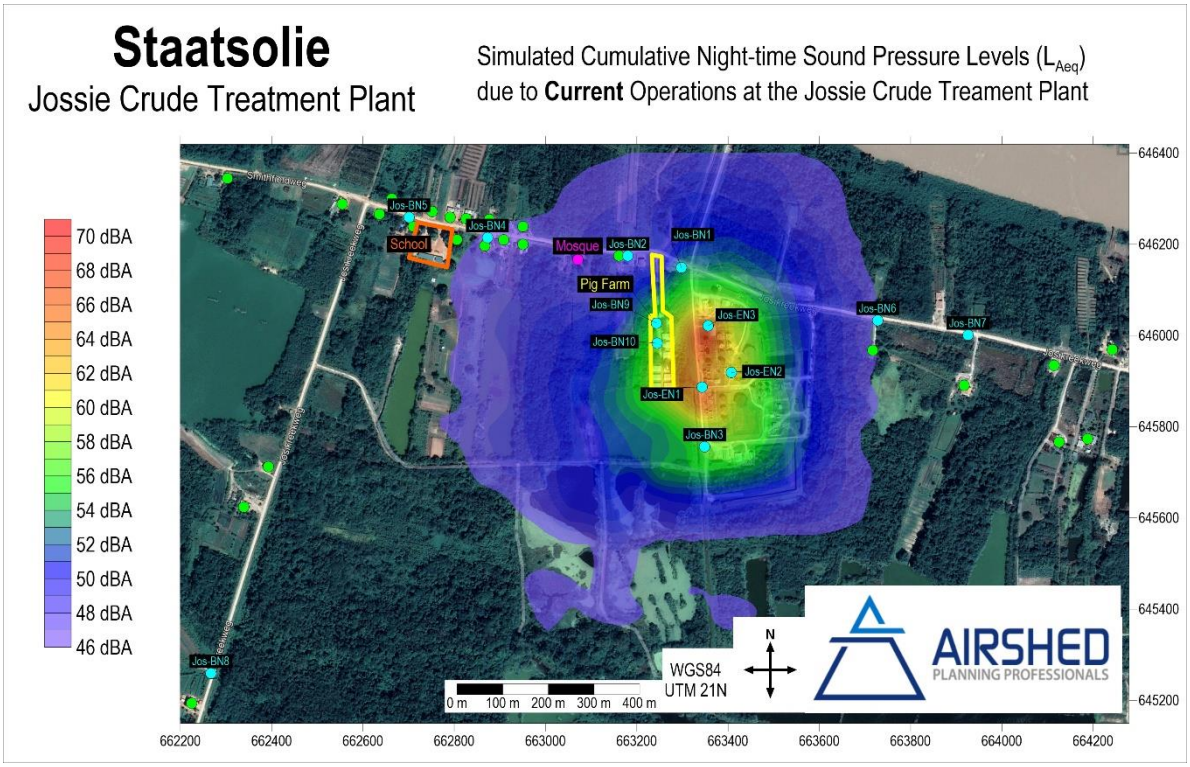


Figure 14: Simulated equivalent continuous night-time rating level ($L_{Aeq,n}$) due to Current Operations

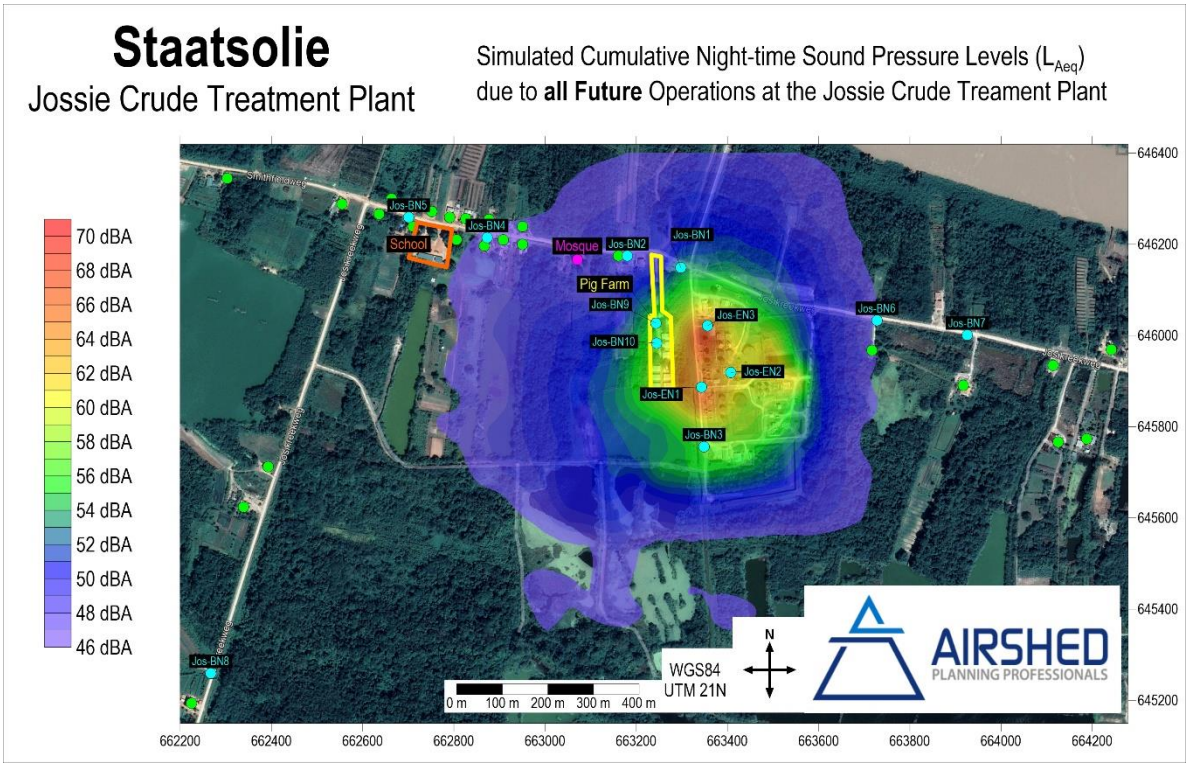


Figure 15: Simulated equivalent continuous night-time rating level ($L_{Aeq,n}$) due to all Future Operations

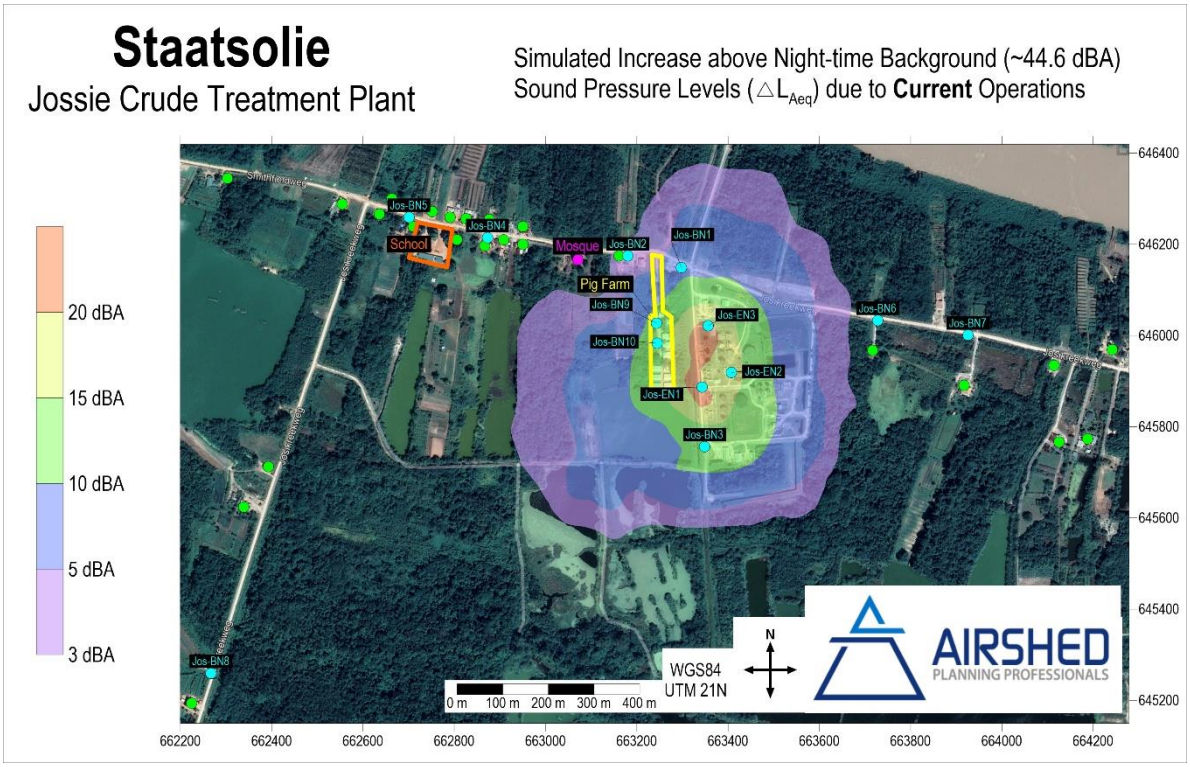


Figure 16: Simulated increase above background night-time rating levels ($\Delta L_{Aeq,n}$) due to Current Operations

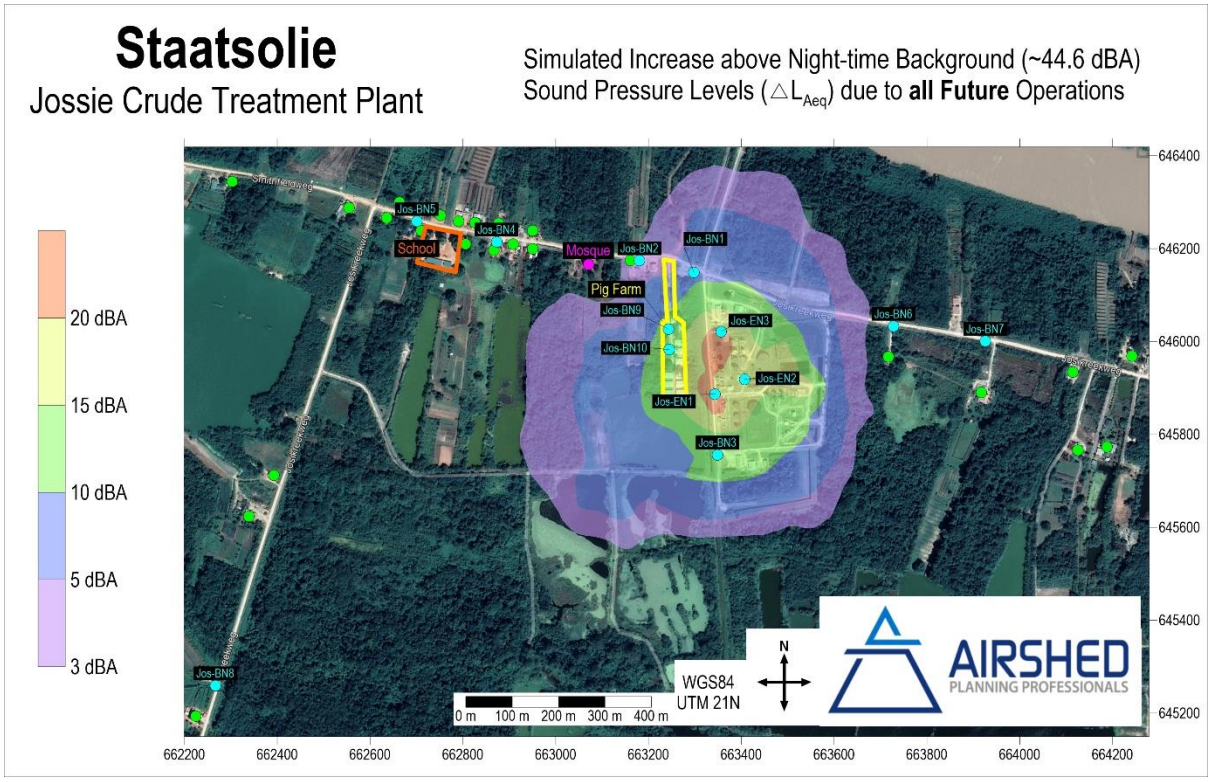


Figure 17: Simulated increase above background night-time rating levels ($\Delta L_{Aeq,n}$) due to all Future Operations

5 CONCLUSIONS AND RECOMMENDATIONS

Propagation modelling results indicate that the proposed project will result in a ***negligibly low*** impact on the acoustic climate throughout the study area. The change in sound pressure levels due to the project will be imperceptible at all nearby noise sensitive receptor locations.

The acoustic climate around the Jossie Treatment Plant, both currently and in the future, is dominated by the current noise sources at the Jossie Treatment Plant, most notably the heater treaters and the transfer pumps.

Both baseline measurements, as well as propagation modelling results, indicate that these sources result in noise levels at the closest sensitive receptor locations that are slightly (between 1 and 3 dBA) in exceedance of the IFC night-time guideline of 45 dBA. For a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level is not detectable. It is therefore unlikely that these sources are disturbing to nearby residents. The current day- and night-time impact of the Jossie operations on noise levels at the nearby sensitive receptor locations is expected to remain the same after the expansion.

It is recommended that a **noise complaints register** be kept on site**,** and that all nearby sensitive receptors be encouraged to report any noise related complaints. Complaints should be investigated and ad-hoc noise measurements undertaken if necessary. If complaints are received regarding the existing noise sources, most notably the heater treaters and transfer pumps, consideration should be given to source based mitigation measures, such as sound cladding, earth berms or vegetation screens, to minimise the impact of the Jossie Treatment Plant on the acoustic climate at residential locations.

Sound pressure levels close to rotating equipment could exceed safe exposure levels (>80 dBA) close to rotating (or other noise generating) equipment on site. It is recommended that workers be required to wear hearing protection when working close to noise generating equipment such as pumps, motors, compressors, boilers and heater treaters.

A noise survey campaign should be undertaken once the project is operational (consideration should be given to a similar campaign during the construction phase as well) to assess the change from baseline levels measured during the 2022 and 2024 campaigns and to verify the noise propagation simulation results.

6 REFERENCES

Brüel & Kjær Sound & Vibration Measurement A/S, (2000). www.bksv.com. [Online] Available at: http://www.bksv.com [Accessed 14 October 2018].

Crocker, M. J., (1998). Handbook of Acoustics. s.l.:John Wiley & Sons, Inc.

EC WG-AEN, 2003. Good Practice Guide for Strategic Noise Mapping and the Production of Associated Data on Noise Exposure, s.l.: s.n.

IFC (2007). General Environmental, Health and Safety Guidelines, s.l.: s.n.

ILACO (2023) Baseline Assessment on Air Emissions, Ambient Air Quality and Noise for the Upstream Operations of Staatsolie: Final Noise Baseline Report. Project Number IS-401

ILACO (2024) Environmental Management and Monitoring Plan (EMMP) for the Optimized fluid handling capacity and efficiency project for the Jossiekreek Crude Treatment Facility

SANS 10103 (2008). The measurement and rating of environmental noise with respect to annoyance and to speech communication, Pretoria: Standards South Africa.

Scherpenzeel (1977) Climate, in: Encyclopedia van Surinames; based on data Meteorological Service Suriname.

WHO, 1999. Guidelines to Community Noise. s.l.:s.n.

7 FULL NOISE SOURCE INVENTORY

Area / Operation	Equipment Description (based on the provided electrical load list, Staatsolie (J2321) – Jossiekreek Definision Study – Date 10-01-204)	No	Power (kW)	Sound Power (Lw in dB)
Existing Facility	Fire Fighting Pump	1	25	94.1
	Main Pumpstation Pumps	4	149	107.3
	Box Separator Pump	1	15	90.3
	Holding Basin Pump	1	1.12	71.2
	Recirculation Pump	1	7.5	85.2
	Day Tank Feed Pump	2	7.5	85.2
	Transfer Pumps to Heaters	4	40	97.6
	Barge Pump	1	16	90.8
	Internal Transfer Pump	1	40	97.6
	Sump Pump at Pig Launcher	1	15	90.3
	Slop Oil 3 & Skim Tank 3 Pump	2	15	90.3
Oil Treatment	Crude Forwarding Pump B Motor	1	30	95.5
	Electrostatic Coaleser A Transformer 1	1	125	80.2
	Electrostatic Coaleser A Transformer 2	1	125	80.2
	Electrostatic Coaleser B Transformer 1	1	125	80.2
	Electrostatic Coaleser B Transformer 2	1	125	80.2
	Wash Water Pump A Motor	1	1	70.3
	Wash Water Pump B Motor	1	1	70.3
	Pre-Coalescer Feed Pump A Motor	1	22	93.2
	Pre-Coalescer Feed Pump B Motor	1	22	93.2
	Pre-Coalescer Feed Pump C Motor	1	22	93.2
	Calcutta Crude Oil Forwarding Pump A Motor	1	22	93.2
	Calcutta Crude Oil Forwarding Pump B Motor	1	22	93.2
	Calcutta Crude Oil Forwarding Pump C Motor	1	22	93.2
	Calcutta Produced Water Forwarding Pump A Motor	1	18	91.7
	Calcutta Produced Water Forwarding Pump B Motor	1	18	91.7
	Coaleser A Transformer Local Panel Control Voltage	1	0.05	39.4
	Coaleser B Transformer Local Panel Control Voltage	1	0.05	39.4
Water Treatment	Pre-Coalescer Backwash Blower A Motor	1	5.5	82.9
	Pre-Coalescer Backwash Blower B Motor	1	5.5	82.9
	Skim Oil Forwarding Pump A Motor	1	2.2	76.2
	Skim Oil Forwarding Pump B Motor	1	2.2	76.2
	Produced Water Forwarding Pump A Motor	1	22	93.2
	Produced Water Forwarding Pump B Motor	1	22	93.2
	DAF A Sludge Thickner 1 Motor	1	0.75	68.2
	DAF A Sludge Thickner 2 Motor	1	0.75	68.2
	DAF A Sludge Scraper Motor	1	0.75	68.2

Area / Operation	Equipment Description (based on the provided electrical load list, Staatsolie (J2321) – Jossiekreek Definision Study – Date 10-01-204)	No	Power (kW)	Sound Power (Lw in dB)
	DAF A Recirculation Pump Motor	1	22	93.2
	DAF B Sludge Thickner 1 Motor	1	0.75	68.2
	DAF B Sludge Thickner 2 Motor	1	0.75	68.2
	DAF B Sludge Scraper Motor	1	0.75	68.2
	DAF B Recirculation Pump Motor	1	22	93.2
	NSF Feed Pump A Motor	1	75	100.1
	NSF Feed Pump B Motor	1	75	100.1
	NSF A Media Scrubber Pump Motor	1	18.5	91.9
	NSF B Media Scrubber Pump Motor	1	18.5	91.9
	NSF C Media Scrubber Pump Motor	1	18.5	91.9
	ACH - Produced Water Forwarding Pump A Motor	1	0.5	69.0
	ACH - Produced Water Forwarding Pump B Motor	1	0.5	69.0
	ACH - DAF A Recirculation Pump Motor	1	0.5	69.0
	ACH - DAF B Recirculation Pump Motor	1	0.5	69.0
	ACH - NSF Feed Pump A Motor	1	0.5	69.0
	ACH - NSF Feed Pump B Motor	1	0.5	69.0
Slop Oil Treatment	Heated Slop Tank Mixer Motor	1	3	78.5
	Slop Oil Centrifuge Feed Pump A Motor	1	5.5	82.9
	Slop Oil Centrifuge Feed Pump B Motor	1	5.5	82.9
	Slop Oil Centrifuge Motor A	1	22	93.2
	Slop Oil Centrifuge Motor B	1	22	93.2
	Oily Filtrate Transfer Pump A Motor	1	1.5	73.3
	Oily Filtrate Transfer Pump B Motor	1	1.5	73.3
	Recovered Oil Transfer Pump Motor	1	1.5	73.3
	ACH - Slop Oil Centrifuge Motor A	1	0.5	69.0
	ACH - Slop Oil Centrifuge Motor A	1	0.5	69.0
Sludge Treatment	Sludge Tank Mixer Motor	1	3	78.5
	Sludge Feed Pump A Motor	1	5.5	82.9
	Sludge Feed Pump B Motor	1	5.5	82.9
	Sludge Centrifuge Motor A	1	5.5	82.9
	Sludge Centrifuge Motor B	1	5.5	82.9
	Recycle Water Pump A Motor	1	30	95.5
	Recycle Water Pump B Motor	1	30	95.5
	ACH - Recycle Water Pump A Motor	1	0.5	69.0
	ACH - Recycle Water Pump B Motor	1	0.5	69.0
Modification of Existing Facility	Slop Oil Pump A Motor	1	15	90.3
	Slop Oil Pump B Motor	1	15	90.3
	Box Separator 2 skim water Pump	1	15	90.3

Area / Operation	Equipment Description (based on the provided electrical load list, Staatsolie (J2321) – Jossiekreek Definision Study – Date 10-01-204)	No	Power (kW)	Sound Power (Lw in dB)
	Box Separator 1 skim water Pump	1	15	90.3
	Box Separator Oil Recovery Pump A Motor	1	15	90.3
	Box Separator Oil Recovery Pump B Motor	1	15	90.3
	Steam Boiler Burner Blower Motor	1	15	90.3
	Steam Boiler Feed Pump A	1	5.5	82.9
	Steam Boiler Feed Pump B	1	5.5	82.9
	Ring Main Pump A	1	5.5	82.9
	Ring Main Pump B	1	5.3	82.7
	Steam Heat Exchanger Feed Pump A	1	5.5	82.9
	Steam Heat Exchanger Feed Pump B	1	5.5	82.9
	Electric Heater	1	3	78.5
	Plant Instrument Air Compressor A	1	10	87.3
	Plant Instrument Air Compressor B	1	10	87.3
	UPS system (Note-7)	1	12	82.8
	Demulsifier Upstream of CFWKO 1 & CFWKO 2 Pump Motor	1	0.25	60.1
	Demulsifier - Upstream of Calcutta Tank 9A & Tank 9B Pump Motor	1	0.25	60.1
	Flocculant - downstream of PW Forwarding Pump to DAF Pump Motor	1	0.25	60.1
	Flocculant •- downstream of Tank 2/3 to DAF Pump Motor	1	0.25	60.1
	Demulsifier - Upstream of Sludge Tank Pump Motor	1	0.18	57.7
	Coagulant- Upstream of Calcutta PW Forwarding Pump Motor	1	0.18	57.7
	Antifoam - Upstream of CFWKO 1 & CFWKO Pump Motor	1	0.18	57.7
	Antiscale - Upstream of Calcutta Tank 9A & Tank 9B Pump Motor	1	0.18	57.7
	Antiscale - Upstream of CFWKO 1 & CFWKO 2 Pump Motor	1	0.18	57.7
	Demulsifier - Upstream of Crude Forwarding Pump Motor	1	0.18	57.7
	Flocculant -Upstream of Pre Coalescer Feed Pump Motor	1	0.25	60.1
	Flocculant - Downstream of HFWKO2 & HFWKO 3 water side Pump Motor	1	0.18	57.7
	Flocculant- Upstream of Sludge Centrifuge A & B Pump Motor	1	0.18	57.7
	Flocculant - Upstream of Slop Centrifuge Pump Motor	1	0.18	57.7
	Clarifier- NSF Backwash Water Pump Motor	1	0.18	57.7

Appendix 7: Air Quality Impact Assessment

AIR QUALITY IMPACT ASSESSMENT:

Staatsolie: Optimised Fluid Handling Capacity and Efficiency at the Jossie Crude Treatment Facility

Project done on behalf of: **ILACO Suriname NV**

Report Compiled by:
N Grobler

Report No: 23ILC02 AQIA | **Date:** April 2024

Address: 480 Smuts Drive, Halfway Gardens | **Postal:** P O Box 5260, Halfway House, 1685
Tel: +27 (0)11 805 1940 | **Fax:** +27 (0)11 805 7010
www.airshed.co.za

Report Details

Project Name	Air Quality Impact Assessment: Staatsolie: Optimised Fluid Handling Capacity and Efficiency at the Jossie Crude Treatment Facility
Client	ILACO Suriname NV
Report Number	23ILC02 AQIA
Report Version	Revision 1
Date	April 2024
Prepared by	Nick Grobler, BEng (Chem), BEng (Hons) (Env) (University of Pretoria)
Reviewed by	
Notice	Airshed Planning Professionals (Pty) Ltd is a consulting company located in Midrand, South Africa, specialising in all aspects of air quality, ranging from nearby neighbourhood concerns to regional air pollution impacts as well as noise impact assessments. The company originated in 1990 as Environmental Management Services, which amalgamated with its sister company, Matrix Environmental Consultants, in 2003.
Declaration	Airshed is an independent consulting firm with no interest in the project other than to fulfil the contract between the client and the consultant for delivery of specialised services as stipulated in the terms of reference.
Copyright Warning	

Revision Record

Version	Date	Section(s) Revised	Summary Description of Revision(s)
Draft	April 2024	All	Draft report for client review
Rev1	April 2024	All	Revised based on client feedback

EXECUTIVE SUMMARY

Airshed Planning Professionals (Pty) Ltd was appointed by ILACO Suriname NV to conduct an air quality impact assessment for the Optimised Fluid Handling Capacity and Efficiency at the Jossie Crude Treatment Facility of Staatsolie Upstream Operations Project ("the project"). The Jossie Crude Treatment Facility ("the Jossie plant") is located along the Josikreekweg to the south of the Saramacca River, approximately 5 km away from the Oost-Westverbinding.

The current fluid handling capacity of Jossie Crude Treatment Plant is 25,000 Barrels per day (BFPD). Staatsolie aims to increase the capacity to 38,000 BFPD. To increase the fluid handling capacity and efficiency of the plant and mitigate the risk associated with back produced polymer, upgrade of the current oil and water treatment process is required. This project includes the following activities:

- Upgrade Oil Treatment part
- Upgrade Water Treatment part
- Slop Oil Handling (new)
- Sludge Handling (new)
- Centralized Cold Vent System (new)

The Centralized Cold Vent System is proposed to vent flammable gases safely to the atmosphere. A vent header gathers process vents and relief lines from the process plant and storage tanks, and routes them (through a knock-out drum where entrained liquid is removed and recycled back to the process) to the vent stack, located in a sterile area in the firewater pond.

Well fluids coming into the Jossie plant will be passed through a flash drum to separate the majority of the gas. This gas will be injected to a gas header towards the burners of the proposed steam boiler. This gas will be combusted to generate heat for steam generation. The gas will be supplemented by burning crude oil to supplement the heat duty, as and when required. In the event the gas is below the minimum required value for stable burning, the gas shall be routed to the cold vent instead.

The project is expected to result in a significant reduction in VOC emissions, since a large part of the VOCs currently vented to the atmosphere through various process and tank vents will be captured and used as fuel for the boiler. Gas not used in the boiler, or unsuitable to be used as fuel, will be emitted through the elevated cold vent stack, resulting in lower ground level impacts. The boiler, however, is expected to result in an increase in the emissions of combustion products, such as NO_2, SO_2 and PM.

The wind field is dominated by winds from the northeast, east-northeast and east, with an average wind speed of 2.7 m/s. Air quality impacts from the Jossie plant are expected to be most pronounced to the west and southwest of the operations. Very little air quality impacts are expected to occur to the north, south or east of the operations.

Air quality sensitive receptors (AQSR's) in the area include a mosque (150 m to the west) and a school (approximately 550 m west from the entrance of the Jossie plant). Other sensitive receptors include residences

along Josikreekweg. The closest residences are located approximately 100 m to the west (at the pig farm), 350 m to the north-west and 150 m to the east.

Simulated PM, NO_2 and SO_2 concentrations due to current and future operations are below the WHO air quality guidelines at all sensitive receptor locations, but exceed the guideline values at the nearby pig farm (located 100 m to the west of the Jossie Treatment Plant). While simulated criteria pollutant concentrations at the pig farm exceed the WHO AQGs, concentrations are below the WHO interim targets at the pig-farm, and the health of workers are unlikely to be negatively impacted by criteria pollutant emissions from the Jossie plant. Simulated concentrations of these pollutants are also well below the critical levels for animals. Overall, the impact of the project on criteria pollutant concentrations in the study area is expected to be ***low negative***.

Dispersion modelling results indicate that the project will result in a decrease in VOC and H_2S concentrations throughout the study area, including at all sensitive receptor locations. Simulated VOC concentrations are below the assessment criteria of 200 µg/m³ at all sensitive receptor locations, but exceeds this level at the nearby pig farm for both the current and future scenarios. Simulated concentrations at this location are however well below the human discomfort level of 3 000 µg/m³, but falls within the "multifactorial exposure" range, any possible health impacts would therefore depend on the composition of VOC emissions. It is recommended that workers at the pig farm be encouraged to report any symptoms related to VOC exposure (such as difficulty breathing, burning of the throat, mouth or eyes, or nuisance odours) and that any such complaints be investigated and sampling of VOC concentrations at this location be conducted. The impact of the project on VOC concentrations in the study area is expected to be ***moderately positive***.

While the project is expected to result in a decrease in overall H_2S emissions, simulated 98th percentile hourly H_2S concentrations still exceed the 7 µg/m³ at the sensitive receptors to the west, southwest and northwest of the Jossie plant, and some individuals will be able to recognise the distinct smell of H_2S emissions from the Jossie plant from time to time. However, simulated concentrations are below the California EPA guideline value of 42 µg/m³ at which the odour would be detectable by 83% of the population and would be discomforting to 40% of the population and well below the WHO 24-hour guideline for health impacts of 150 µg/m³ at all sensitive receptor locations. No information could be found on the impact of odorous emissions on livestock. The project is expected to have a ***low positive*** impact on H_2S concentrations in the study area.

It is recommended that complaints registers be kept at the Jossie plant The community, as well as Staatsolie personnel, should be encouraged to report any air quality or odour related issues.

TABLE OF CONTENTS

List of Tables

List of Figures

1 INTRODUCTION

Airshed Planning Professionals (Pty) Ltd was appointed by ILACO Suriname NV to conduct an air quality impact assessment for the Optimised Fluid Handling Capacity and Efficiency at the Jossie Crude Treatment Facility of Staatsolie Upstream Operations Project ("the project"). The Jossie Crude Treatment Facility ("the Jossie plant") is located along the Josikreekweg to the south of the Saramacca River, approximately 5 km away from the Oost-Westverbinding.

The current fluid handling capacity of Jossie Crude Treatment Plant is 25,000 Barrels per day (BFPD). Staatsolie aims to increase the capacity to 38,000 BFPD. To increase the fluid handling capacity and efficiency of the plant and mitigate the risk associated with back produced polymer, upgrade of the current oil and water treatment process is required. This project includes the following activities:

- Upgrade Oil Treatment part
- Upgrade Water Treatment part
- Slop Oil Handling (new)
- Sludge Handling (new)
- Centralized Cold Vent System (new)

These activities will be located inside the current Jossie Treatment Plant, on the eastern side (Figure 1).

The Centralized Cold Vent System is proposed to vent flammable gases safely to the atmosphere. A vent header gathers process vents and relief lines from the process plant and storage tanks, and routes them (through a knock-out drum where entrained liquid is removed and recycled back to the process) to the vent stack, located in a sterile area in the firewater pond (Figure 1).

Well fluids coming into the Jossie plant will be passed through a flash drum to separate the majority of the gas. This gas will be injected to a gas header towards the burners of the proposed steam boiler. This gas will be combusted to generate heat for steam generation. The gas will be supplemented by burning crude oil to supplement the heat duty, as and when required. In the event the gas is below the minimum required value for stable burning, the gas shall be routed to the cold vent instead.

Baseline air quality monitoring was conducted by ILACO in 2022. This report details the results and conclusions from the Air Quality Impact Assessment of the project, based on dispersion modelling conducted for the current and proposed emission sources.

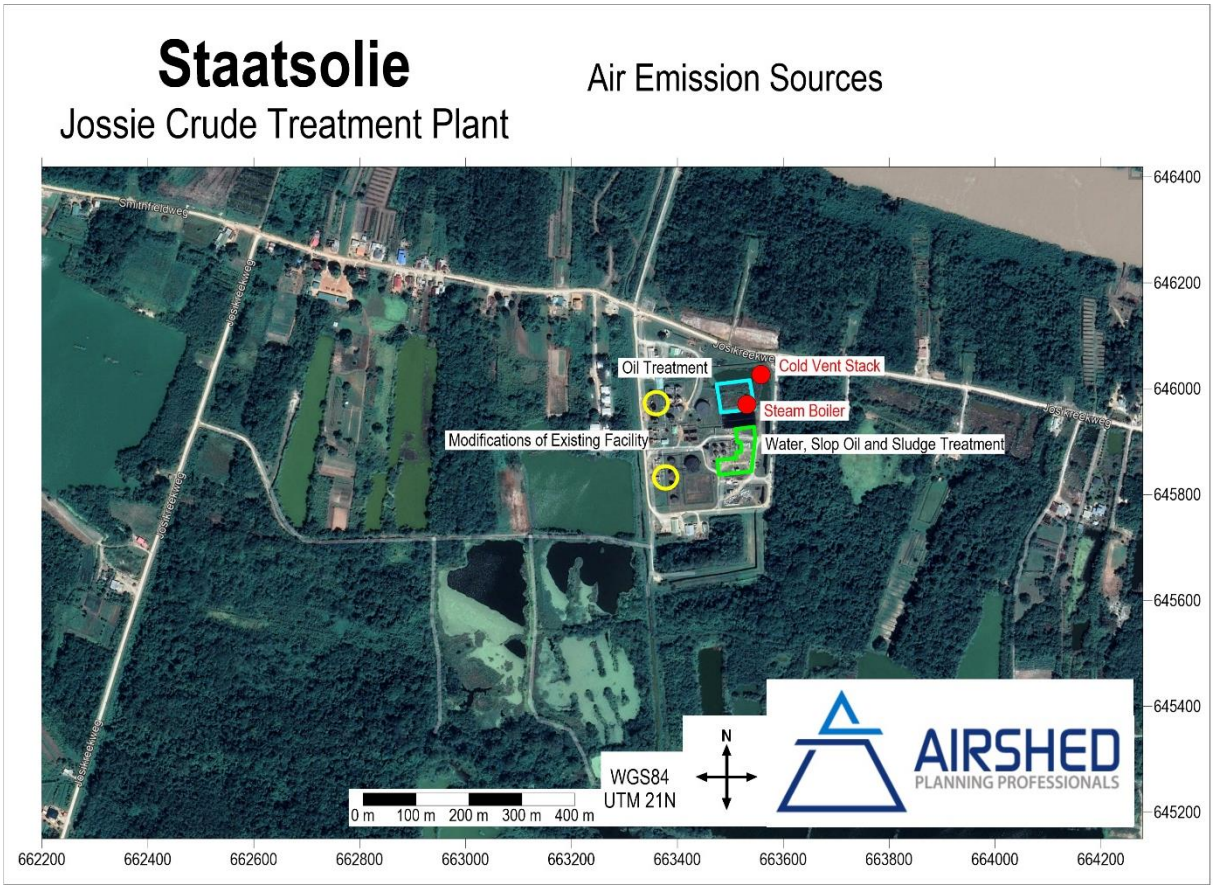


Figure 1: Project Layout

1.1 Methodological Overview

1.1.1 Baseline Characterisation

Meteorological data was obtained from the Weather Research and Forecasting Model (WRF) dataset for an on-site location. Hourly average meteorological data for the period January 2021 to December 2023 was used for the assessment. In the assessment of baseline concentrations and cumulative impacts, reference was made to ambient air quality monitoring conducted by ILACO in June/August 2022 (Grobler, 2022). Monitoring was conducted for ambient concentrations of sulfur dioxide (SO_2), carbon monoxide (CO), hydrogen sulfide (H_2S) and volatile organic compounds (VOCs).

1.1.2 Emissions Inventory

The establishment of a comprehensive emissions inventory formed the basis for the assessment of the impacts of the Jossie plant and the proposed project on the receiving environment. The emissions inventory was based on design specifications, temperatures, flow rates and fuel consumption rates provided by Staatsolie. Reference was made to VOC and H_2S emissions from current sources, sampled by Levego and ILACO and reported on by Airshed (Grobler, 2022).

To estimate the emission rates from current sources, such as the heater treaters and transfer pumps, as well as the proposed steam boiler, use was made of emission factors published by the United States Environmental Protection Agency in AP42, Fifth Edition, Volume 1, Chapter 1: External Combustions Sources. Chapters 1.3 (Fuel Oil Combustion) and 1.4 (Natural Gas Combustion) were referenced in the estimation of emissions.

1.1.3 AERMOD Dispersion Model

Several dispersion models are available for predicting air concentrations downwind of a release into the atmosphere. These range from highly complicated numerical methods, requiring significant computing power and resources, to relatively simplistic formulations. A few dispersion models have been developed for general and regulatory applications, such as the US Environmental Protection Agency's (EPA) AERMOD and CALPUFF dispersion models, which have been widely used for regulatory purposes in the USA and elsewhere. The US EPA promulgates the *Guideline on Air Quality Models* ("Guideline") in which the EPAs preferred models and other recommended techniques, as well as guidance for their use in estimating ambient concentrations of air pollutants are provided (EPA 2017). The EPA originally published the Guideline in April 1978 (EPA–450/2–78–027) and had been revised several times since then (1986, 1987, 1993, 1995, 2003, 2005, 2015, 2017 and the latest in 2023). The Guideline is incorporated into the EPA's regulations, satisfying a requirement under the Clean Air Act (CAA) for the EPA to specify, with reasonable particularity, models to be used in the Prevention of Significant Deterioration (PSD) program. The EPA's preferred near-field dispersion modelling system is AERMOD (American Meteorological Society (AMS)/EPA Regulatory Model). The AERMOD model is based on a new generation, Gaussian plume model. AERMOD was developed under the support of the AMS/EPA Regulatory Model Improvement Committee (AERMIC), whose objective was to include state-of the-art science in regulatory models (Hanna *et al.*, 1999). The AERMOD is a dispersion modelling system with three components, namely: AERMOD (AERMIC Dispersion Model), AERMAP (AERMOD terrain pre-processor), and AERMET (AERMOD meteorological pre-processor).

- AERMOD is an advanced new-generation model. It is designed to predict pollution concentrations from continuous point, flare, area, line, and volume sources. AERMOD offers new and potentially improved algorithms for plume rise and buoyancy, and the computation of vertical profiles of wind, turbulence and temperature however retains the single straight-line trajectory limitation of ISCST3[1] (Hanna *et al*, 1999).
- AERMET is a meteorological pre-processor for the AERMOD model. Input data can come from hourly cloud cover observations, surface meteorological observations and twice-a-day upper air soundings. Output includes surface meteorological observations and parameters and vertical profiles of several atmospheric parameters.
- AERMAP is a terrain pre-processor designed to simplify and standardize the input of terrain data for the AERMOD model. Input data includes receptor terrain elevation data. The terrain data may be in the form of digital terrain data. Output includes, for each receptor, location and height scale, which are elevations used for the computation of air flow around hills.

[1] Industrial Source Complex (ISC) model (version 3) (ISC3), is the forerunner to the US EPAs AERMOD model

Software Versions used:

- AERMOD version 19191 with the front end from BREEZE Ver. 9.0.0.17.
- AERMET version 16216
- AERMAP version 11103

1.1.3.1 *AERMOD Model Uncertainty*

In the Guideline (EPA, 2017), the need to address the uncertainties associated with dispersion modelling is acknowledged as an important issue that should be considered. The Guideline divides the uncertainty associated with dispersion model predictions into two main types, as follows:

- Reducible uncertainty, which results from (1) Uncertainties in the input values of the known conditions (i.e., emission characteristics and meteorological data); (2) errors in the measured concentrations which are used to compute the concentration residuals; and (3) inadequate model physics and formulation. The ''reducible'' uncertainties can be minimized through better (more accurate and more representative) measurements and better model physics.
- Inherent uncertainty is associated with the stochastic (turbulent) nature of the atmosphere and its representation or approximation by numerical models. Models predict concentrations that represent an ensemble average of numerous repetitions for the same nominal event. An individual observed value can deviate significantly from the ensemble value. This uncertainty may be responsible for a ± 50% deviation from the measured value.

Atmospheric dispersion models are often criticised for being inadequate since "…*it is only a model approximating reality*", and therefore include inherent uncertainty. Both reducible and inherent uncertainties mean that dispersion modelling results may over- or under-estimate measured ground-level concentrations at any specific time or place. However, the Guideline also states that:

"Models are more reliable for estimating longer time-averaged concentrations than for estimating short-term concentrations at specific locations; and the models are reasonably reliable in estimating the magnitude of highest concentrations occurring sometime, somewhere within an area. For example, errors in highest estimated concentrations of ± 10 to 40 percent are found to be typical, certainly well within the often-quoted factor-of-two accuracy that has long been recognized for these models."

To minimise the overall uncertainty, but specifically the "reducible uncertainty", the following simple principles were followed in the investigation:

- Understanding the objectives of the investigation;
- Demonstrating that the model inputs are as correct as possible;
- Understanding and stating the model performance limitations; and
- Demonstrating that the modelling process has been conducted appropriately and in line with international practice.

Whilst model validation using information from monitoring records that might be available would normally form part of the management of uncertainty, it did not form part of the current study.

1.1.3.2 *Model Input Data*

Input data types required for the AERMOD models include: hourly average meteorological data, source data, and information on the nature of the receptor grid such as topography and land use. Each of these data types will be described below.

1.1.3.3 *Meteorological Data*

AERMOD requires two specific input files generated by the AERMET pre-processor. AERMET is designed to be run as a three-stage processor and operates on three types of data (upper air data, on-site measurements, and the national meteorological database). The dispersion potential of the site was based on modelled WRF meteorological data for an on-site location. The available data period was from 1 January 2021 to 31 December 2023.

1.1.3.4 *Air Emission Sources*

The model has the ability to simulate point (including flare sources), area, volume and line sources, using the BREEZE interface and executable for AERMOD. The proposed cold vent stack, proposed boiler stack, and current heater treater stack and transfer pump stacks was modelled as point sources, while fugitive process and tank emissions was modelled as area sources.

1.1.3.5 *Modelling Domain*

The modelling domain was chosen such that the modelling area includes the closest sensitive receptors to the proposed project and the expected spatial extent, or area of impact (AOI). Modelling was conducted for a 2 km (east-west) x 1.5 km (north-south) area with the Jossie plant located centrally.

A regular receptor grid of 50 m by 50 m was used to construct the concentration isopleths. Because the area is relatively flat with the topography (Figure 2) ranging between sea level and 20 metres above mean sea level (mamsl), no topography was included in the dispersion modelling simulations.

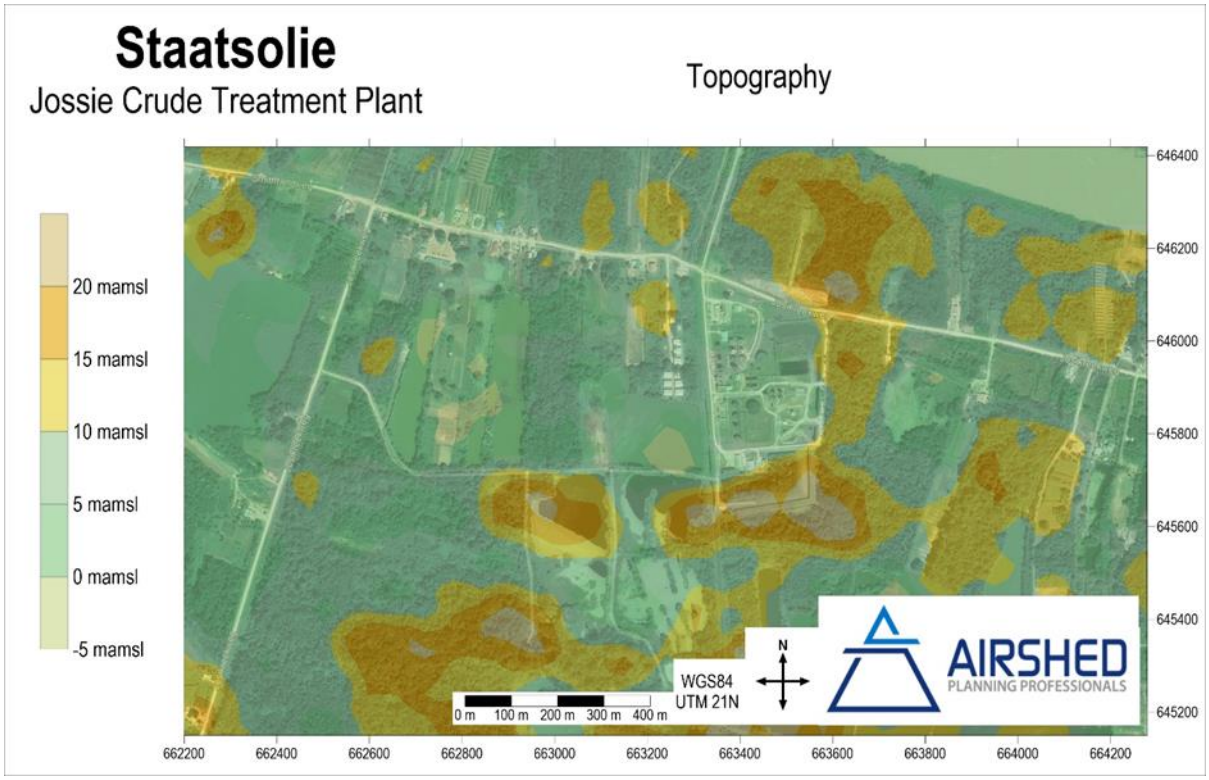


Figure 2: Dispersion Modelling Domain and Study Area Topography

2 ASSESSMENT CRITERIA

2.1 IFC EHS Guidelines and WHO Standards

Best practice is usually a standard implemented and required by developed countries, often with very different environmental, social and economic characteristics. In general, the minimum standards should be a politically feasible and economically viable standard to be met by industry. The standards used must however meet the ultimate objective of ambient air quality improvement and management throughout the various phases of the project. As of April 30, 2007, new versions of the World Bank (WB) Environmental, Health, and Safety Guidelines (known as the 'EHS Guidelines') are in use. These replace those documents previously published in Part III of the Pollution Prevention and Abatement Handbook. The EHS Guidelines are technical reference documents and intended to be used together with the Industry Sector EHS Guidelines for specific industry sectors. They provide performance levels and measures on what is considered achievable by existing technology at reasonable costs. It is made clear that these guidelines should be adapted to site-specific variables considering the sensitivity of the environment and other project factors as indicated by the environmental assessment, and in the context of the host country.

In general, the most stringent guidelines need to be applied. If less stringent levels or measures are appropriate in view of specific project circumstances, a full and detailed justification for any proposed guideline alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment (IFC, 2007)

The new EHS Guidelines were developed as part of a two-and-a-half-year review process. The EHS Guidelines are intended to be 'living documents' and will be updated on a regular basis going forward (IFC, 2007). The EHS Guidelines provides a general approach to air quality management for a facility, including the following:

- Identify possible risks and hazards associated with the project as early on as possible and understand the magnitude of the risks, based on:
    - the nature of the project activities; and
    - the potential consequences to workers, communities, or the environment if these hazards are not adequately managed or controlled.
- Prepare project- or activity-specific plans and procedures incorporating technical recommendations relevant to the project or facility;
- Prioritize the risk management strategies with the objective of achieving an overall reduction of risk to human health and the environment, focusing on the prevention of irreversible and / or significant impacts;
- When impact avoidance is not feasible, implement engineering and management controls to reduce or minimize the possibility and magnitude of undesired consequence; and
- Continuously improve performance through a combination of ongoing monitoring of facility performance and effective accountability.

Significant impacts to air quality should be prevented or minimized by ensuring that:

- Emissions to air do not result in pollutant concentrations exceeding the relevant ambient air quality guidelines or standards. These guidelines or standards can be national guidelines or standards or in their absence WHO Air Quality Guidelines (WHO, 2021). Since no air quality standards have been published for Suriname, reference is made to the WHO air quality guidelines (2021). These are presented in Table 1.
- Emissions do not contribute significantly to the relevant ambient air quality guidelines or standards. It is recommended that 25% of the applicable air quality standards can enable future development in a given airshed.

The EHS Guidelines recognizes the use of dispersion models to assess potential ground level concentrations. The models used should be internationally recognized or comparable.

Table 1: WHO Ambient Air Quality Guidelines

Pollutant	Averaging Period	WHO AQGs
PM_{10} ($\mu g/m^3$)	24-hour	45
	Annual	15
$PM_{2.5}$ ($\mu g/m^3$)	24-hour	15
	Annual	5
SO_2 ($\mu g/m^3$)	24-hour	40
NO_2 ($\mu g/m^3$)	24-hour	25
	Annual	10
CO ($\mu g/m^3$)	24-hour	4 000
H_2S ($\mu g/m^3$)	24-hour	150
	30-minute (Odour)	7

Given that air pollution levels in developing countries frequently far exceed the recommended WHO AQGs, interim target (IT) levels were included in the (WHO, 2021) update. These are higher than the WHO AQGs themselves, to promote steady progress towards meeting the WHO AQGs. There are between two and four interim targets starting at WHO interim target-1 (IT-1) as the most lenient and IT-3 or IT-4 as more stringent targets before reaching the AQGs. The WHO permits a 1% frequency of exceedance per calendar year.

2.1 Other Assessment Criteria

2.1.1 International Ambient Air Quality Criteria for Hydrocarbon Exposure

Due to the nature of the Staatsolie Upstream operations, *i.e.* the storage, handling and processing of crude oil, mainly hydrocarbons are expected to be released to the atmosphere as air pollutants. Hydrocarbon compounds are defined chemically as compounds consisting of carbon and hydrogen. VOC (volatile organic compounds) is

the name given to a class of several hundred carbon-based chemical compounds that evaporate easily into the air. VOC sources include evaporation, venting of gas, and incomplete combustion. Some VOCs have little or no known direct human health effects, while others are extremely toxic and/or carcinogenic. Very little is known about how various VOC's combine in the atmosphere or in the human body, or what the cumulative impacts of exposure might be.

As the term hydrocarbon compound and volatile organic compound refers to a group of pollutants, standards are not generally available for the health impacts due to exposure to these pollutants as a group. To estimate the probable health impacts a breakdown of the group into separate species is required, which allows a comparison for individual toxicities to be made.

Although **standards** for exposure to VOCs in non-industrial settings do not exist, a number of exposure **guidelines** have been recommended. The European Collaborative Action (ECA) Report No. 11 titled *Guidelines for Ventilation Requirements in Buildings* (CEC, 1992) lists the following Total Volatile Organic Compounds (TVOC) concentration ranges as measured with a flame ionisation detector calibrated to toluene. These recommendations are based on Mølhave's toxicological work on mucous membrane irritation (Mølhave, 1982, 1993).

Comfort range:	<200 µg/m³
Multifactoral exposure range:	200 to 3 000 µg/m³
Discomfort range:	3 000 to 25 000 µg/m³
Toxic range:	>25 000 µg/m³

The same European report also lists a second method based on Seifert's work. This method established TVOC guidelines based on the ten most prevalent compounds in each of seven chemical classes. The concentrations in each of these classes should be below the maximums listed below.

Alkanes:	100 µg/m³
Aromatic hydrocarbons:	50 µg/m³
Terpenes:	30 µg/m³
Halocarbons:	30 µg/m³
Esters:	20 µg/m³
Aldehydes and ketones (excluding formaldehyde):	20 µg/m³
Other:	50 µg/m³

The TVOC concentration is calculated by adding the totals from each class. Seifert gives a target TVOC concentration of 300 µg/m³ which is the sum of the above-listed target concentrations. The author also states that no individual compound concentration should exceed 50 percent of the guideline for its class or 10 percent of the TVOC guideline concentration. However, Seifert states that "…the proposed target value is not based on toxicological considerations but – to the author's best judgement."

In addition to Seifert's work, the most recent available version (2016) of the Environmental Screening Levels (ESLs) for the individual compounds proposed by the Texas Commission on Environmental Quality (TCEQ) have been perused. This is the most complete listing of exposure levels available. ESLs are chemical-specific air concentrations set to protect human health and welfare. They are based on data concerning health effects, the potential for odours to be a nuisance, and effects on vegetation. They are not ambient air standards. If predicted airborne levels of a constituent do not exceed the screening level, adverse health or welfare effects are not expected. If predicted ambient levels of constituents in air exceed the screening levels, it does not necessarily indicate a problem but rather triggers a review in more depth (TCEQ 2022). Exposure to an air concentration at or below the ESL is not likely to cause an adverse health effect in the general public, including sensitive subgroups such as children, the elderly, pregnant women, and people with pre-existing health conditions. These are comparison levels, not ambient air standards 'Short-term' indicates hourly values; 'long-term' indicates annual averages.

The limits for general hydrocarbons with regard to non-health related impacts are mostly set to reduce their role in photochemical reactions that produce secondary pollutants created mainly in urban atmospheres by the reactions between these compounds and the oxides of nitrogen and ozone. An example is the US Federal 3-hour average standard (for the period 6 AM to 9 AM) of 160 µg/m³, not to be exceeded more than once per year.

In this study, reference is made to the "comfort range" of **200 µg/m³** as published Mølhave (1982) as the assessment criteria for ambient VOC concentrations.

2.1.2 Odour Impact Evaluation of Hydrogen Sulphide

Odour thresholds are defined in several ways including *absolute perception thresholds*, *recognition thresholds* and *objectionability thresholds*. At the perception threshold one is barely certain that an odour is detected but it is too faint to identify further. Recognition thresholds are normally given for 50% and 100% recognition by an odour panel.

For the purposes of this study, reference was made to the WHO guideline for short-term H_2S exposure, which states that *"in order to avoid substantial complaints about odour annoyance among the exposed population, hydrogen sulfide concentrations should not be allowed to exceed* **7 µg/m³** *with a 30-minute averaging period"* (WHO 2000). Unfortunately the shortest averaging period that can be modelled with hourly meteorological data is hourly concentrations, so modelled 99th percentile hourly H_2S concentrations were compared to the WHO guideline.

Since the WHO guideline is based on the odour perception threshold only, reference is also made to the California Ambient Air Quality Standard for H_2S of **42 µg/m³,** averaged over one hour. At this concentration the odour would be detectable by 83% of the population and would be discomforting to 40% of the population.

2.1.3 Effects of Particulate Matter on Animals

As presented by the Canadian Environmental Protection Agency (CEPA, 1998) experimental studies using animals have not provided convincing evidence of particle toxicity at ambient levels. Acute exposures (4-6 hour single exposures) of laboratory animals to a variety of types of particles, almost always at concentrations well above those occurring in the environment have been shown to cause decreases in lung function, changes in airway defence mechanisms and increased mortality rates.

The epidemiological finding of an association between 24-hour ambient particle levels below 100 µg/m^3 and mortality has not been substantiated by animal studies as far as PM_{10} and $PM_{2.5}$ are concerned. With the exception of ultrafine particles (0.1 µm), none of the other particle types and sizes used in animal inhalation studies cause such acute dramatic effects, including high mortality at ambient concentrations. The lowest concentration of $PM_{2.5}$ reported that caused acute death in rats with acute pulmonary inflammation or chronic bronchitis was 250 g/m^3 (3 days, 6 hr/day), using continuous exposure to concentrated ambient particles.

2.1.4 Effects of SO_2 on Animals

Experimental studies on animals have shown the acute inhalation of SO_2 produces bronchioconstriction, increases respiratory flow resistance, increases mucus production and has been shown to reduce abilities to resist bacterial infection in mice (Costa and Amdur, 1996). Short exposures to low concentrations of SO_2 (~2.6 mg/m³) have been shown to have immediate physiological response without resulting in significant or permanent damage. In rabbits, acute exposures (16 mg/m³ for 4 hours) to SO_2 gas was irritating to the eyes and resulted in conjunctivitis, infection and lacrimation (Von Burg, 1995). Short exposures (<30 min) to concentrations of 26 mg/m³ produced more significant respiratory changes in cats but were usually completely reversible once exposure had ceased (Corn *et al*., 1972).

Sulfur dioxide can produce mild bronchial constriction, changes in metabolism and irritation of the respiratory tract and eyes in cattle (Blood and Radostits, 1989 as cited in Coppock and Nostrum, 1997). An increase in airway resistance was reported in sensitized sheep after four hours of exposure to 13 mg/m³. Studies report chronic exposure can affect mucus secretions and result in respiratory damage similar to chronic bronchitis. These effects were reported at concentrations above typical ambient concentrations (26-1 053 mg/m³) (Dalhamn, 1956 as cited in Amdur, 1978).

Exposure to air pollutants is expected to result in similar adverse effects in wildlife and livestock as in laboratory and domestic animals (Newman, 1979).

2.1.5 Effects of NO_2 on Animals

The toxicity of NO_2 is related to oxidation processes that form nitric acid with water in the eyes, lungs, mucous membranes and on the skin of animals (MFE, 2004) and result in oxidation of cell membrane lipids and proteins triggering inflammation (Menzel, 1994). Long term exposure to nitrogen oxides increases respiratory infections resulting in lowered resistance to diseases such as pneumonia and influenza (MFE, 2004). An acute association

between ambient NO_2 concentrations and dairy cattle mortality was found in Belgium during cold and warm season exposure to NO_2, however, these acute associations did not influence cumulative exposure over a 26-day experimental period (Cox, et al., 2016). The daily average NO_2 concentrations to which for the dairy cattle studied by Cox *et al.* (2016) were exposed ranged between 7.8 and 60 µg/m³ in the warm season and between 21 and 93 µg/m³ in the cold season.

Critical NO_2 levels, as given by the United Nations Economic Commission for Europe (UNECE) Convention on Long Range Trans-boundary Air Pollution Limits (CLRTAP, 2015) is 75 µg/m³ daily average and 30 µg/m³ annual average.

3 ATMOSPHERIC DISPERSION POTENTIAL

Meteorological mechanisms govern the dispersion, transformation, and eventual removal of pollutants from the atmosphere. The analysis of hourly average meteorological data is necessary to facilitate a comprehensive understanding of the dispersion potential of the site and the assessment of air quality impacts from the proposed operations. In the absence of on-site meteorological data (which is required for atmospheric dispersion modelling), simulated Weather Research and Forecasting (WRF) modelled meteorological data for a period between January 2021 to December 2023 was used for the study. WRF data is a regional mesoscale model used for creating weather forecasts and climate projections.

3.1.1 Surface Wind Field

Wind roses comprise 32 spokes, which represent the directions from which winds blew during a specific period. The colours used in the wind roses below, reflect the different categories of wind speeds; the yellow area, for example, representing winds in between 5 and 6 m/s. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. The frequency with which calms occurred, i.e. periods during which the wind speed was below 1 m/s, are also indicated.

The period wind field and diurnal variability in the wind field as extracted from the modelled meteorological data set for the period January 2021 to December 2023 are shown in Figure 3**.** During this period, the wind field was dominated by winds from the northeast, east-northeast and east, with an average wind speed of 2.7 m/s. Calm conditions occurred 1.5 % of the time.

A difference between the day and night-time wind field is observed. The day-time wind field was dominated by winds from the northeast, an average wind speed of 3.1 m/s and 1.9% calm conditions. During the night, wind speeds are generally lower and the wind field is dominated more by winds from the east and east-northeast, with an average wind speed of 2.3 m/s and 1.1% calm conditions. The highest wind speeds occur during the day.

In general, air quality impacts from the project are expected to be most pronounced to the west and southwest of the operations. Very little air quality impacts are expected to occur to the north, south or east of the operations.

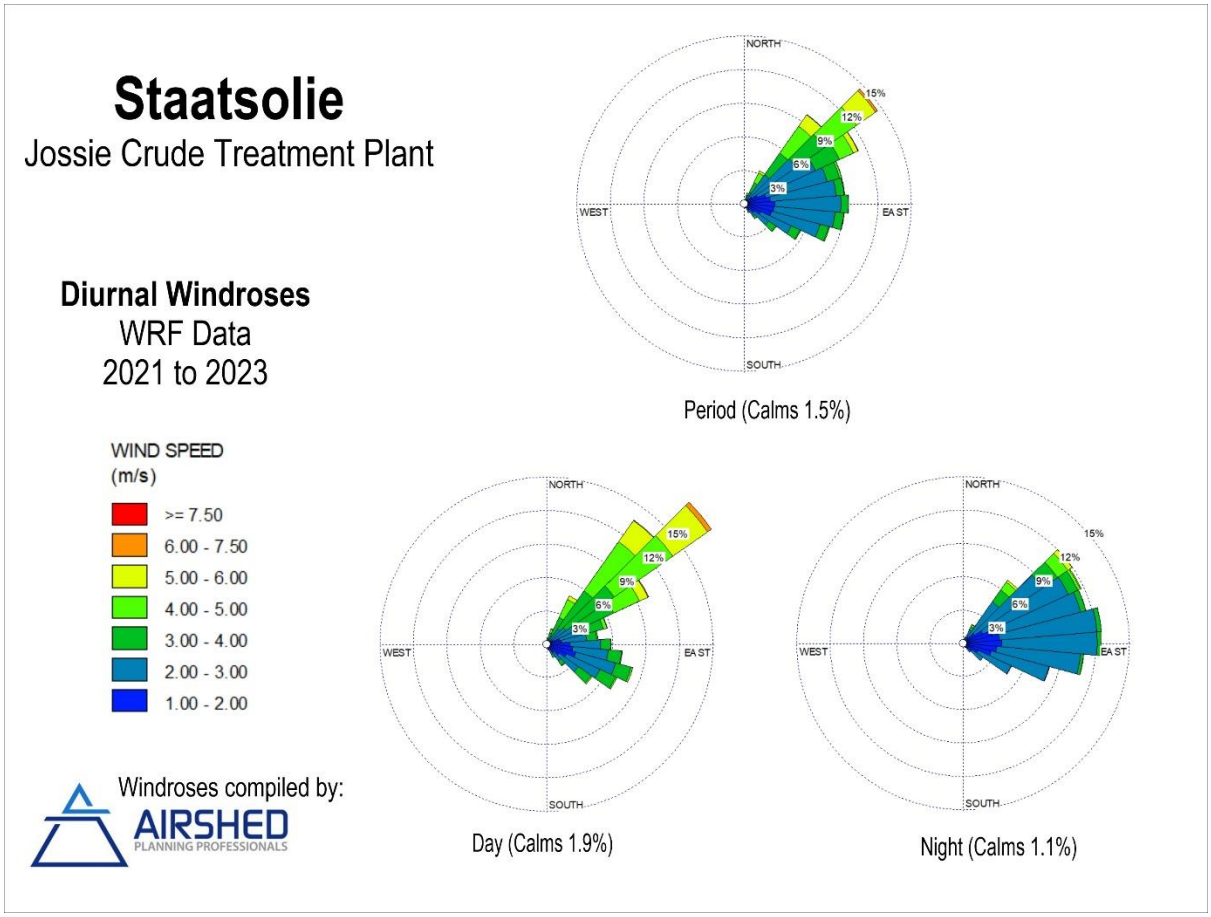


Figure 3: Period, day- and night-time wind roses (WRF Data, January 2021 to December 2023)

3.1.2 Temperature

Air temperature is important, both for determining the effect of plume buoyancy (the larger the temperature difference between the emission plume and the ambient air, the higher the plume can rise) and determining the development of the mixing and inversion layers. Diurnal and average monthly temperature trends are presented in Figure 4. Monthly mean and hourly maximum and minimum temperatures are given in Table 2. Temperatures generally ranged between 18.2°C in March and 36.0°C in October, with an annual average temperature of 25.3°C. During the day, temperatures increase to reach maximum at around 13:00 in the afternoon. Ambient air temperature decreases to reach a minimum at around 06:00 i.e. just before sunrise.

Table 2: Monthly temperature summary

Hourly Minimum, Hourly Maximum and Monthly Average Temperatures (°C)												
Parameter	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Minimum	18.4	19.3	18.2	19.1	19.4	20.4	20.1	19.6	20.5	20.9	21.1	19.1
Average	24.2	24.4	24.4	24.9	25.2	25.3	25.6	26.1	26.5	26.6	25.8	25.1
Maximum	30.2	29.4	30.3	32.0	32.0	32.4	32.9	34.4	35.9	36.0	33.8	32.3

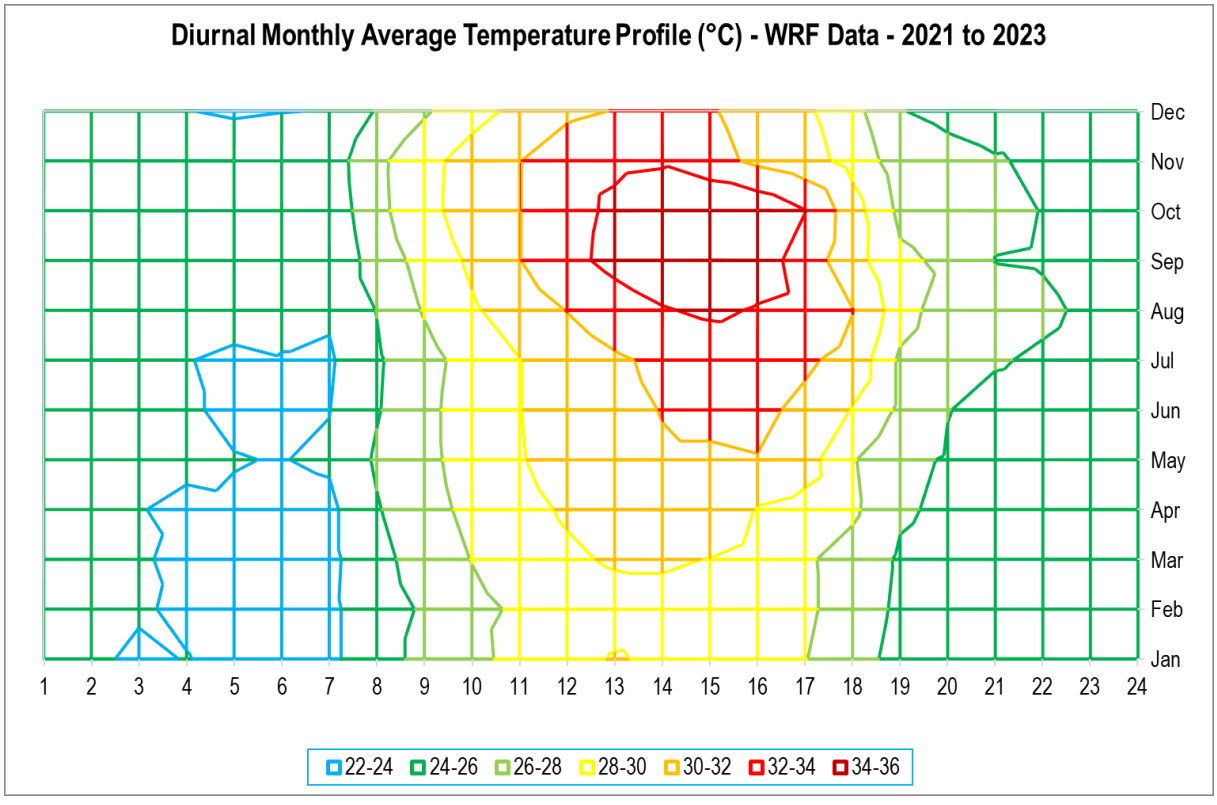
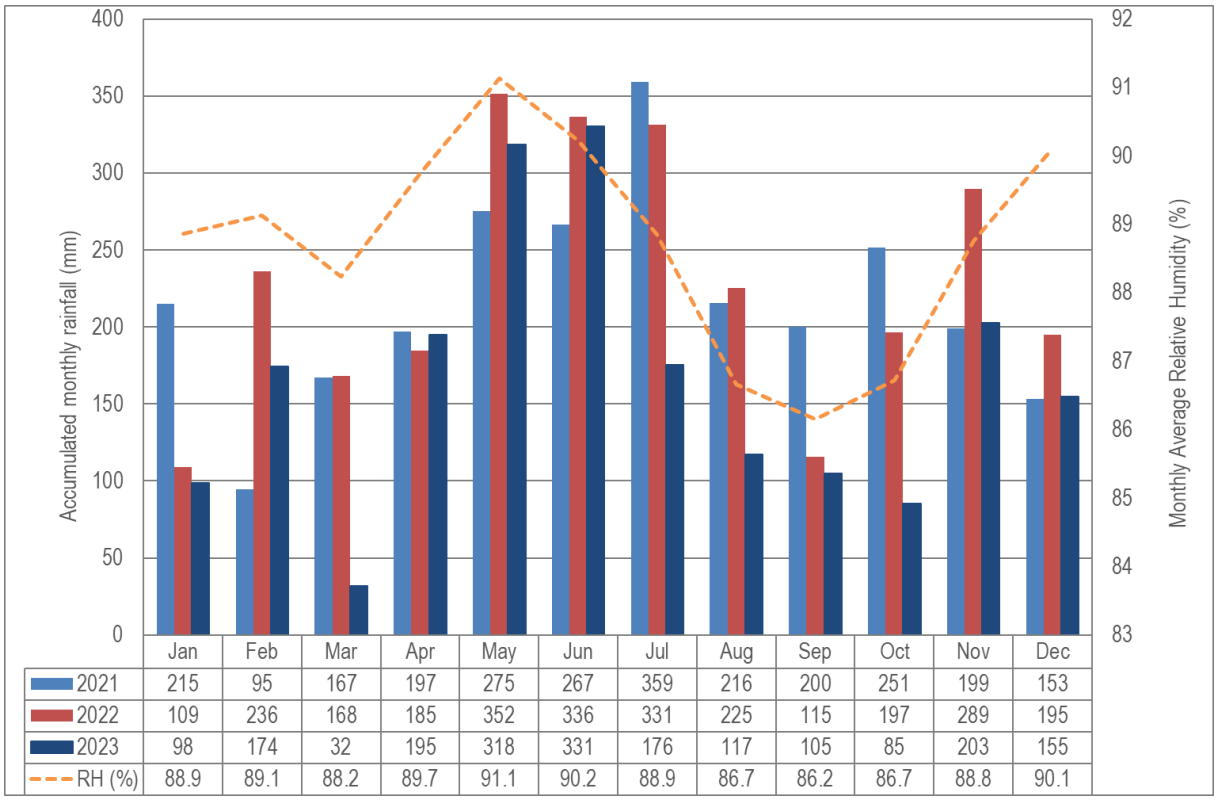


Figure 4: Diurnal temperature profile

3.1.3 Precipitation

Rainfall represents an effective removal mechanism of atmospheric pollutants ("washout") and provides natural mitigation for fugitive dust sources and is therefore frequently considered during air pollution studies. The climate of the study area is tropical, and rain is received year-round, with average rainfall between 2500 and 3300 mm per year (Figure 5). The rainfall patterns can be distinguished into four seasons, a minor rainy season from December to February, a minor dry season from February to April, a major rainy season from April to August and a major dry season from August to December. Due to its tropical climate, relative humidity in the study area is high, with an annual average relative humidity of 88.7%.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2021	215	95	167	197	275	267	359	216	200	251	199	153
2022	109	236	168	185	352	336	331	225	115	197	289	195
2023	98	174	32	195	318	331	176	117	105	85	203	155
RH (%)	88.9	89.1	88.2	89.7	91.1	90.2	88.9	86.7	86.2	86.7	88.8	90.1

Figure 5: Total monthly rainfall based on modelled WRF data for the study site (January 2021 to December 2023)

3.1.4 Atmospheric Stability

The new generation air dispersion models differ from the models traditionally used in a number of aspects, the most important of which are the description of atmospheric stability as a continuum rather than discrete classes. The atmospheric boundary layer properties are therefore described by two parameters; the boundary layer depth and the Monin-Obukhov length, rather than in terms of the single parameter Pasquill Class.

The Monin-Obukhov length (L_{Mo}) provides a measure of the importance of buoyancy generated by the heating of the ground and mechanical mixing generated by the frictional effect of the earth's surface. Physically, it can be thought of as representing the depth of the boundary layer within which mechanical mixing is the dominant form of turbulence generation (CERC, 2004). The atmospheric boundary layer constitutes the first few hundred metres of

the atmosphere. During daytime, the atmospheric boundary layer is characterised by thermal turbulence due to the heating of the earth's surface. Night-times are characterised by weak vertical mixing and the predominance of a stable layer. These conditions are normally associated with low wind speeds and lower dilution potential.

Diurnal variation in atmospheric stability described by the inverse Monin-Obukhov length and the mixing height is provided in Figure 6. The highest concentrations for ground level, or near-ground level releases from non-wind dependent sources would occur during weak wind speeds and stable atmospheric conditions. For elevated releases, unstable conditions can result in very high concentrations of poorly diluted emissions close to the stack. This is called *looping* and occurs mostly during daytime hours. Neutral conditions disperse the plume equally in both the vertical and horizontal planes and the plume shape is referred to as *coning*. Stable conditions prevent the plume from mixing vertically, although it can still spread horizontally and is called *fanning (Tiwary & Colls, 2010)*.

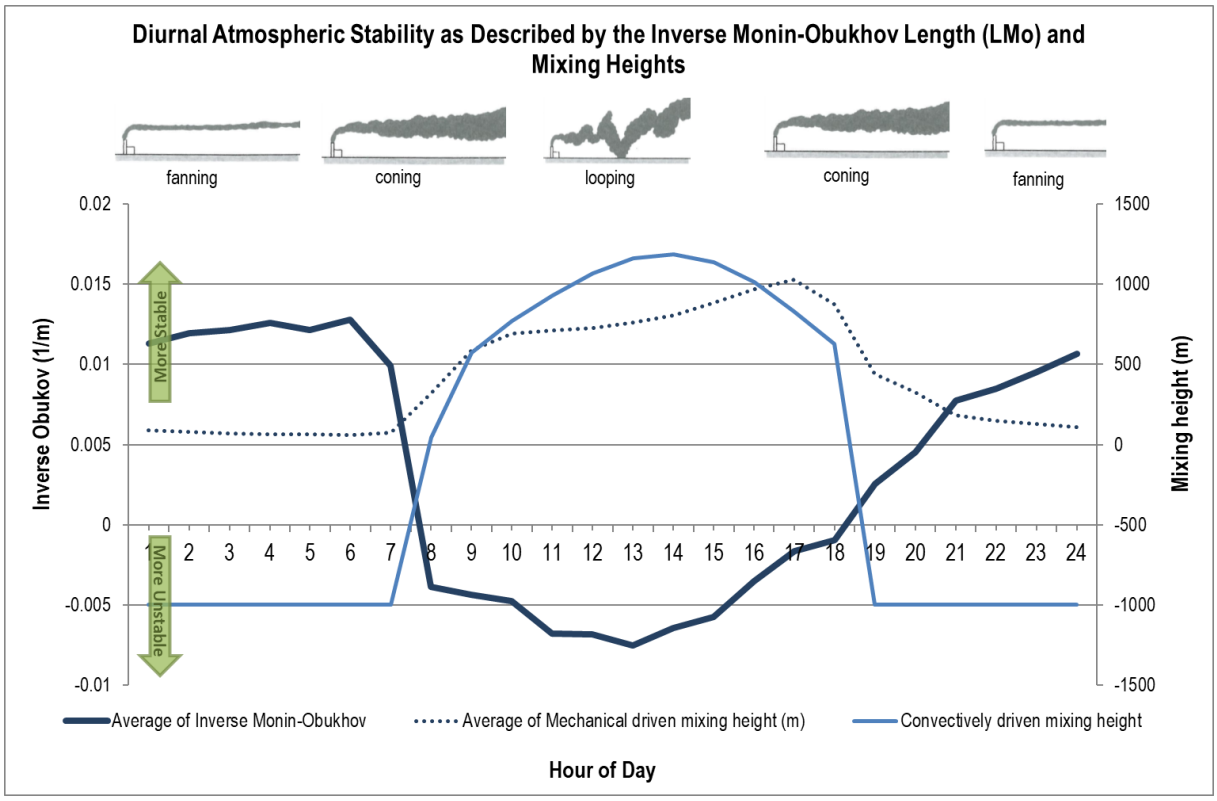


Figure 6: Diurnal atmospheric stability from the WRF data set for 2021 to 2023

4 STUDY AREA AND BASELINE AIR QUALITY

The Jossie plant is located along the Josikreekweg to the south of the Saramacca River, approximately 5 km away from the Oost-Westverbinding. The Josikreekweg is a local road with predominantly local traffic and traffic for the Jossie plant.

The plant is located in an area with scattered horticultural fields of which the users live along the road. Most of the area around the plant is covered by secondary forest with spots of abandoned shell excavation pits, now flooded. A pig farm is located approximately 100 m from the western border of the plant. Air quality sensitive receptors (AQSRs) in the area include a mosque (150 m to the west) and a school (approximately 550 m west from the entrance of the Jossie plant). Other sensitive receptors include residences along Josikreekweg, as shown in Figure 7. The area surrounding the Jossie plant can be classified as rural.

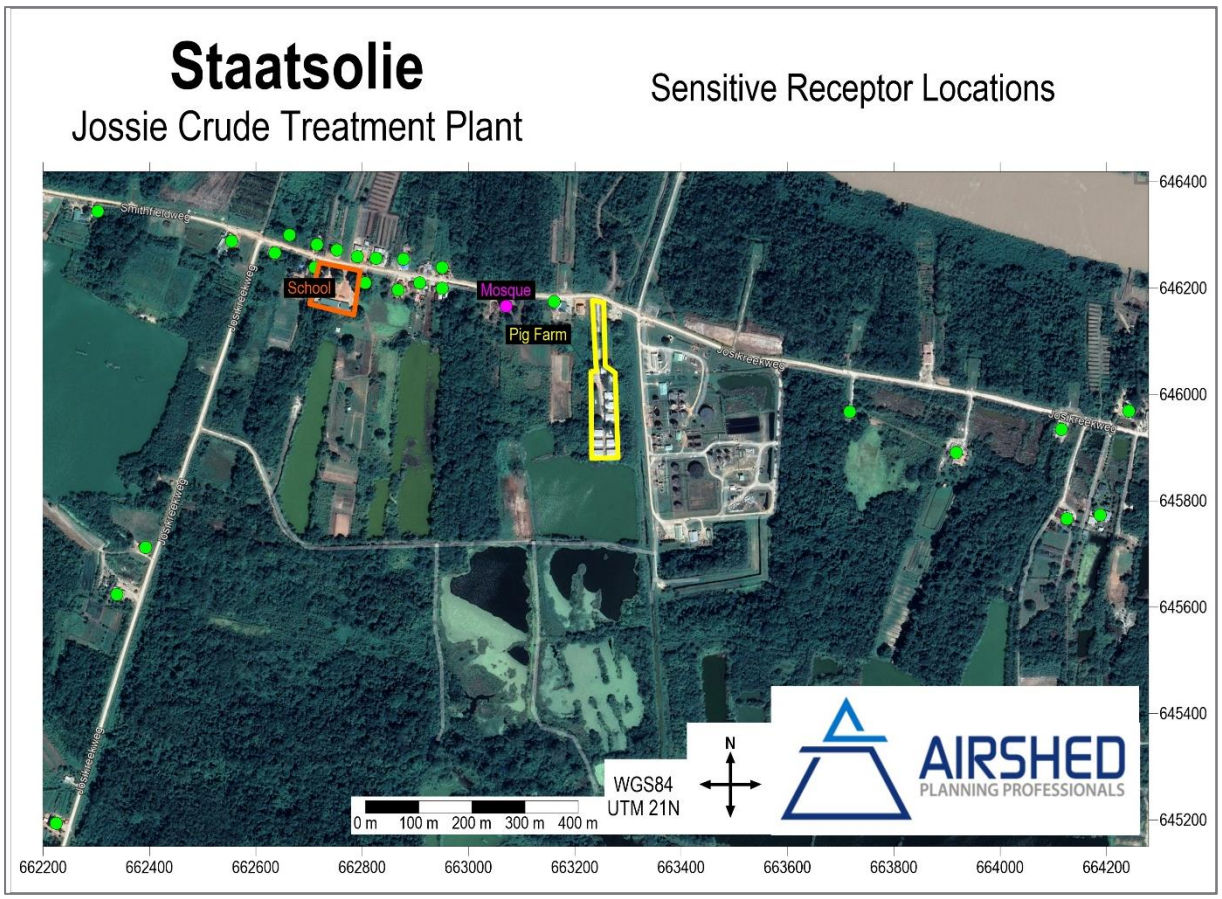


Figure 7: Noise sensitive receptor locations

ILACO Suriname NV conducted a baseline air quality monitoring survey during 2022, including active sampling of SO_2, H_2S, CO and VOCs at several locations in the plant, as well as passive diffusive sampling of a wide range of VOCs at two locations (upwind and downwind) of the Jossie plant. These surveys found that average concentrations of all pollutants were low, with short term spikes in H_2S, CO and VOC concentrations. A strong H_2S odour was observed by sampling personnel at all sampling locations. Sampled average SO_2 concentrations

were in exceedance of the WHO guideline, but it has since been established that the SO_2 monitor employed is not suitable for sampling in high humidity environments, and given the lack of major SO_2 sources in the study area, apart from the current heater treaters, transfer pumps and internal pumps, it is likely that SO_2 concentrations sampled are significantly higher than the actual values. This phenomenon is still being investigated.

In light of the above, and since there will be significant changes to the current Jossie plant when the expansion project is implemented, it was decided to quantify and model existing sources as well as proposed project sources to estimate cumulative impacts, rather than modelling project sources only and estimating cumulative impacts by adding modelled project sources to measured baseline concentrations.

5 EMISSIONS INVENTORY

The emissions inventory was based on design specifications, temperatures, flow rates and fuel consumption rates provided by Staatsolie. Reference was made to VOC and H_2S emissions from current sources, sampled by Levego and ILACO and reported on by Airshed (Grobler, 2022). The estimated total current VOC emissions, as reported in (Grobler, 2022) is approximately 880 tonne/annum (t/a) while the current H_2S emission rate is approximately 6.6 t/a.

To estimate the emission rates from current sources, such as the heater treaters and transfer pumps, as well as the proposed steam boiler, use was made of emission factors published by the United States Environmental Protection Agency in AP42, Fifth Edition, Volume 1, Chapter 1: External Combustions Sources. Chapters 1.3 (Fuel Oil Combustion) and 1.4 (Natural Gas Combustion) were referenced in the estimation of emissions. The emission factors used in the estimation of emissions in given in Table 3.

The project is expected to result in a significant reduction in VOC emissions, since a large part of the VOCs currently vented to the atmosphere through various process and tank vents will be captured and used as fuel for the boiler. Gas not used in the boiler, or unsuitable to be used as fuel, will be emitted through the elevated cold vent stack, resulting in smaller ground level impacts. The boiler, however, is expected to result in an increase in the emissions of combustion products, such as NO_2, SO_2 and PM.

Table 3: Emission Factors (based on quantity of fuel combusted)

Fuel Type	NOx	CO	PM	SO_2	VOC
Oil Combustion	6600 g/m³	600 g/m³	1489.2 g/m³	18840 g/m³	91.2 g/m³
Natural Gas Combustion	1.6 g/m³	1.344 g/m³	0.1216 g/m³	0.0096 g/m³	0.088 g/m³

The emissions inventory for current and project emission sources is given in Table 4.

Table 4: Emissions Inventory – Current and Future Sources

Emission Source	Physical Parameters			Emissions (tonne / annum)					
	Exit Temperature	Height (m)	Diameter (m)	NOx	CO	PM	SO_2	VOC	H_2S
Existing Sources									
Heater Treater (1 operational at a time)	180	~6	~0.3	7.7	0.7	1.7	21.9	19.0	0.0
Transfer Pumps (2 operational at a time)	140	~4	~0.1	1.8	0.2	0.4	5.2	0.0	0.0
Fugitive Emissions from Tanks, Vents, Separators Etc	Ambient	Various	Various					120.1	5.6
Project Sources									
Steam Boiler	180	~6	~0.3	32.1	20.3	3.8	25.3	1.4	0.0
Cold Vent Stack	176.5	27.5	~0.254					9.6	0.4
Fugitive Emissions from Tanks and Vents	Ambient	Various	Various					2.1	0.1

6 DISPERSION MODELLING RESULTS

Dispersion modelling was undertaken using the AERMOD model (as described in Section 1.1.3) with WRF meteorological data for the period January 2020 to December 2022. All pollutants shown in Table 4 were modelled.

In addition to the grid output, which is used to create isopleth plots, five discreet receptors were also included in the dispersion modelling to model pollutant concentrations at the four closest AQSRs, as well as at the neighbouring pig farm. These discreet receptors are shown Figure 8.

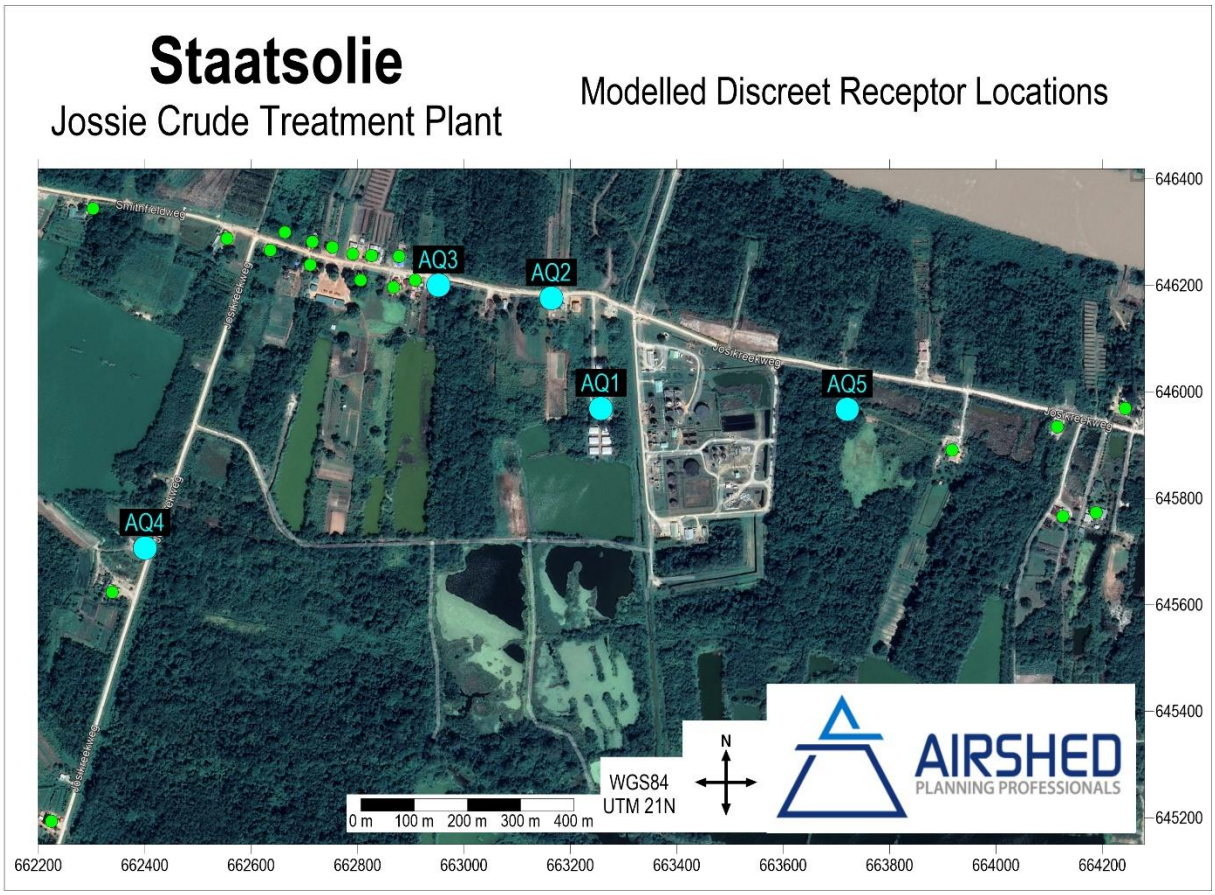


Figure 8: Modelled Discreet Receptor Locations

Modelled pollutant concentrations, together with the reference to the isopleth plot for each pollutant and scenario, are given in Table 5.

Simulated criteria pollutant (PM, NO_2 and SO_2) concentrations are below the WHO air quality guidelines at all sensitive receptor locations, but exceed the guideline values at the nearby pig farm. Simulated concentrations of these pollutants are however well below the critical levels for animals, as discussed in Section 2.1.3 to 2.1.5. Simulated concentrations are below the WHO interim targets at the pig-farm, and workers are unlikely to be negatively impacted by criteria pollutant emissions from the Jossie plant.

Dispersion modelling results indicate that the project will result in a decrease in VOC and H_2S concentrations throughout the study area, including at all sensitive receptor locations. Simulated VOC concentrations are below

the assessment criteria of 200 µg/m³ at all sensitive receptor locations, but exceeds this level at the nearby pig farm for both the current and future scenarios. Simulated concentrations at this location are however well below the human discomfort level of 3 000 µg/m³, but falls within the "multifactorial exposure" range, any possible health impacts would therefore depend on the composition of VOC emissions. It is recommended that workers at the pig farm be encouraged to report any symptoms related to VOC exposure (such as difficulty breathing, burning of the throat, mouth or eyes, or nuisance odours) and that any such complaints be investigated and sampling of VOC concentrations at this location be conducted.

While the project is expected to result in a decrease in overall H_2S emissions, simulated 98th percentile hourly H_2S concentrations still exceed the 7 µg/m³ at the sensitive receptors to the west of the Jossie plant, and some individuals will be able to recognise the distinct smell of H_2S emissions from the Jossie plant from time to time. However, simulated concentrations are below the California EPA guideline value of 42 µg/m³ at which the odour would be detectable by 83% of the population and would be discomforting to 40% of the population and well below the WHO 24-hour guideline for health impacts of 150 µg/m³ at all sensitive receptor locations. No information could be found on the impact of odorous emissions on livestock.

Simulated pollutant concentrations inside the Jossie plant are well below the occupational health guidelines for all pollutants, which are a few orders of magnitude higher than ambient guidelines. However, workers operating close to emission sources, such as tank vents, could be exposed to higher concentrations. It is recommended that workers be encouraged to report any air quality or odour issues and that respirators be worn in areas with known high VOC (or other pollutant) concentrations.

Table 5: Simulated Pollutant Concentrations at Discreet Receptor Locations

Pollutant and Averaging Period	Scenario	Isopleth Plot	Assessment Criteria	Simulated Concentration at Discreet Receptor Location				
				AQ1	AQ2	AQ3	AQ4	AQ5
Annual Average VOC Concentration	Current	Figure 9	200 µg/m³ (Molhave)	2134.7	81.1	89.6	121.3	1.0
	Future	Figure 10		397.4	33.1	35.1	30.2	0.7
	Change			-81%	-59%	-61%	-75%	-27%
98th Percentile Hourly H_2S Concentration	Current	Figure 11	7 µg/m³ (WHO) 42 µg/m³ (CAL EPA)	102.3	22.2	22.0	16.1	0.0
	Future	Figure 12		86.8	18.8	18.6	13.6	0.0
	Change			-15%	-15%	-15%	-15%	0%
Highest Daily H_2S Concentration	Current	Figure 13	150 µg/m³ (WHO AQG)	51.2	18.1	10.8	6.5	4.5
	Future	Figure 14		43.4	15.4	9.1	5.5	3.8
	Change			-15%	-15%	-15%	-15%	-15%
Annual Average NO_2 Concentration	Current	Figure 15	10 µg/m³ (WHO AQG)	15.4	1.8	2.0	1.8	0.0
	Future	Figure 16		30.9	8.0	7.2	5.4	0.0
	Change			100%	354%	260%	205%	348%
99th Percentile Daily NO_2 Concentration	Current	Figure 17	25 µg/m³ (WHO AQG)	25.1	8.5	7.0	5.0	0.2
	Future	Figure 18		53.9	24.8	20.9	15.4	0.9
	Change			114%	191%	197%	211%	379%
Annual Average PM Concentration	Current	Figure 19	5 µg/m³ (WHO AQG - $PM_{2.5}$)	3.4	0.4	0.4	0.4	0.0017
	Future	Figure 20		5.2	1.1	1.1	0.8	0.0047
	Change			54%	189%	137%	107%	184%
Highest Daily PM Concentration	Current	Figure 21	15 µg/m³ (WHO AGQ - $PM_{2.5}$)	6.0	2.5	1.9	1.4	0.24
	Future	Figure 22		9.0	4.1	4.0	2.9	0.8
	Change			50%	65%	110%	112%	231%
99th Percentile Daily SO_2 Concentration	Current	Figure 23	40 µg/m³ (WHO AQG)	70.2	24.3	19.9	14.2	0.5
	Future	Figure 24		85.5	33.7	29.3	22.7	1.0
	Change			22%	39%	48%	60%	81%

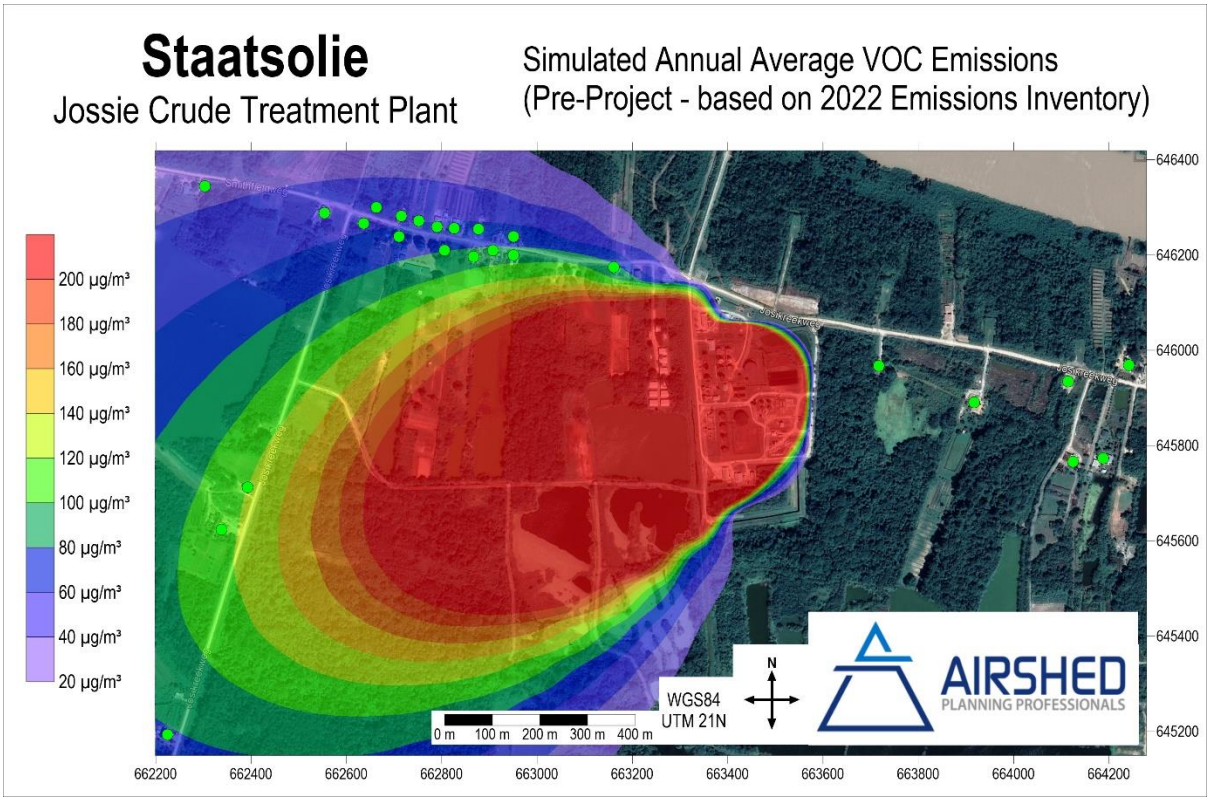


Figure 9: Simulated Annual Average VOC Concentration – Current Sources

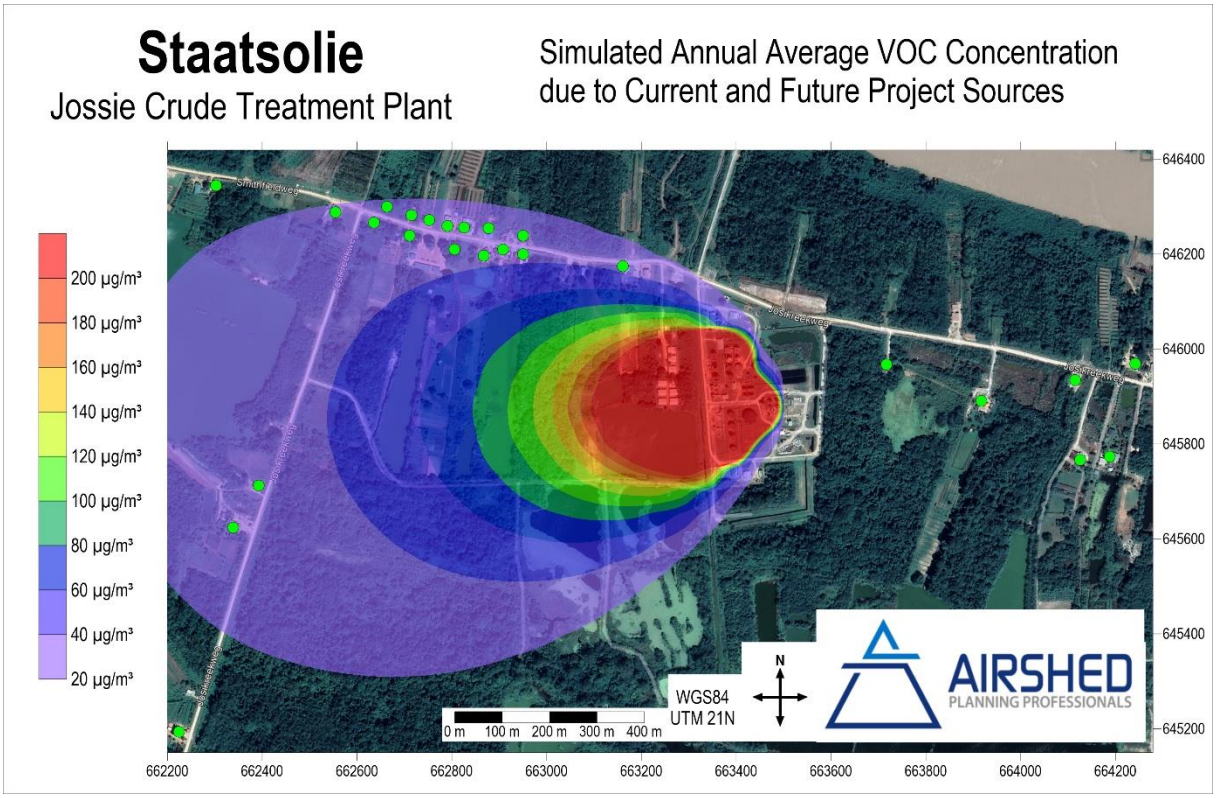


Figure 10: Simulated Annual Average VOC Concentration – Future - Current and Project Sources

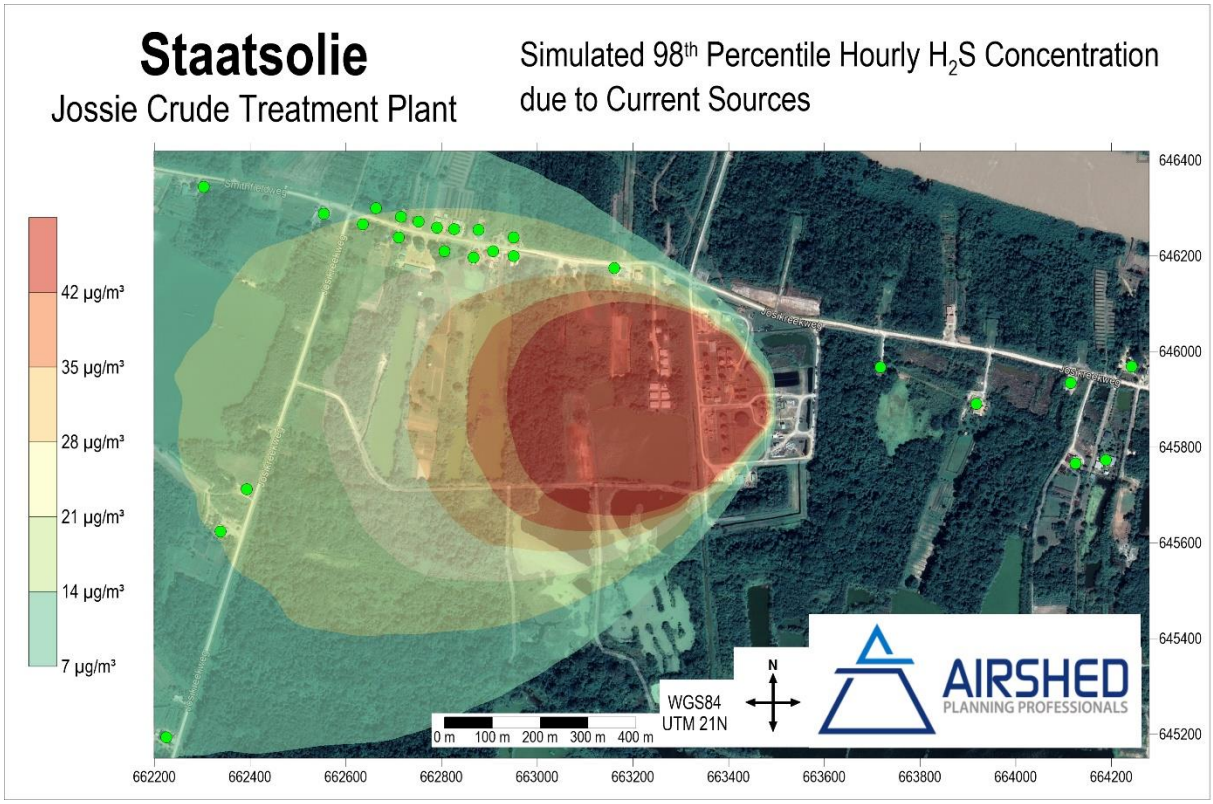


Figure 11: Simulated 98th Percentile Hourly H_2S Concentration – Current Sources

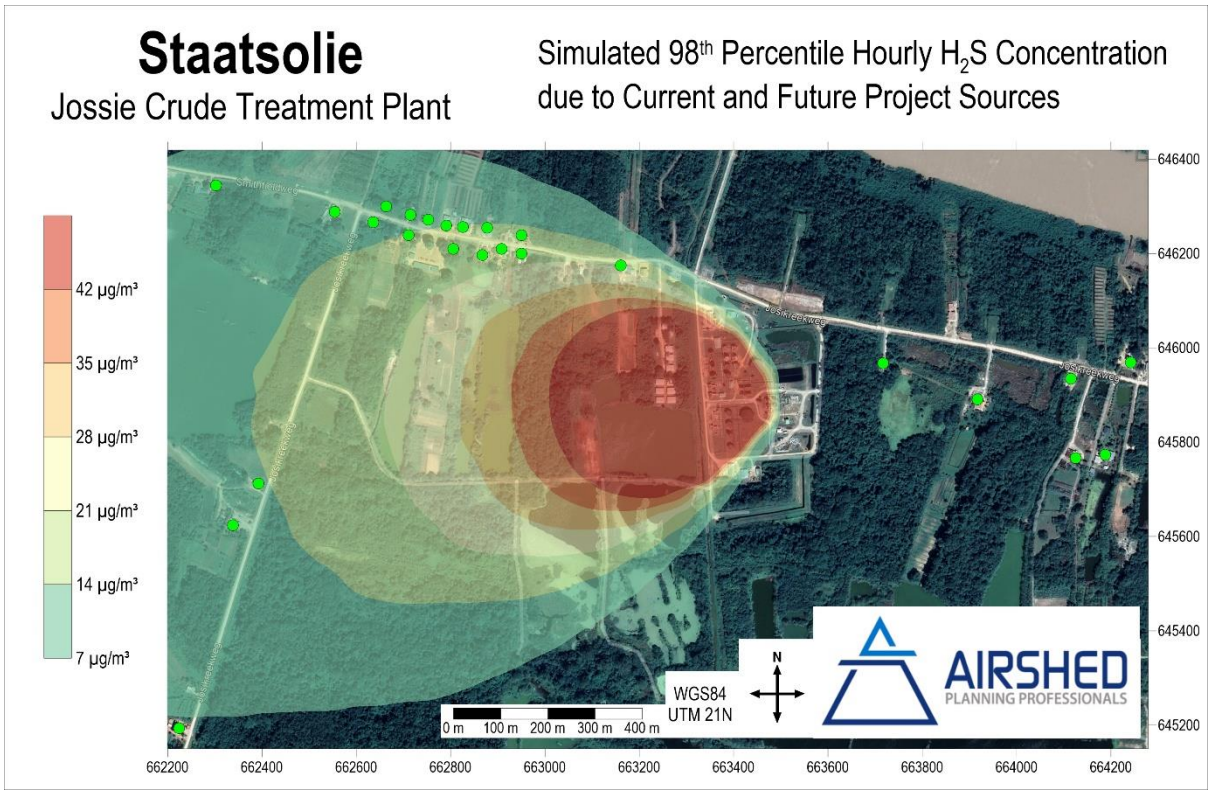


Figure 12: Simulated 98th Percentile Hourly H_2S Concentration – Future - Current and Project Sources

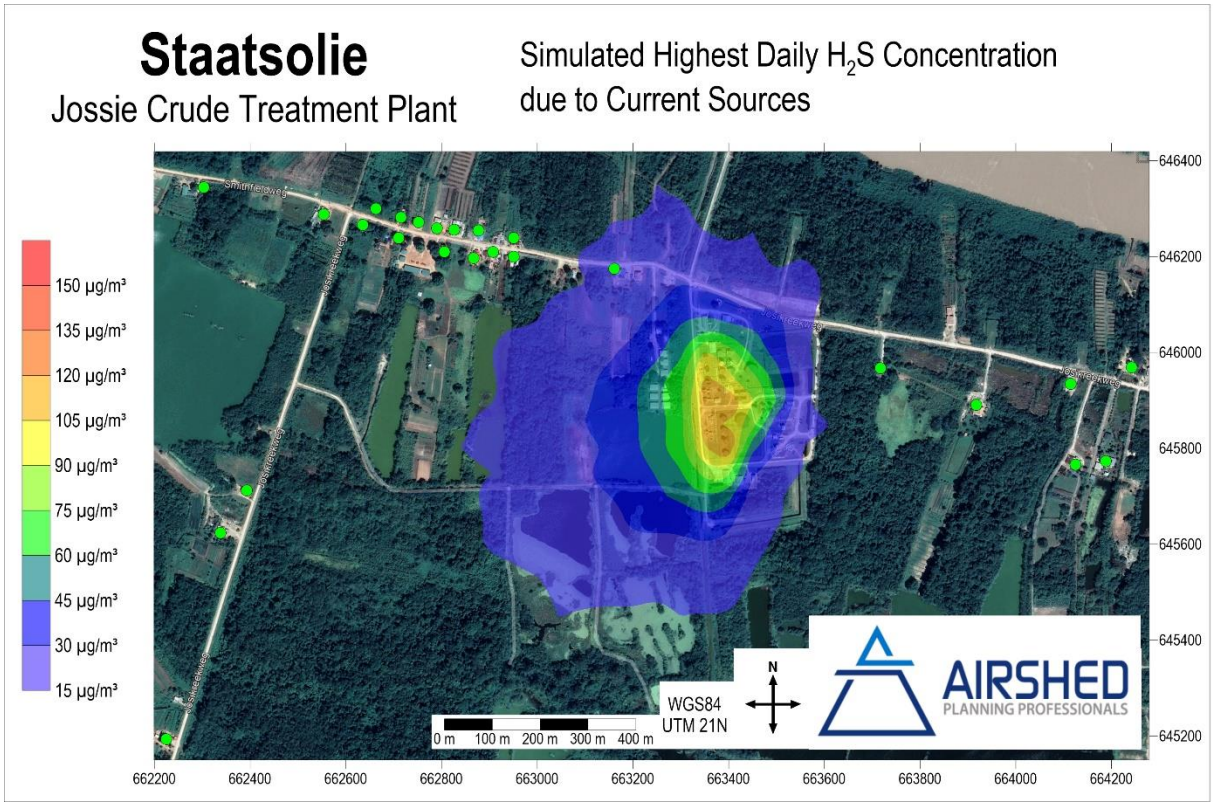


Figure 13: Simulated Highest Daily H_2S Concentration – Current Sources

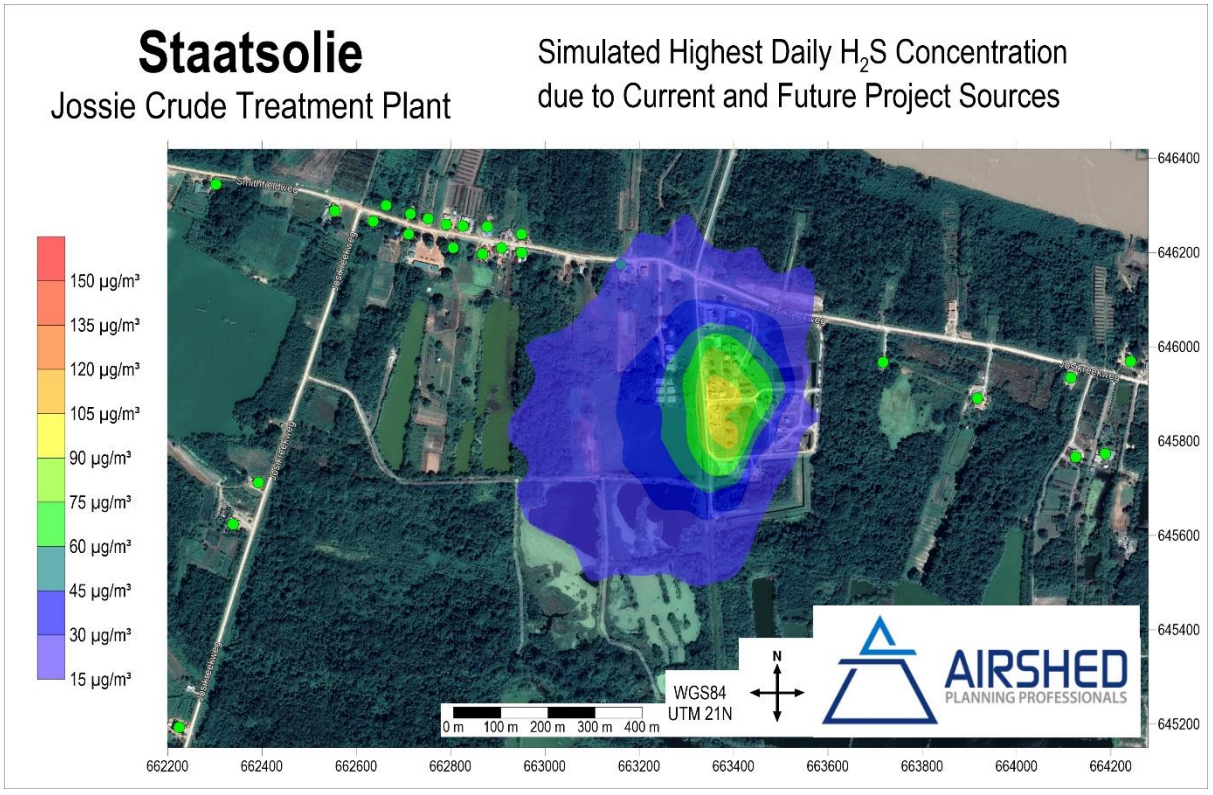


Figure 14: Simulated Highest Daily H_2S Concentration – Future - Current and Project Sources

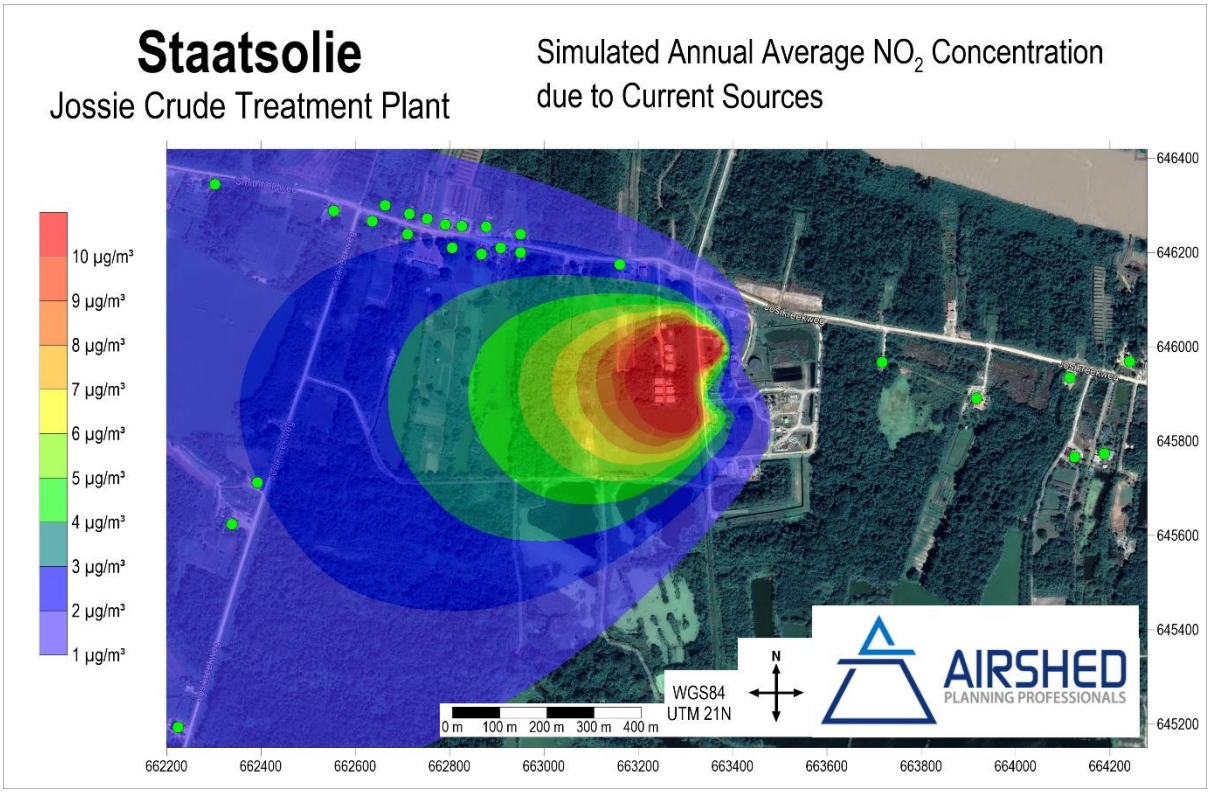


Figure 15: Simulated Annual Average NO_2 Concentration – Current Sources

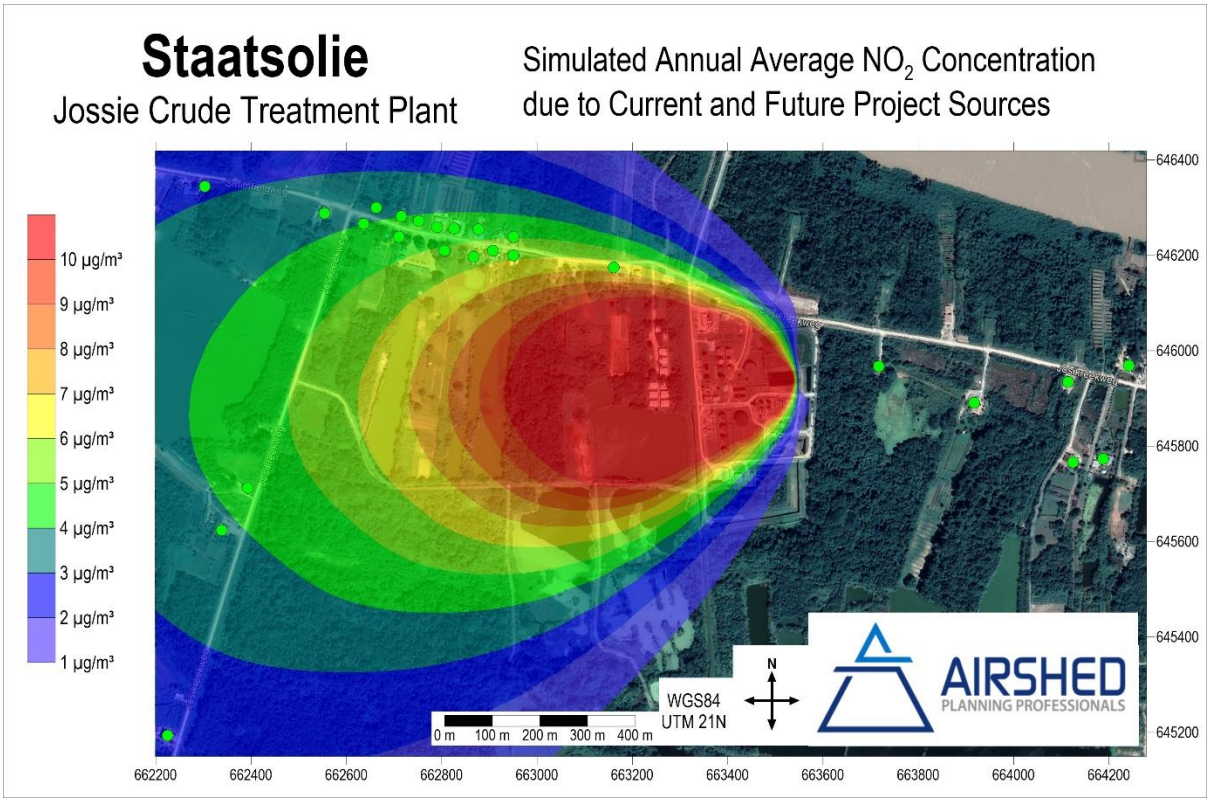


Figure 16: Simulated Annual Average NO_2 Concentration – Future - Current and Project Sources

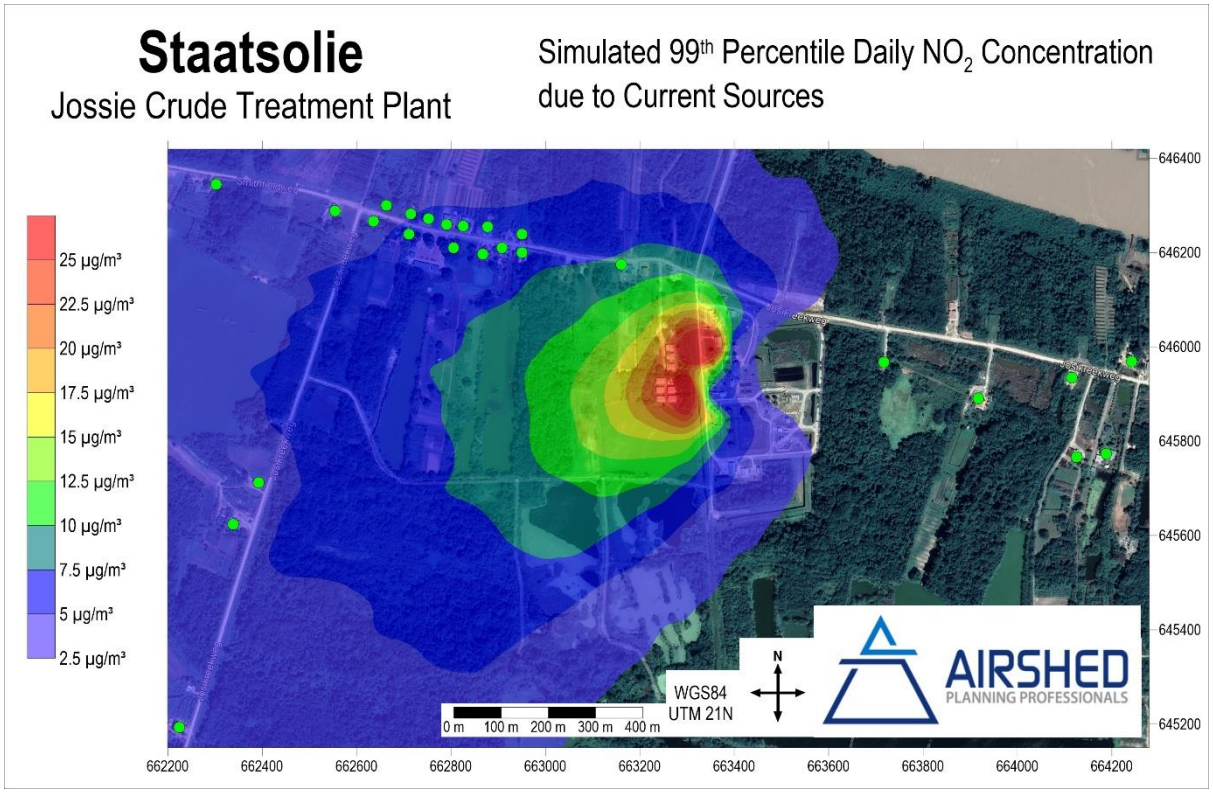


Figure 17: Simulated 99th Percentile Daily NO_2 Concentration – Current Sources

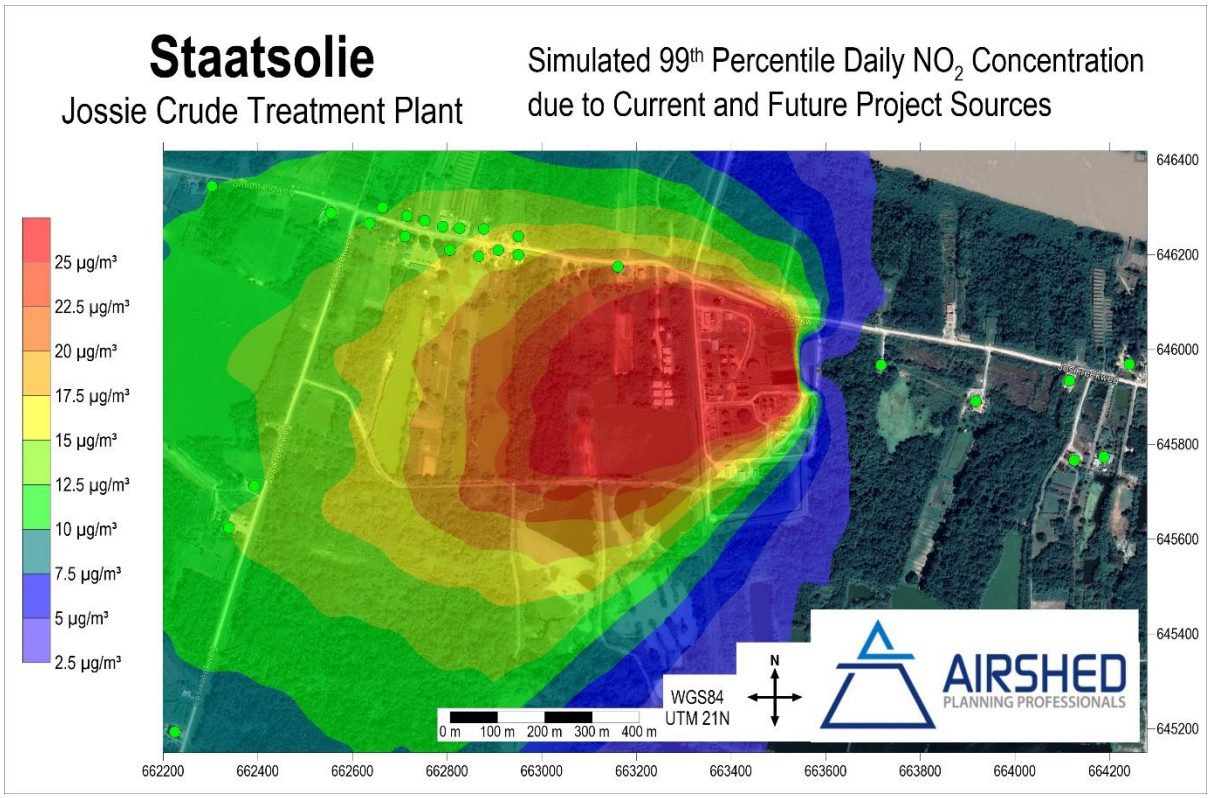


Figure 18: Simulated 99th Percentile Daily NO_2 Concentration – Future - Current and Project Sources

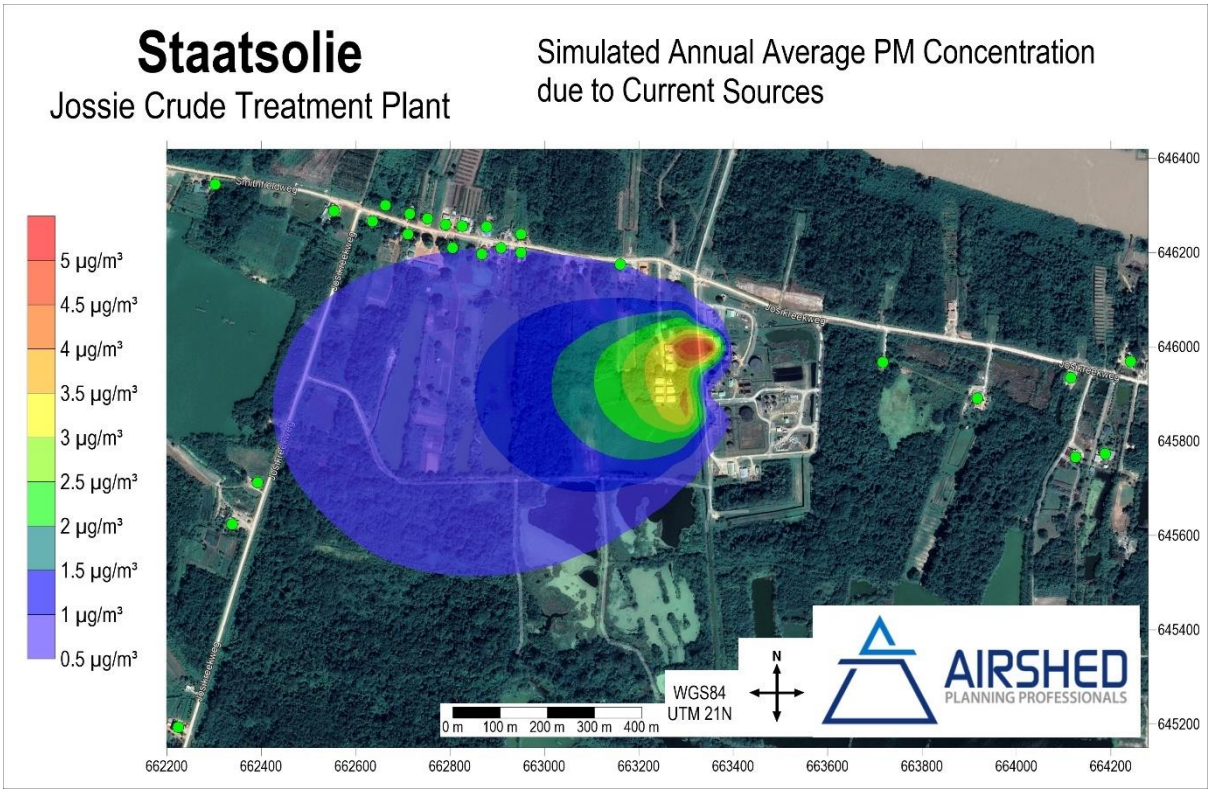


Figure 19: Simulated Annual Average PM_{10} & $PM_{2.5}$ ($PM_{2.5}$ AQG Shown) Concentration – Current Sources

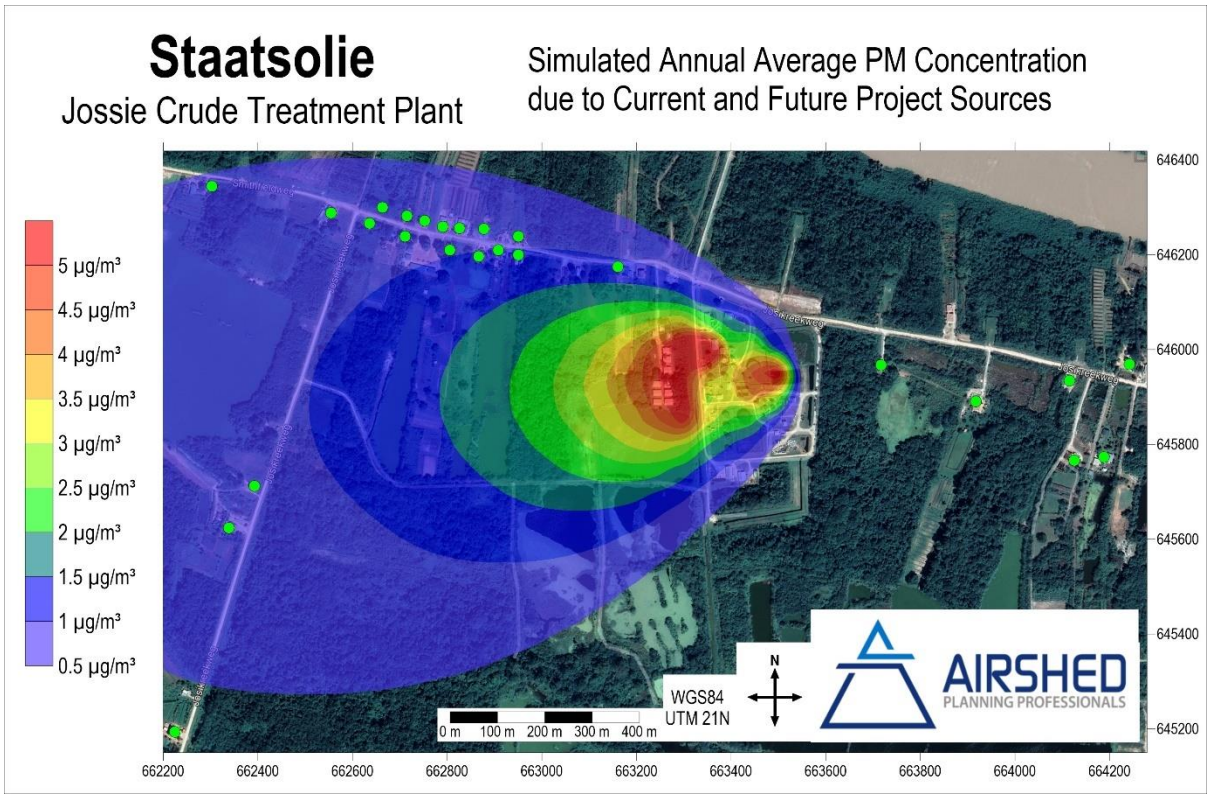


Figure 20: Simulated Annual Average PM_{10} & $PM_{2.5}$ ($PM_{2.5}$ AQG Shown) Concentration – Future - Current and Project Sources

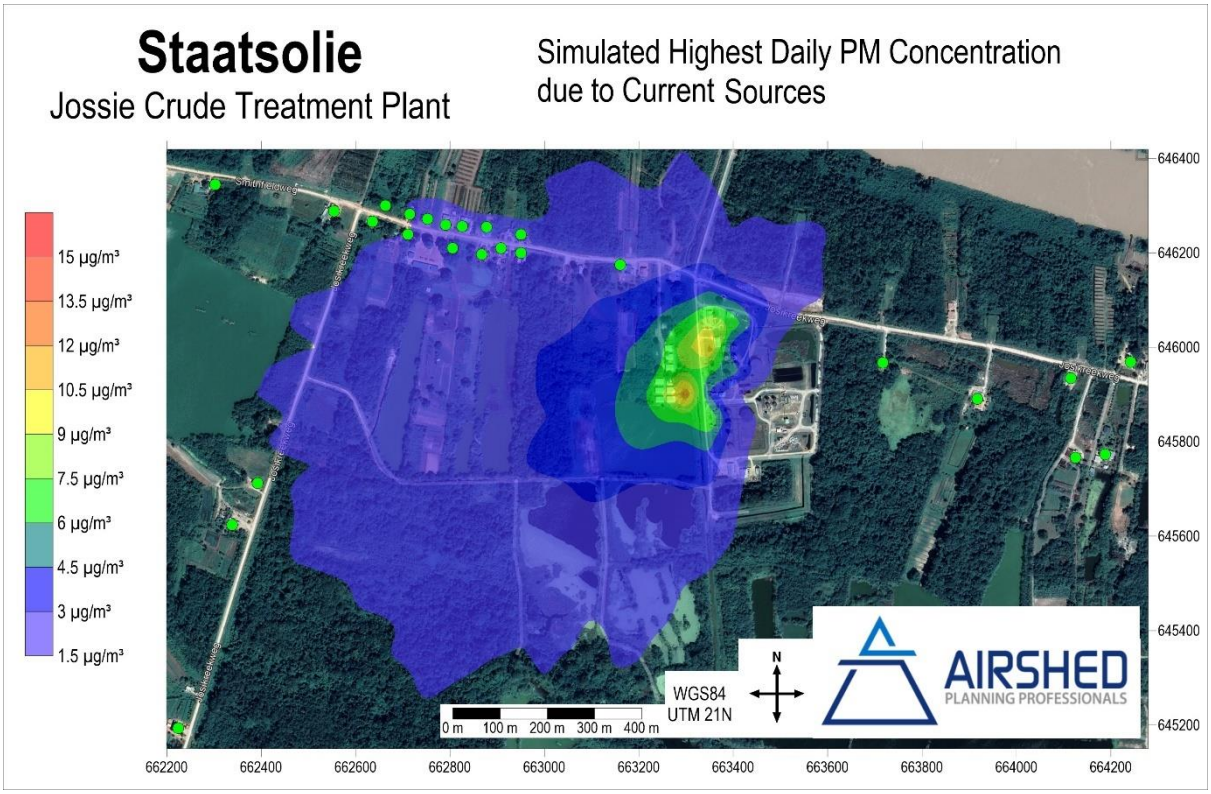


Figure 21: Simulated Highest Daily PM_{10} & $PM_{2.5}$ ($PM_{2.5}$ AQG Shown) Concentration – Current Sources

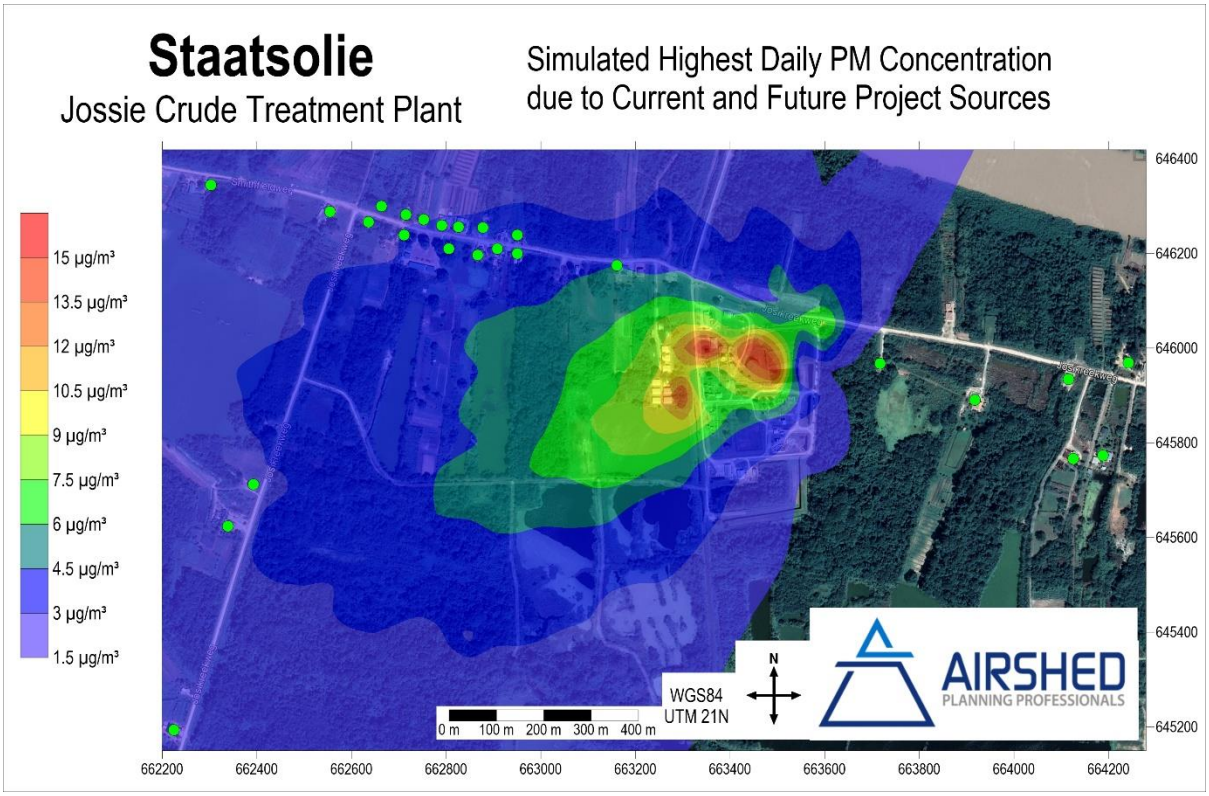


Figure 22: Simulated Highest Daily PM_{10} & $PM_{2.5}$ ($PM_{2.5}$ AQG Shown) Concentration – Future - Current and Project Sources

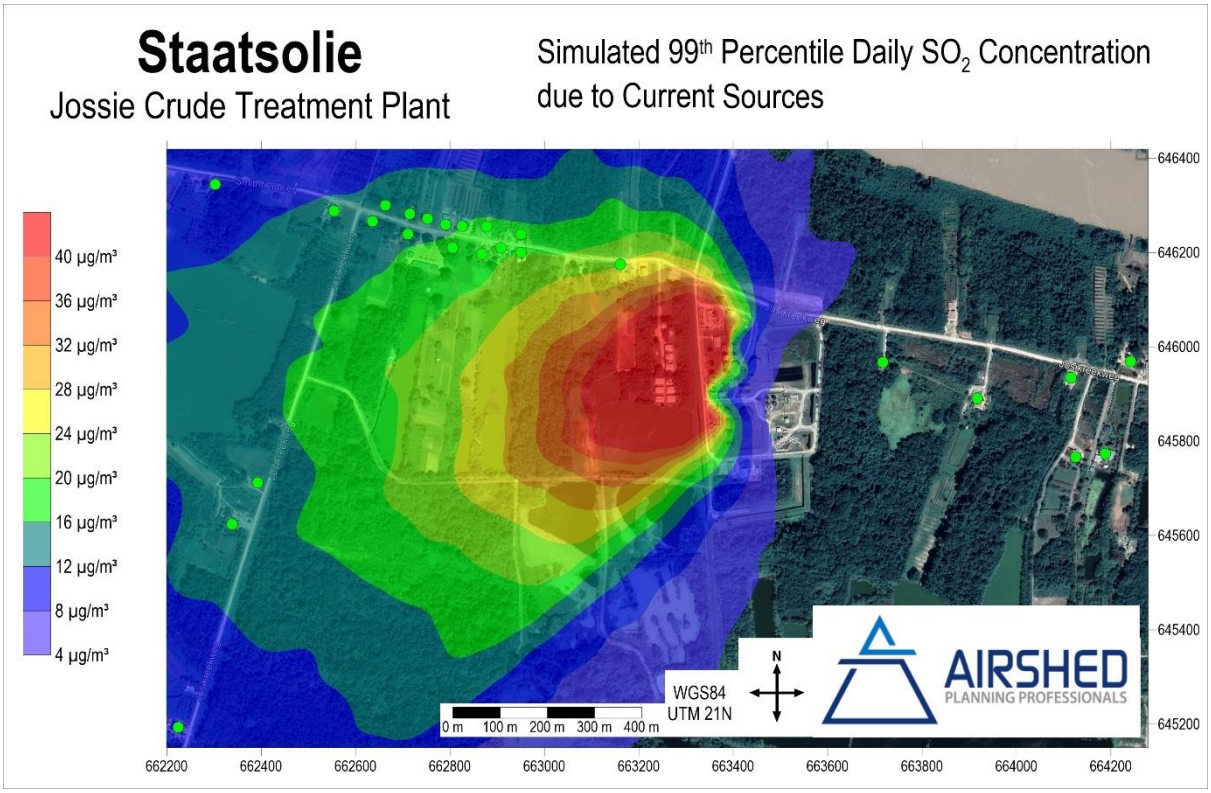


Figure 23: Simulated 99th Percentile Daily SO_2 Concentration – Current Sources

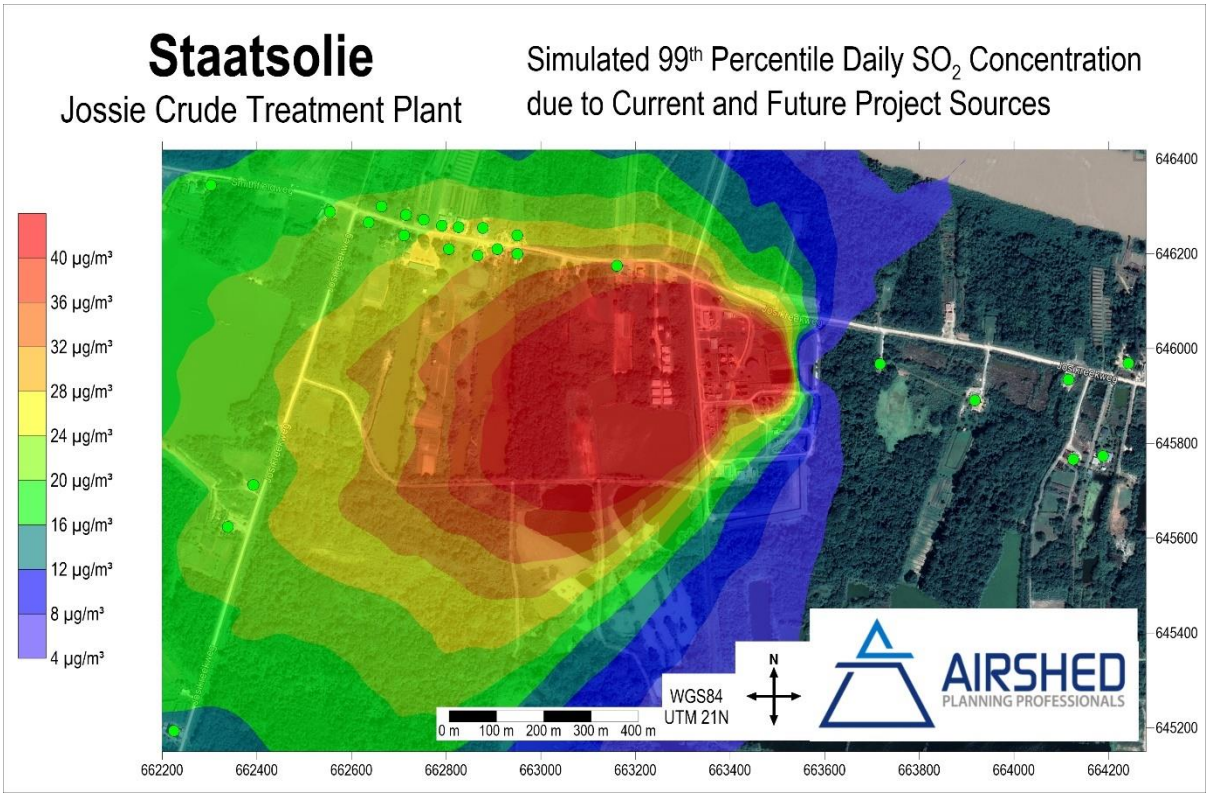


Figure 24: Simulated 99th Percentile Daily SO_2 Concentration – Future - Current and Project Sources

7 CONCLUSIONS AND RECOMMENDATIONS

The project is expected to result in a significant reduction in VOC emissions, since a large part of the VOCs currently vented to the atmosphere through various process and tank vents will be captured and used as fuel for the boiler. Gas not used in the boiler, or unsuitable to be used as fuel, will be emitted through the elevated cold vent stack, resulting in lower ground level impacts. The boiler, however, is expected to result in an increase in the emissions of combustion products, such as NO_2, SO_2 and PM.

The wind field is dominated by winds from the northeast, east-northeast and east, with an average wind speed of 2.7 m/s. Air quality impacts from the Jossie plant are expected to be most pronounced to the west and southwest of the operations. Very little air quality impacts are expected to occur to the north, south or east of the operations.

Air quality sensitive receptors (AQSR's) in the area include a mosque (150 m to the west) and a school (approximately 550 m west from the entrance of the Jossie plant). Other sensitive receptors include residences along Josikreekweg. The closest residences are located approximately 100 m to the west (at the pig farm), 350 m to the north-west and 150 m to the east.

Simulated PM, NO_2 and SO_2 concentrations due to current and future operations are below the WHO air quality guidelines at all sensitive receptor locations, but exceed the guideline values at the nearby pig farm (located 100 m to the west of the Jossie Treatment Plant). While simulated criteria pollutant concentrations at the pig farm exceed the WHO AQGs, concentrations are below the WHO interim targets at the pig-farm, and the health of workers are unlikely to be negatively impacted by criteria pollutant emissions from the Jossie plant. Simulated concentrations of these pollutants are also well below the critical levels for animals. Overall, the impact of the project on criteria pollutant concentrations in the study area is expected to be ***low negative***.

Dispersion modelling results indicate that the project will result in a decrease in VOC and H_2S concentrations throughout the study area, including at all sensitive receptor locations. Simulated VOC concentrations are below the assessment criteria of 200 µg/m³ at all sensitive receptor locations, but exceeds this level at the nearby pig farm for both the current and future scenarios. Simulated concentrations at this location are however well below the human discomfort level of 3 000 µg/m³, but falls within the "multifactorial exposure" range, any possible health impacts would therefore depend on the composition of VOC emissions. It is recommended that workers at the pig farm be encouraged to report any symptoms related to VOC exposure (such as difficulty breathing, burning of the throat, mouth or eyes, or nuisance odours) and that any such complaints be investigated and sampling of VOC concentrations at this location be conducted. The impact of the project on VOC concentrations in the study area is expected to be ***moderately positive***.

While the project is expected to result in a decrease in overall H_2S emissions, simulated 98th percentile hourly H_2S concentrations still exceed the 7 µg/m³ at the sensitive receptors to the west, southwest and northwest of the Jossie plant, and some individuals will be able to recognise the distinct smell of H_2S emissions from the Jossie plant from time to time. However, simulated concentrations are below the California EPA guideline value of 42 µg/m³ at which the odour would be detectable by 83% of the population and would be discomforting to 40% of the population and well below the WHO 24-hour guideline for health impacts of 150 µg/m³ at all sensitive receptor

locations. No information could be found on the impact of odorous emissions on livestock. The project is expected to have a ***low positive*** impact on H_2S concentrations in the study area.

Simulated pollutant concentrations inside the Jossie plant are well below the occupational health guidelines for all pollutants, which are a few orders of magnitude higher than ambient guidelines. However, workers operating close to emission sources, such as tank vents, could be exposed to higher concentrations. It is recommended that workers be encouraged to report any air quality or odour issues and that respirators be worn in areas with known high VOC (or other pollutant) concentrations.

It is recommended that complaints registers be kept at the Jossie plant The community, as well as Staatsolie personnel, should be encouraged to report any air quality or odour related issues.

8 REFERENCES

Amdur, MO (1978) Effects of Sulfur Oxides on Animals. Sulphur in the Environment. Part II: Environmental Impacts. John Wiley and Sons, Toronto. pp 61-74.

California Environmental Protection Agency (2007). Air Toxics Hot Spots Program Risk Assessment Guidelines. Part I: The Determination of Acute Reference Exposure Levels for Airborne Toxicants.

CEC (Commission of the European Community) (1992) European Collaborative Action (ECA) Report No. 11 *Guidelines for Ventilation Requirements in Buildings* (CEC, 1992)

CEPA/FPAC Working Group (1998). National Ambient Air Quality Objectives for Particulate Matter. Part 1: Science Assessment Document, A Report by the Canadian Environmental Protection Agency (CEPA) Federal-Provincial Advisory Committee (FPAC) on Air Quality Objectives and Guidelines.

CERC (2004). ADMS Urban Training. Version 2. Unit A. s.l.:s.n.

CLRTAP. (2015). Mapping Critical Levels for Vegetation, Chapter III of Manual on methodologies and criteria for modelling and mapping critical loads and levels and air pollution effects, risks and trends. UNECE Convention on Long-range Transboundary Air Pollution (www.icpmapping.org). Retrieved 12 12, 2016, from http://www.rivm.nl/media/documenten/cce/manual/binnenop17Juni/Ch3-MapMan-2016-05-03_vf.pdf

Coppock, RW and Nostrum MS, (1997) Toxicology of oilfiend pollutants in cattle and other species. Alberta Research Council, ARCV97-R2, Vegreville, Alberta pp 45-114.

Cox, B., Gasparrini, A., Catry, B., Fierens, F., Vangronsveld, J., & Nawrot, T. (2016). Ambient Air Pollution-Related Mortality in Dairy Cattle: Does It Corroborate Human Findings? Epidemiology, 27(6), 779-786. doi:10.1097/EDE.0000000000000545

EPA (1999) United States Environmental Protection Agency in AP42, Fifth Edition, Volume 1, Chapter 1: External Combustion Sources. Chapter 1.3 (Fuel Oil Combustion).

EPA (1998) United States Environmental Protection Agency in AP42, Fifth Edition, Volume 1, Chapter 1: External Combustion Sources. Chapter 1.4 (Natural Gas Combustion).

Grobler, N.B. (2022) Emissions Inventory and Air Dispersion Modelling for the Staatsolie Upstream Operations, Suriname. Airshed Planning Professionals Report No 13ILC01_03

Hanna, S. R., Egan, B. A., Purdum, J. & Wagler, J., (1999). Evaluation of ISC3, AERMOD, and ADMS Dispersion Models with Observations from Five Field Sites, s.l.: s.n.

IFC, (2007). Environmental, Health and Safety Guidelines, General EHS Guidelines. 30 April 2007., s.l.: s.n.

Menzel, D. (1994). The toxicity of air pollution in experimental animals and humans: the role of oxidative stress. Toxicology Letters, 72(1-3), 269-277

MFE. (2004). Health effects of CO, NO2, SO2, ozone, benzene and benzo(a)pyrene in New Zealand, Air Qualit Technical Report No. 43. Wellington, New Zealand: New Zealand Ministry for the Environment. Retrieved from https://www.mfe.govt.nz/sites/default/files/air-quality-tech-report-43.pdf

Mølhave, L et al. (1993) Human response to different mixtures of Volatile Organic Compounds. Proc. 6th International Conference on Indoor Air Quality and Climate: Indoor Air '93, Helsinki.

Mølhave, L. (1982). "Indoor Air Pollution Due to Organic Gases and Vapours of Solvents in Building Materials." *Environ Int.* 8:117-127.

Newman, JR and Schreiber (1984). Animals as Indicators of Ecosystem Responses to Air Emissions. *Environ. Mgmt.,* 8(4)309-324.

TCEQ (Texas Commission on Environmental Quality (2022) https://www.tceq.texas.gov/toxicology/esl

Tiwary, A. & Colls, J., (2010). Air pollution: measurement, monitoring and mitigation. 3rd Edition ed. Oxon: Routledge.

US EPA, (2005). Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions. North Carolina, U.S. Environmental Protection Agency, 2005. Federal Register / Vol. 70, No. 216 / Rules and Regulations. Appendix W of 40 CRF Part 51.

Von Burg, R (1995). Toxicological Update. *J .Appl. Toxicol 16(4):365-371*

WHO (2021) Air Quality Guidelines, World Health Organisation, Geneva.

Appendix 8: Project Impact Management Summary Table

Project Impact Summary Table

Project Actions	Component	Potential Impact	Proposed mitigation measures	Proposed Monitoring	Additional Recommendation
Construction Phase					
Construction works, project traffic, use of heavy machinery and equipment (power tools, grinders, and drills)	Noise	Increased noise levels during construction due to construction works, project traffic, use of heavy machinery and equipment (power tools, grinders, and drills)	• Regularly maintain engines of vehicles and equipment. • Operate and maintain exhaust systems and engines in accordance with the manufacturer's specifications. • Use preventative maintenance and repair programs. • Maintain awareness of exceeding speed limits and safe driving behavior. • Limit construction activities to the daytime and inform residents within the 200m in case of noisy activities. Avoid using equipment that generates a lot of noise during nighttime and on weekends. • Provide PPE for staff/personnel, as required.	Visual observations and inspections Maintenance logs	Monitoring of complaints through the Staatsolie GRM
Earth and construction works and movement of project traffic	Air quality	Dust emissions from earthworks and construction work at OTP & PWT area (civil foundation and landfilling activities) and the movement of project traffic along Jossiekreekweg Emissions from heavy equipment and project traffic (transport of materials)	• See equipment maintenance measures for noise. • Maintain awareness of exceeding speed limits and safe driving behavior to avoid dust. • In dry periods: spray the road near houses with water.	Continuous visual observations for dust in dry periods Maintenance logs	Monitoring of complaints through the Staatsolie GRM
All construction activities	Surface water	Water pollution due to spilled and leaked fuel during construction	• Any spill will be localized and is not expected to be able to move far from its origin. Have spill kits and secondary containment available. • Proper maintenance of heavy equipment and vehicles. • Have an oil spill contingency plan in place. • Follow the Staatsolie procedures for maintenance and clean-up of spills. • Conduct frequent monitoring to detect any spill or leak as soon as possible.	Visual observations (oil, turbidity)	-

Project Actions	Component	Potential Impact	Proposed mitigation measures	Proposed Monitoring	Additional Recommendation
All construction activities	Waste	Environmental pollution due to improper management of solid and liquid waste during the construction phase	• Minimize waste generation and recycle as much as possible. • Manage waste according to Staatsolie Waste Management Plan: o Store solid waste in a designated area in covered drums for collection and disposal. o Provide rubbish bins for litter at appropriate locations and arrange for regular collection. o Depending on the waste type, this will be recycled, reused, or disposed of in a suitable facility. o All hazardous materials, including oil and contaminated soil, will be stored separately, and disposed of according to Staatsolie requirements • Notify the contractor about the WMP and require its implementation	Housekeeping inspection Visual observation: weekly inspections using the EMMP checklist. Waste log records	Implementation of waste management plan Training and awareness
All construction activities	Socio-economic	Nuisance (noise, dust or otherwise) to the people living along the Jossiekreekweg	• Implement measures to minimize the impacts on air quality and noise • Reduce the number of transportation trips to the minimum (adequate planning) • Truck traffic and other transport of heavy equipment/machinery should be limited to daytime. • Register and address complaints according to the Staatsolie Grievance Redress Mechanism which is in place and operational.	See monitoring for noise and air quality impacts Monitoring of complaints through the Staatsolie GRM	Follow up measures, if required
		Occupational Health and Safety: Incidents and accidents	• Proper planning and communication of ongoing production activities and construction works. • Proper marking/ fencing of construction areas • Ensure contractors follow Staatsolie Corporate Contractor Health, Safety and Environmental Management procedures and other health and safety related procedures.	Training and awareness (toolbox meetings and safety talks) Visual observations	-

Project Actions	Component	Potential Impact	Proposed mitigation measures	Proposed Monitoring	Additional Recommendation
Earth works	Cultural resources	Disturbance or destruction of archaeological sites	• Create awareness amongst construction staff regarding the significance of such finds and indicators of the presence of such sites (especially bones, exposed bottles, pieces of earthenware, metal, pottery sherds, bed structures, spots with deviating terrain and vegetation). • Follow measures of the chance find procedure: o Cease all construction activities in the area, if a potential site is noticed, and cordon off the area o Notify the Districts-Commissioner and request that the Archaeological Service conducts a preliminary assessment of the site. o Allow that a detailed assessment of the site is undertaken by, or on behalf of, the Archaeological Service, if deemed necessary in the preliminary assessment. o Follow recommendations made in preliminary and/or detailed assessment, as appropriate.	Awareness Visual inspection Report of the Archaeological Service	-
Operational phase					
Operational activities	Noise	Elevated noise levels caused by future (new) equipment resulting in nuisance for nearby residents	• Regularly maintain engines of vehicles and equipment. • Operate and maintain exhaust systems and engines in accordance with the manufacturer's specifications. • Use preventative maintenance and repair programs. • Maintain awareness of exceeding speed limits and safe driving behavior. • Provide PPE for staff/personnel, as required.	Noise measurements once the project is operational to check actual noise levels. In case of complaints: measure noise levels at the complainant and implement measures as required. Maintenance logs.	Monitoring of complaints through the Staatsolie GRM Adress cumulative impacts by implementing the following mitigation measures: • Consider engineering measures to reduce noise levels such as high pressure (HP) pumps on variable frequency drive (VFD) or replacement of the transfer pumps with electrical engine pumps. • Consider exhaust mufflers or silencers on required equipment.

Project Actions	Component	Potential Impact	Proposed mitigation measures	Proposed Monitoring	Additional Recommendation
					• Consider the establishment of buffer zones (e.g. vegetation screen) in between the plant and closest residents • If complaints regarding noise are received, carry out noise monitoring and take noise abatement measures if necessary.
Operational activities (emissions)	Air Quality	Reduction of air quality for sensitive receptors as a result of emission of gases from the stack and operation of equipment.	• See equipment maintenance measures for noise. • Maintain awareness of exceeding speed limits and safe driving behavior to avoid dust. • In dry periods: spray the road near houses with water. • Operate and maintain the steam boiler in accordance with the manufacturer's specifications. • Keep a record of any complaints related to air quality and odor related issues.	Continuous visual observations during dry periods Maintenance logs Air quality monitoring (ambient air quality measurements and isokinetic sampling for emission rates.)	Monitoring of complaints through the Staatsolie GRM Adress cumulative impacts by implementing the following mitigation measures: • Consider the establishment of buffer zones (e.g. vegetation screen) in between the plant and closest residents • If complaints are received, carry out air quality monitoring and take measures if necessary.
		Reduction of air quality for Jossie Plant as a result of emission of gases from the stack and operation of equipment.	• See equipment maintenance measures for noise. • Maintain awareness of exceeding speed limits and safe driving behavior to avoid dust. • In dry periods: spray the road near houses with water. • Operate and maintain the steam boiler in accordance with the manufacturer's specifications. • Provide PPE and gas detector for staff/personnel, as required. • Keep a record of any complaints related to air quality and odor related issues.		
		Reduction of air quality for the pig farm as a result of emission of gases from the stack and operation of equipment.	• See equipment maintenance measures for noise. • Maintain awareness of exceeding speed limits and safe driving behavior to avoid dust. • In dry periods: spray the road near houses with water. • Operate and maintain the steam boiler in accordance with the manufacturer's specifications.		

Project Actions	Component	Potential Impact	Proposed mitigation measures	Proposed Monitoring	Additional Recommendation
			• Keep a record of any complaints related to air quality and odor related issues. • Undertake ambient air quality monitoring once the upgraded Jossie Plant is operational in order to verify the simulations. • Undertake isokinetic sampling of emissions once the upgraded Jossie Plant is operational in order to verify the simulated emission rates estimated in this assessment.		
Discharge of effluent	Surface water quality	Discharge of produced water (containing dissolved salts, oil content, trace metals, back-produced polymer, residual chemical additives, etc.) in the Saramacca River	• All produced water coming from the oil dehydration processing train will be passed to the upgraded produced water treatment system. • Continue to measure water quality of the effluent. In case of discharges exceeding the IFC/ EU criteria, take appropriate measures to minimize the duration and volume. • Monitor surface water quality at the discharge point, upstream and downstream of the discharge point. • While discharge of back produced polymer is likely to dilute quickly so that safe levels of potentially harmful substances such as AAM are not exceeded, all PAMs contain some level of residual AAM due to an incomplete polymerization process. AAM migrates faster than PAM presenting a greater risk of dispersed contamination, but also degrades faster, as such the following is recommended: o Enhance monitoring efforts of AAM to verify the assumption that AAM constitutes 0.1% of HPAM concentration. o Establish a trigger value based on current calculations of AAM that would necessitate the sampling and testing. This proactive measure aims to ensure accurate monitoring and validation of the assumed correlation between AAM and HPAM concentrations, thereby safeguarding environmental and public health.	Visual observations (oil, turbidity) Water quality monitoring	-

Project Actions	Component	Potential Impact	Proposed mitigation measures	Proposed Monitoring	Additional Recommendation
			○ Obtain a discharge permit for AAM from NIMOS based on current calculations and/or established trigger value as mentioned above.		
All operational activities	Waste	Environmental pollution due to improper management of solid (including polymer containing sludge) and liquid waste during the operational phase	• Minimize waste generation and recycle as much as possible. • Manage waste according to Staatsolie Waste Management Plan: ○ Store solid waste in a designated area in covered drums for collection and disposal. ○ Provide rubbish bins for litter at appropriate locations and arrange for regular collection. ○ Depending on the waste type, this will be recycled, reused, or disposed of in a suitable facility. • All hazardous materials, including polymer containing sludge, will be stored separately, and disposed of according to Staatsolie requirements. • Treat sludge through bioremediation at the Staatsolie Waste Management Facility.	Housekeeping inspection Waste log records	Implementation of waste management plan Training and awareness
All operational activities	Socio-economic	Nuisance (noise, dust, or otherwise) to the people living along the Jossiekreekweg	• Register and address complaints according to the Grievance Redress Mechanism which is in place and operational. • Ensure maintenance schedule for combustion equipment and that maintenance on the equipment is done accordingly. • In dry periods: maintain a low driving speed. • In dry periods: spray the road near houses with water; keep the road sufficiently moist.	See monitoring for noise and air quality impacts Monitoring of complaints through the Staatsolie GRM	Follow-up measures if required

Overzichtstabel projectimpacts

Projectactiviteiten	Component	Potentiële impact	Voorgesteld mitigerende maatregelen	Voorgesteld monitoringplan	Additionele aanbevelingen
Constructiefase					
Constructiewerkzaamheden, projectverkeer, gebruik van zware machines en apparatuur (elektrisch gereedschap, slijpmachines en boormachines)	Geluid	Verhoogde geluidsniveaus als gevolg van constructie werkzaamheden	• Optimale onderhoud van voertuigen en apparatuur. • Uitlaatsystemen en motoren bedienen en onderhouden volgens de specificaties van de fabrikant. • Gebruik preventieve onderhouds- en reparatieprogramma's. • Handhaaf snelheidslimieten en veilig rijgedrag. • Beperk constructieactiviteiten gedurende de dag en informeer bewoners binnen een straal van 200 meter in geval lawaaierige activiteiten. Vermijd gebruik van apparatuur die veel lawaai maakt tijdens de nacht en in het weekend. • Personeel voorzien van de nodige PPE.	Visuele observaties en inspecties. Onderhoudslogboeken.	Monitoring van klachten middels Staatsolie GRM.
Grondwerken, andere constructiewerkzaamheden en projectverkeer	Luchtkwaliteit	Verslechtering van de luchtkwaliteit als gevolg van stofontwikkeling en uitlaatgassen van machines en projectverkeer langs de Jossiekreekweg.	• Zie onderhoudsmaatregelen voor geluid. • Handhaaf snelheidslimieten en veilig rijgedrag om stofvorming te minimaliseren. • In droge periodes: natmaken van de weg nabij huizen.	Continue visuele observaties gedurende droge periodes. Onderhoudslogboeken.	Monitoring van klachten middels Staatsolie GRM.
Alle constructie activiteiten	Oppervlaktewater	Vermindering van de oppervlaktewaterkwaliteit door morsen en lekkage van brandstof	• Lekkage zullen beperkt blijven tot de directe omgeving en verspreiding verder dan de bron wort niet verwacht. Zorg voor spill kits en secundaire opvangsystemen. • Optimale onderhoud van voertuigen en apparatuur.	Visuele observaties (olie, troebelheid)	-

Projectactiviteiten	Component	Potentiële impact	Voorgesteld mitigerende maatregelen	Voorgesteld monitoringplan	Additionele aanbevelingen
			• Zorg voor een noodplan voor olielekkages. • Volg de procedure van Staatsolie voor onderhoud en opruimen van lekkages. • Voer frequente controles uit om lekkages zo snel mogelijk te detecteren.		
Alle constructie activiteiten	Afval	Milieuvervuiling door onvoldoende beheer van vast en vloeibaar afval	• Beperk de productie van afval tot een minimum en recycle zoveel mogelijk. • Beheer afval volgens het afvalbeheersplan van Staatsolie: o Bewaar vast afval in een aangewezen ruimte in afgesloten tonnen voor inzameling en verwijdering. o Zorg op strategische plaatsen voor afvalbakken en haal regelmatig op. o Afhankelijk van het soort afval zal dit worden gerecycled, hergebruikt of afgevoerd naar een geschikte faciliteit. o Alle gevaarlijke materialen, inclusief olie en verontreinigde bodem, worden apart opgeslagen en afgevoerd volgens de richtlijnen van Staatsolie. • Informeer de aannemer over het afvalbeheersplan en vereis de uitvoering ervan.	Inspecties Visuele observaties: wekelijkse inspecties met behulp van de EMMP-checklist. Hou een afval logboek bij	Implementatie van het afvalbeheersplan. Training en bewustwording.
Alle constructie activiteiten	Sociaal-economie	Overlast (geluid, stof, of anderszins) voor de bewoners langs de Jossiekreekweg	• Implementeer maatregelen om de effecten op luchtkwaliteit en geluid te minimaliseren. • Beperk het aantal transporten tot het minimum (adequate planning). • Vrachtverkeer en ander transport van zwaar materieel/machines minimaliseren tot overdag.	Zie monitoring van effecten op geluid en luchtkwaliteit. Monitoring van klachten middels het Staatsolie GRM.	Vervolgmaatregelen implementeren, indien nodig.

Projectactiviteiten	Component	Potentiële impact	Voorgesteld mitigerende maatregelen	Voorgesteld monitoringplan	Additionele aanbevelingen
			• Registreer klachten en handel deze af volgens het klachtenmechanisme van Staatsolie.		
		Arbeidsgezondheid en -veiligheid: incidenten en ongevallen	• Goede planning en communicatie van lopende projectactiviteiten en constructie werkzaamheden. • Juiste markering/afzetting van constructie gebieden. • Zorg ervoor dat aannemers de gezondheids-, veiligheids- en milieubeheer procedures van Staatsolie naleven, evenals andere procedures met betrekking tot gezondheid en veiligheid.	Training en bewustwording Veiligheidsgesprekken Visuele observaties	-

Grondwerken	Cultureel erfgoed	Verstoring of vernietiging van archeologische plaatsen	• Maak het constructie personeel bewust van het belang van dergelijke vondsten en bespreek indicaties van de aanwezigheid van dergelijke locaties (met name blootgestelde antieke flessen, stukken aardewerk, metaal, scherven van aardewerk, bed structuren, plekken met afwijkend terrein en vegetatie).
			• Volg de procedure in geval van een vondst:
			  ○ Stop alle constructie activiteiten in het gebied in geval van onverwachte vondsten in het gebied, en stel de locatie veilig.
			  ○ Informeer de districtscommissaris en verzoek om een eerste beoordeling van het gebied door de Archeologische Dienst.
			  ○ Indien nodig geacht: zorg ervoor dat een gedetailleerde beoordeling van de locatie wordt uitgevoerd door, of namens, de Archeologische Dienst.
			  ○ Volg de aanbevelingen op die worden gedaan in de voorlopige
				Bewustwording
				
				Visuele inspecties
				
				Rapport van de Archeologische Dienst
					-

Projectactiviteiten	Component	Potentiële impact	Voorgesteld mitigerende maatregelen	Voorgesteld monitoringplan	Additionele aanbevelingen
			en/of gedetailleerde beoordeling, indien van toepassing.		
Operationele fase					
Operationele activiteiten	Geluid	Verhoogde geluidsniveaus die leiden tot overlast voor nabijgelegen bewoners.	• Optimale onderhoud van voertuigen en apparatuur. • Uitlaatsystemen en motoren bedienen en onderhouden volgens de specificaties van de fabrikant. • Gebruik preventieve onderhouds- en reparatieprogramma's. • Handhaaf snelheidslimieten en veilig rijgedrag. • Personeel voorzien van de nodige PPE.	Voer geluidsmetingen uit zodra het project operationeel is om de werkelijke geluidsniveaus vast te stellen. In geval van klachten: meet de geluidsniveaus bij de klager en neem de nodige maatregelen. Onderhoudslogboeken.	Monitoring van klachten middels het Staatsolie GRM. Beperk de cumulatieve effecten door de volgende maatregelen te treffen: • Overweeg technische maatregelen zoals het gebruik van hogedrukpompen met een variabele frequentieaandrijving of het vervangen van transferpompen door elektrische pompen om het geluidsniveau te verlagen. • Overweeg uitlaatdempers of geluiddempers op benodigde apparatuur. • Creëer een bufferzone (bijv. vegetatiestrook of geluidsscherm of -wal) tussen de Jossie Plant en de dichtstbijzijnde bewoners. • Als er klachten over geluid worden ontvangen, voer dan geluidsmetingen uit en neem zo nodig geluidsbeperkende maatregelen.

Projectactiviteiten	Component	Potentiële impact	Voorgesteld mitigerende maatregelen	Voorgesteld monitoringplan	Additionele aanbevelingen
Operationele activiteiten (uitstoot van gassen)	Luchtkwaliteit	Verslechtering van de luchtkwaliteit voor gevoelige receptoren als gevolg van de uitstoot van gassen uit de schoorsteen en overige apparatuur	• Zie onderhoudsmaatregelen voor geluid. • Handhaaf snelheidslimieten en veilig rijgedrag om stofvorming te voorkomen. • In droge periodes: nat maken van de weg nabij huizen. • Opereer en onderhoud de stoomketel volgens de specificaties van de fabrikant. • Registreer en houd klachten bij over luchtkwaliteit en geurproblemen.	Voortdurende visuele observaties tijdens droge periodes Onderhoudslogboeken Monitoring van de luchtkwaliteit (Omgevingslucht en isokinetische bemonstering voor emissie hoeveelheden)	Beperk de cumulatieve effecten door de volgende maatregelen te treffen: • Creëer een bufferzone (bijv. vegetatiestrook of geluidsscherm of -wal) tussen de Jossie Plant en de dichtstbijzijnde bewoners. • Voer luchtkwaliteitsmetingen uit indien klachten over luchtkwaliteit worden ontvangen en neem indien nodig maatregelen.
		Verslechtering van de luchtkwaliteit voor de Jossie Plant als gevolg van de uitstoot van gassen uit de schoorsteen en apparatuur	• Zie onderhoudsmaatregelen voor geluid. • Handhaaf snelheidslimieten en veilig rijgedrag om stofvorming te voorkomen. • In droge periodes: nat maken van de weg nabij huizen. • Opereer en onderhoud de stoomketel volgens de specificaties van de fabrikant. • Personeel voorzien van de nodige PPE en gasdetector. • Registreer en houd klachten bij over luchtkwaliteit en geur problemen.		
		Verslechtering van de luchtkwaliteit voor de varkenshouderij als gevolg van de uitstoot van gassen uit de schoorsteen en apparatuur	• Zie onderhoudsmaatregelen voor geluid. • Handhaaf snelheidslimieten en veilig rijgedrag om stofvorming te voorkomen. • In droge periodes: natmaken van de weg nabij huizen. • Opereer en onderhoud de steam boiler volgens de specificaties van de fabrikant. • Registreer en houd klachten bij over luchtkwaliteit en geur problemen • Monitor de emissies na afronding van de upgrade van de Jossie Plant. • Voer isokinetische bemonstering uit van emissies zodra de geüpgradede Jossie-installatie operationeel is, om de emissie hoeveelheden te verifiëren.		

Projectactiviteiten	Component	Potentiële impact	Voorgesteld mitigerende maatregelen	Voorgesteld monitoringplan	Additionele aanbevelingen
Lozen van afvalwater	Oppervlaktewater kwaliteit	Verslechtering van de oppervlaktewater kwaliteit vanwege lozing van geproduceerd water met een hoog oliegehalte en andere mogelijke verontreinigen in de Saramacca rivier	• Geproduceerd water afkomstig van de olie-ontwateringsverwerkingsinstallatie moet worden doorgevoerd naar het waterzuiveringssysteem. • Voortdurende monitoring van de waterkwaliteit van het effluent; bij overschrijding van de IFC/EU criteria moeten passende maatregelen worden toegepast om de duur en het volume te verminderen. • Controleer de kwaliteit van oppervlaktewater, zowel stroomopwaarts als stroomafwaarts van het lozingspunt. • Hoewel de afvoer van teruggewonnen polymeer waarschijnlijk snel verdund wordt, bevatten alle PAM's wat AAM residu door onvolledige polymerisatie. AAM verspreidt en breekt sneller af dan PAM. Om de risico op verontreiniging te verminderen wordt het volgende aanbevolen: o Monitor en verifieer de concentratie van AAM. o Stel een drempelwaarde vast voor AAM op basis van de huidige berekeningen. o Verkrijg een vergunning van NIMOS voor de lozing van AAM op basis van de huidige berekeningen en/of de drempelwaarde.	Visuele observaties (olie, troebelheid) Monitoringresultaten	-
Alle operationele activiteiten	Afval	Milieuvervuiling als gevolg van onvoldoende beheer van vast (inclusief polymeren bevattend slib) en afvalwater tijdens	• Minimaliseer de hoeveelheid afval en recycle zoveel mogelijk. • Behandel afval volgens het afvalbeheersplan van Staatsolie: o Bewaar vast afval in een aangewezen ruimte in afgesloten	Inspectie van bedrijfshuishouding Afval logistiek	Implementatie van het afvalbeheersplan Training en bewustwording.

Projectactiviteiten	Component	Potentiële impact	Voorgesteld mitigerende maatregelen	Voorgesteld monitoringplan	Additionele aanbevelingen
			vaten voor inzameling en verwijdering. o Zorg op strategische plaatsen voor afvalbakken en haal het vuil regelmatige op. o Afhankelijk van het soort afval zal dit worden gerecycled, hergebruikt of afgevoerd naar een geschikte faciliteit. • Alle gevaarlijke materialen, inclusief olie en verontreinigde bodem, worden apart opgeslagen en afgevoerd volgens de richtlijnen van Staatsolie. • Behandel slib door bioremediatie bij de Staatsolie Afvalbeheerfaciliteit.		
Alle operationele activiteiten	Sociaal-economie	Overlast (geluid, stof, of anderszins) voor de bewoners langs de Jossiekreekweg	• Registreer klachten en handel ze af volgens het klachtenmechanisme van Staatsolie. • Zorg voor een onderhoudsschema voor verbrandingsapparatuur en zie erop toe dat het onderhoud van de apparatuur volgens dit schema wordt uitgevoerd. • In droge periodes: handhaaf een lage snelheid. • In droge periodes: nat maken van de weg nabij huizen; houd de weg voldoende vochtig.	Zie monitoring van effecten voor geluid en luchtkwaliteit. Monitoring van klachten middels Staatsolie GRM.	Vervolgmaatregelen implementeren, indien nodig.