Addressing Challenges in Adapting Life Cycle Inventory Templates to New Products

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Pacific Northwest National Laboratory

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Overview: PNNL Recent Work Addressing Data-Driven Sustainability for Buildings and Infrastructure

Low embodied carbon

Goal: Apply existing or improved Life Cycle Assessment (LCA) approaches to address lack of high-quality data and accounting methods for both products and buildings

- Enhancing sustainability data and reporting by enabling manufacturers to access and collect high-quality data, feeding this data into the Federal Commons for setting baselines and targets, and leveraging industry-average product data for Whole Building Life Cycle Assessment (WBLCA).
  - Partnership and industry collaboration (e.g., 17 orgs in focus group and more who have tested the template, ASHRAE, AHRI, IES, Building Re-Use products, and more),
  - Developed unique LCA (life cycle inventory/life cycle impact analysis) template for luminaires and rooftop units,
  - Collaborated with industry on first LCA rules for luminaires in North America,
  - Addressed data gap (power supplies),
  - Identified recommended practices for WBLCA.

Key industry partners & collaborators

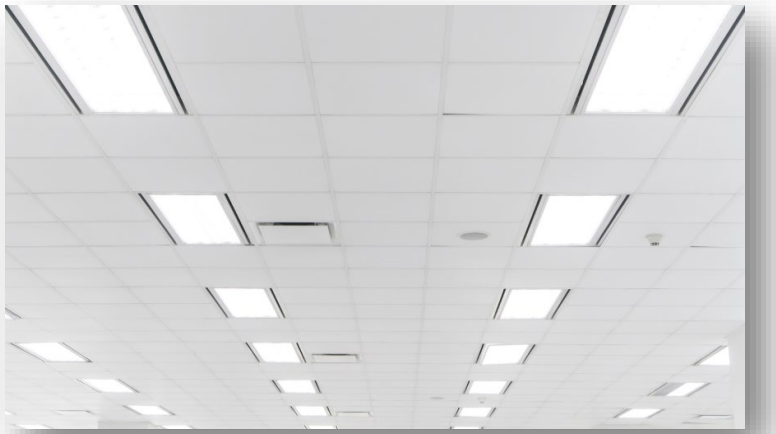
DAIKIN
TRANE TECHNOLOGIES
IES The Lighting Authority
ASHRAE
FINELITE Better Lighting
AHRI AIR-CONDITIONING, HEATING, & REFRIGERATION INSTITUTE
Johnson Controls
SMART EPD

New PNNL LCA website, more posted soon.

What is the motivation for this project?

Adapting LCI templates to different product types can impact the reliability and relevance of LCA results

This presentation focuses on the transition from a luminaire-specific template to one tailored for Rooftop Units (RTUs) in HVAC systems



Accurate LCI data are a critical element of more informed sustainability decisions

- Inaccurate or incomplete data can lead to **flawed assessments** and **poor decision-making**
- High-quality LCI data supports **better sustainability practices** and **product development**
- Reliable data enables **more informed decisions** by designers, policymakers, and sustainability professionals

Source: https://www.arkatechture.com/blog/why-data-quality-is-important

LCI templates are most useful when they are product specific

- Designed to capture unique data requirements for different products
- Tailored frameworks enhance accuracy of LCA results
- Customization involves aligning functional units, material flows, and system boundaries with product characteristics
- Effective templates must be representative and actionable for specific products

The luminaire LCI template was the genesis of our current work

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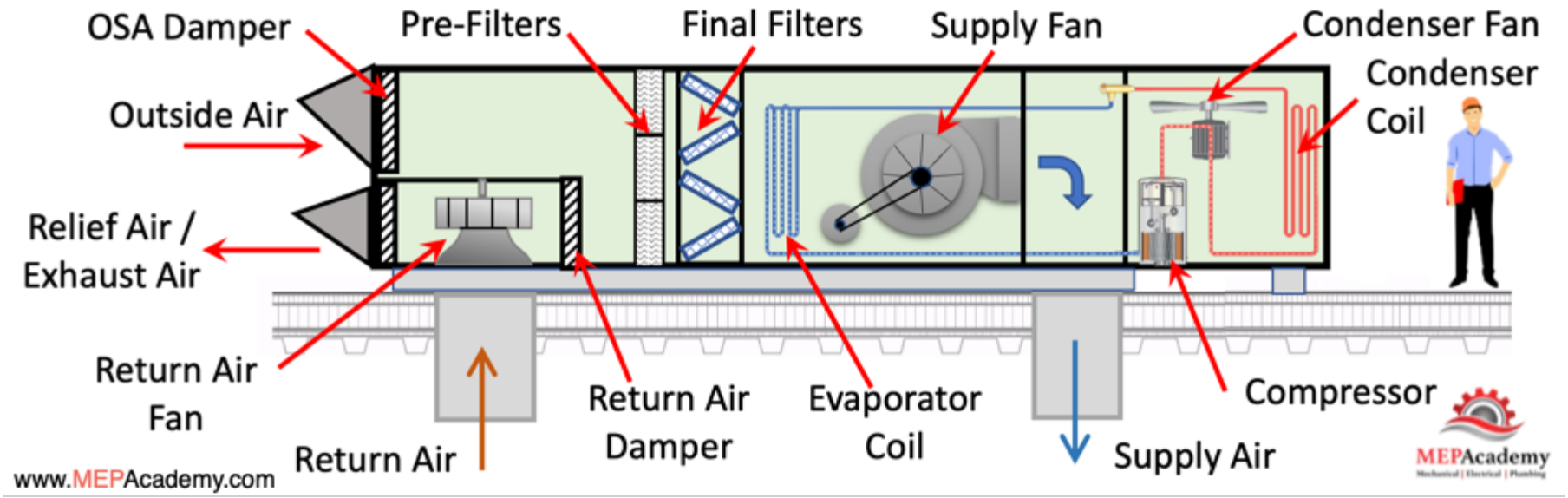
LUMINAIRE PRODUCT SPECS:

Driver specifications:			
Driver warranty time			
Body type & specifications:			
Diffuser:			
Class (shock protection):			
Luminaire Input Power:		W	
Stand-by Power (if known):		W	
Luminaire luminous flux:		Lumens (lm)	
Luminaire efficacy:		lm/W	
LED Lumen Maintenance per LM-80		hours	hours
Version of LM-80 used		Version 1 or 2	

What are components of an RTU and how do they operate?



RTUs are components of HVAC systems for heating and cooling large spaces

Key characteristics include varying energy requirements and maintenance needs

Accurate LCI for RTUs requires understanding these complex factors

Detailed LCI is necessary for assessing environmental performance throughout the RTU lifecycle

Transitioning from a luminaire LCI template to an RTU templates presented many challenges

- Modifying functional units to align with RTU specifications
- Mapping product materials requires comprehensive knowledge of RTU lifecycles and materials
- Addressing complexities in system boundaries and use-phase inputs
- These challenges are common to various product types

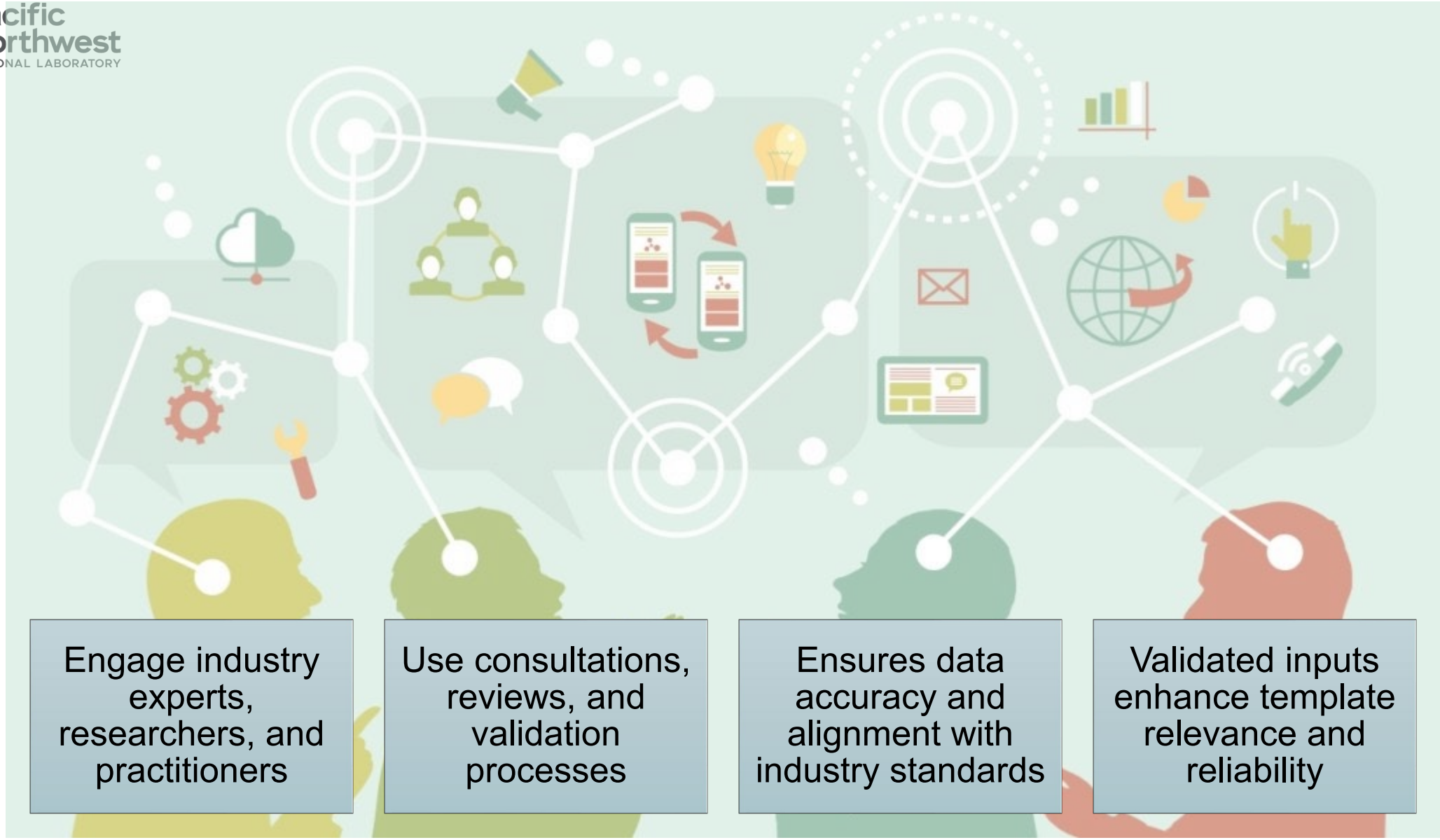
A detailed analysis of an RTU was necessary in our effort to develop a corresponding LCI template

Analyze RTU specifications and operational characteristics

Collect and interpret data relevant to RTUs

Provides insights for adjusting the LCI template's functional unit

Engaging stakeholders was a key component of our work



Engage industry experts, researchers, and practitioners

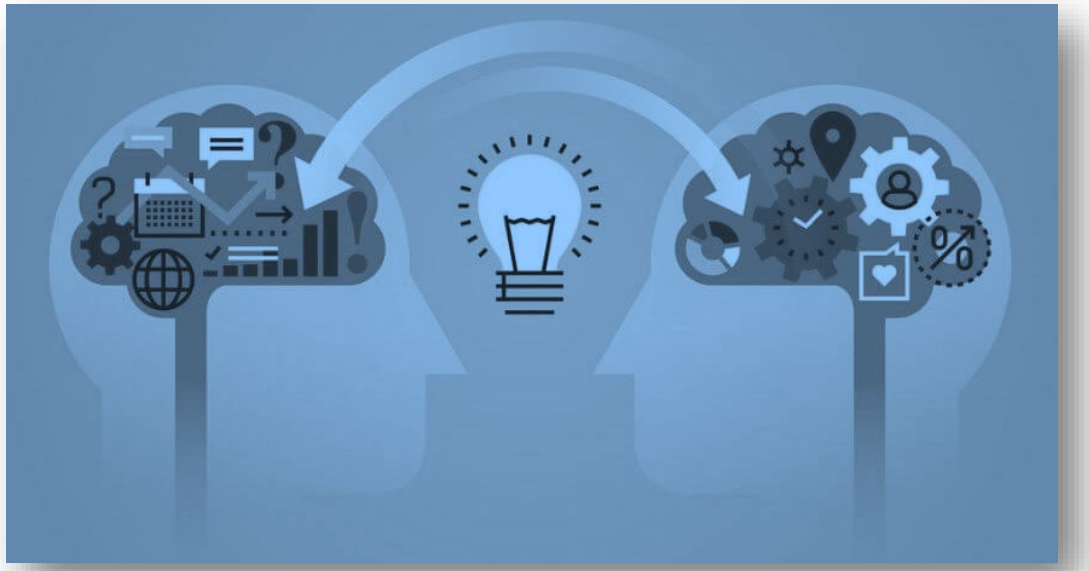
Use consultations, reviews, and validation processes

Ensures data accuracy and alignment with industry standards

Validated inputs enhance template relevance and reliability

Interdisciplinary collaboration also played a critical role in our work

- Involves diverse knowledge areas such as engineering and environmental science
- Integrates insights from different disciplines
- Results in improved template adaptation and problem-solving
- Strengthens the reliability and applicability of the LCI template

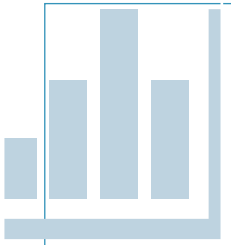


The newly developed RTU template contained relevant inputs developed with our partners

RTU PRODUCT SPECS:

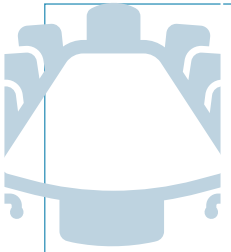
Capacity:		tons (in cooling mode)				
Efficiency:		EER (in cooling mode)				
Dimensions:		meters	by		meters	by		meters
RTU weight:		kg				
RTU input power:		W				
Lifetime (in hours)		hours				
Link for additional information:						
Attachments:						
Certifications/Programs:						

The development of an RTU LCI template has several positive outcomes

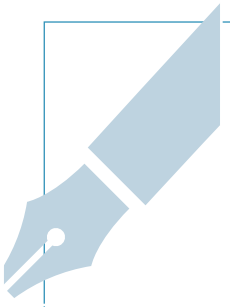


LCA Practitioners: Strategies for tailored LCI data collection

Product Designers: Insights into developing adaptable LCI templates



Sustainability Professionals: Contributions to more accurate LCAs



Policymakers: Impact on regulations and standards for environmental assessment

Upcoming Work by PNNL includes expanding the use of the PCR-aligned LCI template to new sectors, and working with industry to improve LCI practices

LCI Template for Batteries

LCI Template for Mechanical and Electrical (M&E)

LCI Template for Building Reuse Materials

Digitize LCI Template into WebApp (flow into Fed Commons)

WBLCA workflows to incorporate M&E

Costs and Benefits of Modularity in Luminaires

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Thank you

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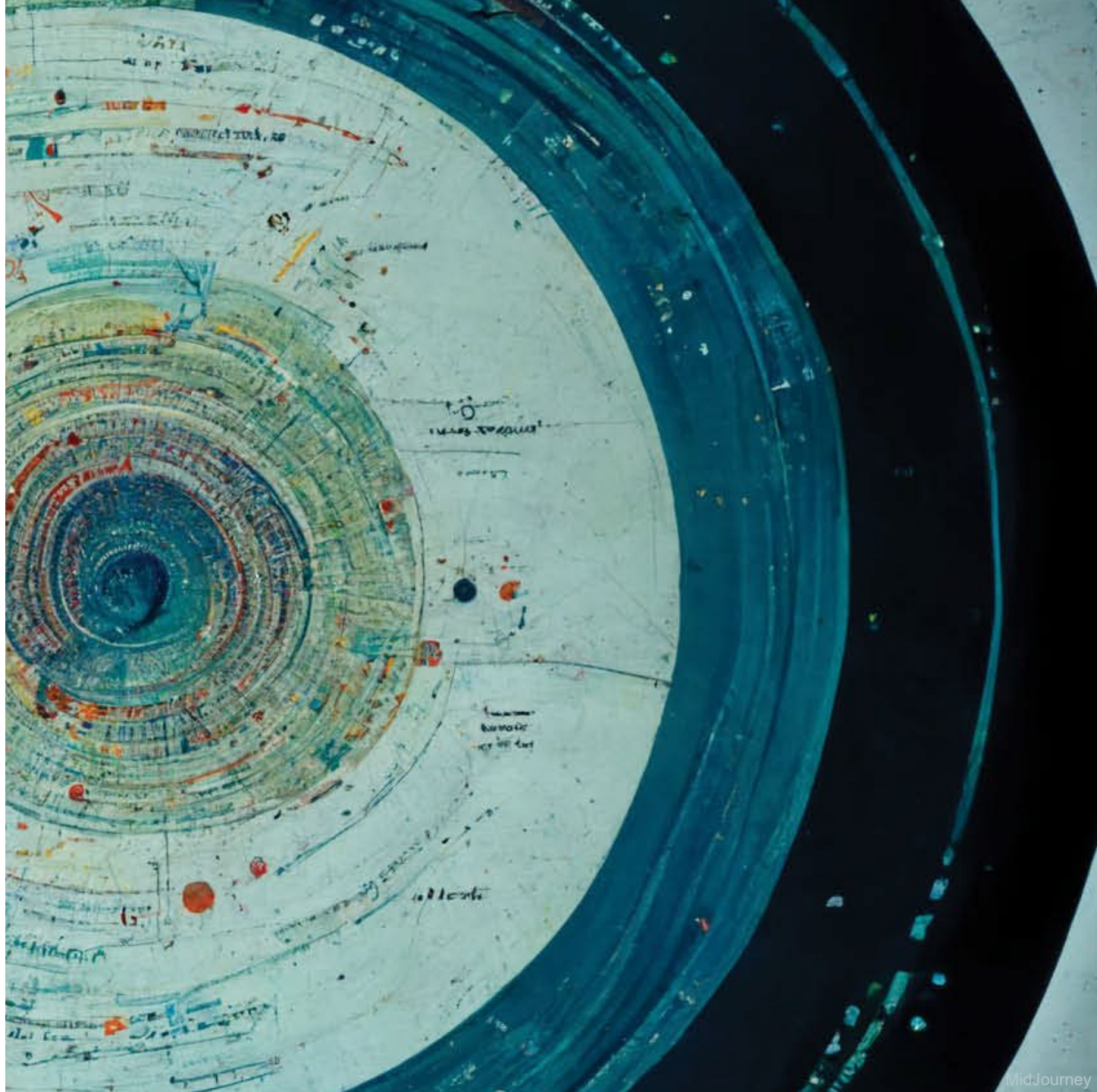

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