SORR Gyroid™ Material

EPA-Safe Technical Description for Environmental Deployment

(Trade-Secret Protected | Non-Confidential Disclosure)

Proponent: SORR Pty Ltd
Technology Class: Passive interception and recovery system
Deployment Context: Natural and modified aquatic environments
IP Status: Proprietary materials science and process engineering protected as trade secrets

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1. Purpose of This Document

This document provides a **non-confidential, regulator-appropriate description** of the SORR Gyroid™ material and its deployment methodology to support **environmental assessment, pilot approvals, and controlled field deployment**.

It is intended to:

- Explain **how the material functions** in physical and environmental terms
- Describe **process engineering controls (PAGE™)**
- Identify **materials captured and managed**
- Demonstrate **environmental safety, recoverability, and lifecycle accountability**
- Reference **independent laboratory testing, pilots, and academic studies**

This document **does not disclose** formulations, ratios, manufacturing steps, surface treatments, or process parameters that constitute protected trade secrets.

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2. Technology Overview

The **SORR Gyroid™ material** is a **self-supporting, three-dimensional polymeric interception matrix** engineered for **passive capture and removal of mixed contaminants** from water systems.

The system operates:

- Without chemical dosing
- Without biological agents
- Without active energy input
- Without permanent installation

The material is deployed temporarily and **fully recovered** at the conclusion of each deployment period.

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3. Material Description (Trade-Secret Protected)

3.1 Compound Material Class (High-Level)

The Gyroid™ material is a **composite polymer system** comprising commercially established substances commonly used in regulated industrial contexts, including:

- Structural polymer matrices (mechanical integrity)
- Elastomeric and binding components (resilience and cohesion)
- Reinforcing and stabilising fillers (dimensional and thermal stability)
- Processing modifiers (controlled pore formation and surface development)

All components are **chemically stable, insoluble, and non-dispersive** under deployment conditions.

No material constituents are released into the environment during use.

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4. Functional Mechanisms of Action

4.1 Physical Properties

The Gyroid™ material exhibits:

- **Continuous 3D lattice geometry**, providing self-supporting structure
- **Interconnected multi-scale porosity**, allowing water flow with low hydraulic resistance
- **Capillary transport behaviour**, promoting passive migration of contaminants
- **Mechanical robustness**, enabling intact recovery

These characteristics support **extended deployment** without rapid clogging or collapse.

4.2 Chemical and Interfacial Properties

Observed interfacial behaviours include:

- Hydrophobic and oleophilic affinity for oils and organic compounds
- Surface energy interactions enabling adhesion of particulates and organic films
- Film-based retention rather than pore blockage

No chemical reactions are induced in situ.

4.3 Emergent (Observed) Behaviours

Field deployments and post-recovery analysis show reproducible but conservatively treated behaviours, including:

- Stable micro- and nano-scale contaminant films
- Retention exceeding simple surface-area-only models
- Sustained performance under mixed contaminant loading

These behaviours are **managed through process controls** and are not relied upon independently.

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5. PAGE™ Process Engineering Framework

Pollutant Adaptive Gradient Extraction

All deployments are governed by **PAGE™**, SORR's process engineering methodology.

PAGE™ ensures that physical, chemical, and emergent behaviours remain **bounded, repeatable, and auditable**.

PAGE™ comprises:

1. **Process Configuration**
   Geometry, density, placement, and containment are adapted to site-specific hydraulic and contaminant conditions.
2. **Adaptive Gradient Extraction**
   Natural gradients (concentration, polarity, capillary forces, surface energy) are used to draw contaminants into the matrix without reagents or energy input.
3. **Monitoring and Control**
   Deployment duration, inspection intervals, and recovery triggers are predefined.
4. **Recovery and End-of-Life Management**
   Material is retrieved intact and managed off-site under controlled conditions.

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6. Materials and Contaminant Classes Captured

Based on laboratory testing, pilot deployments, and post-deployment analysis, the SORR Gyroid™ system has demonstrated interception of the following **material classes**, subject to site-specific conditions.

6.1 Hydrocarbons and Oils

- Crude and refined petroleum hydrocarbons
- Fuels, lubricants, and oil residues
- Hydrocarbon sheens and emulsified fractions[1]

6.2 Organic Matter and Biomass

- Algal biomass (including bloom material)
- Organic particulates
- Biofilm-associated matter[2]

6.3 Microplastics and Fine Particulates

- Microplastic fragments and fibres
- Synthetic and natural particulates
- Sediment-associated contaminants[1]

6.4 PFAS-Associated Fractions

- PFAS bound to particulates or organic matter
- PFAS present within mixed contaminant matrices

Capture occurs via **physical sequestration of PFAS-bearing material**, rather than chemical destruction[3].

6.5 Nutrient-Associated Loads

- Nitrogen-bearing organic matter
- Ammonia-associated particulates
- Phosphorus-associated solids

Demonstrated through reduction in COD, BOD, TSS, ammonia, and total nitrogen in field samples[4].

6.6 Metals and Metal-Associated Species (Context-Dependent)

- Metals present as particulates or surface-associated species
- Metal-organic complexes

Post-deployment leachability testing of used Gyroid™ material indicates metals remain **stabilised and non-leachable**under TCLP conditions[5].

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7. End-of-Life Management (No Incineration)

Incineration is explicitly NOT used in the end-of-life management of the SORR Gyroid™ material.

Recovered material is managed off-site using **controlled, non-incineration thermal and physical processing pathways**, designed to:

- Stabilise captured contaminants
- Avoid uncontrolled emissions
- Avoid landfill disposal
- Enable circular reuse or conversion into durable secondary products

No open burning, uncontrolled thermal destruction, or waste-to-energy incineration is employed.

Lifecycle responsibility remains with SORR or its authorised partners.

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8. Environmental Safety and Risk Controls

From a regulatory perspective:

- No chemical dosing
- No dispersible particles
- No biological amplification
- No permanent installation
- No in-situ degradation processes

The material is:

- Temporarily deployed
- Retrieved intact
- Managed under documented chain-of-custody

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9. Monitoring, Validation, and Governance

Deployments are supported by:

- Pre-deployment baseline assessment
- Defined monitoring parameters aligned to site objectives
- Post-deployment material recovery and laboratory analysis
- Documentation of deployment configuration and duration

The system is suitable for **staged trials under regulator oversight**.

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10. Intellectual Property and Trade-Secret Protection

The following are intentionally excluded:

- Material formulations and ratios
- Manufacturing and surface-treatment processes
- Thermal processing parameters
- PAGE™ optimisation algorithms

These details are not required for environmental risk assessment.

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11. Regulatory Summary Statement

The SORR Gyroid™ system is a passive, recoverable interception technology whose performance arises from physical structure, surface interactions, and bounded emergent behaviours. Deployment is governed by the PAGE™ process engineering framework to ensure environmental safety, predictability, and full lifecycle accountability. Captured materials are managed off-site using non-incineration pathways, with no chemical dosing or permanent environmental alteration.

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12. Sources and Supporting Evidence

1. **SORR Pty Ltd (2025).**
   Low-Energy Remediation: The Advantages of SORR's Gyroid Sponge™ Over High-Flow GAC and Resin Systems for PFAS and Microplastic Capture. June 2025.
   Low Energy Deployment White Pap…
2. **Kerle, S. (2024).**
   Remediation Potential of a Synthesised Polymeric Material for Toxic Metals and PFAS.
   Honours Thesis, University of Technology Sydney.
   Low Energy Deployment White Pap…
3. **Central Coast Council / SORR Pilot Reporting (NSW).**
   Tuggerah Lakes stormwater and drain deployments (hydrocarbons, plastics).
   Low Energy Deployment White Pap…
4. **Sadekar Enviro Engineers Pvt Ltd (2024).**
   Independent laboratory analysis of water samples and SORR sponge deployments (COD, BOD, TSS, ammonia, nitrogen).
   SORR India Lab results
5. **Sadekar Enviro Engineers Pvt Ltd (2024).**
   TCLP leachability testing of used and unused SORR sponge material (metals stabilisation).
   SORR India Lab results
