Integrating Risk Management into R&D

Approaches for Hazard Screening, Exposure Modeling, and Collaborative Controls

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About Me

- Risk assessment scientist and industrial hygienist with Insight Exposure & Risk Sciences Group

- Experience supporting academic and industrial R&D programs across:
  - Pharmaceuticals, Therapeutics, & Nutraceuticals
  - Nanoparticles & Consumables
  - Clinical Testing & Biological Agents
  - Semiconductors & Battery Technology
  - Food & Beverage
  - Antimicrobials

- Focused on embedding OEHS and risk decision logic into R&D to align innovation with worker health and corporate resilience

Agenda

- Introduction & Context
- The Need for Adaptative Risk Management
- Enterprise Integration
- Case Study: Food & Beverage R&D Integration
- Lessons Learned & Strategic Value
- Closing Remarks & Discussion

Linking the Pieces: Integrating Risk Management Across R&D

The Need for Adaptive Risk Management

- R&D priorities shift rapidly in response to economic conditions, supply chains, and consumer demand
- These shifts introduce new materials, processes, and scientific uncertainties at a faster pace than traditional OEHS systems can adapt
- Embedding automated, flexible, and data-driven risk tools enables OEHS to evolve alongside science and business strategy
- Effective integration elevates OEHS from a reactive compliance function to a proactive strategic partner in innovation

What Lens are You Using to Assess Risk?

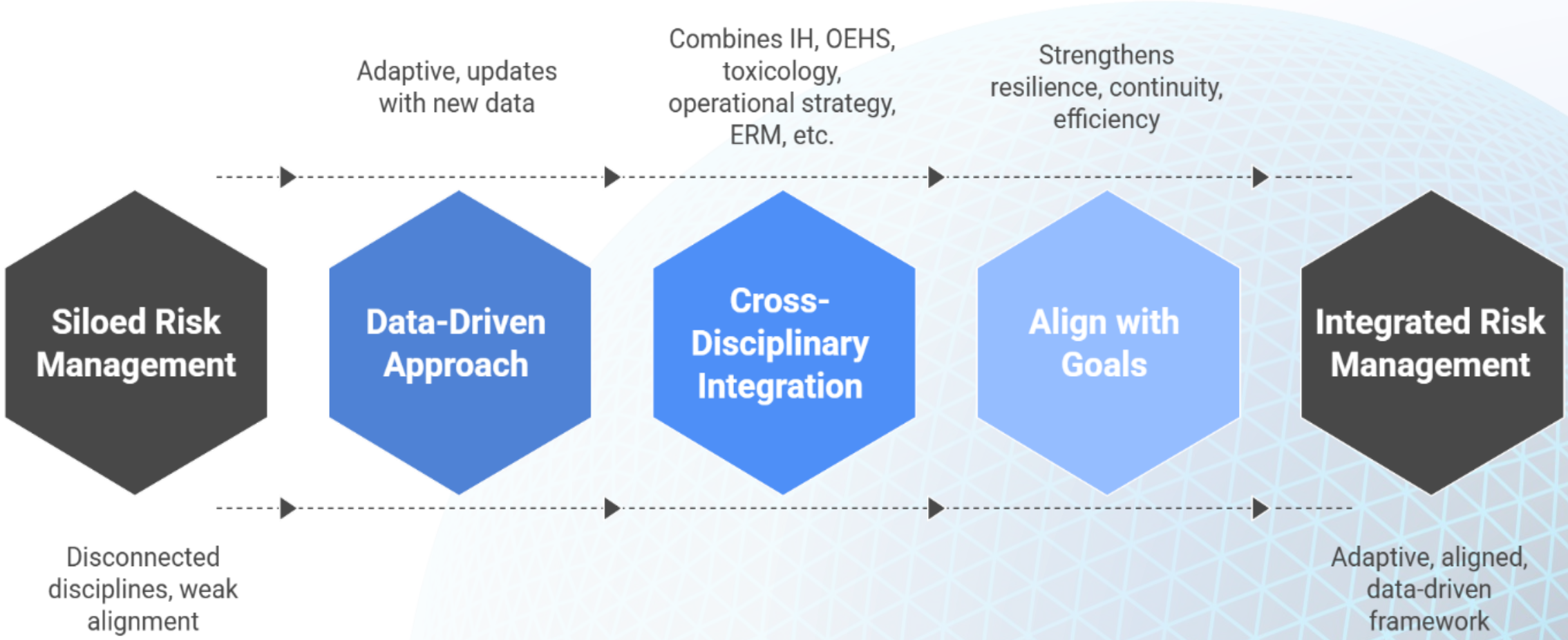
- Scientific background and discipline
- Robustness, quality of scientific data
- Politics
- Organizational policies and focus
- Economics
- Personal experiences and bias
- Level of risk tolerance and acceptance

Different roles see risk differently, integrated frameworks create shared understanding

Why Focus on the Food & Beverage Sector?

- Combines diverse chemicals, global R&D shifts, and rapid innovation cycles
  - Constant pressure from shifts in market trends and customer preferences
- Requires bespoke framework for evaluating materials with limited hazard data
- Demonstrates how custom OEHS tools can integrate
  - Across labs, pilot, and global operations

Integrated Risk Management



Case Study: Adding Some Flavor...

Case Study : Building a Living R&D Framework

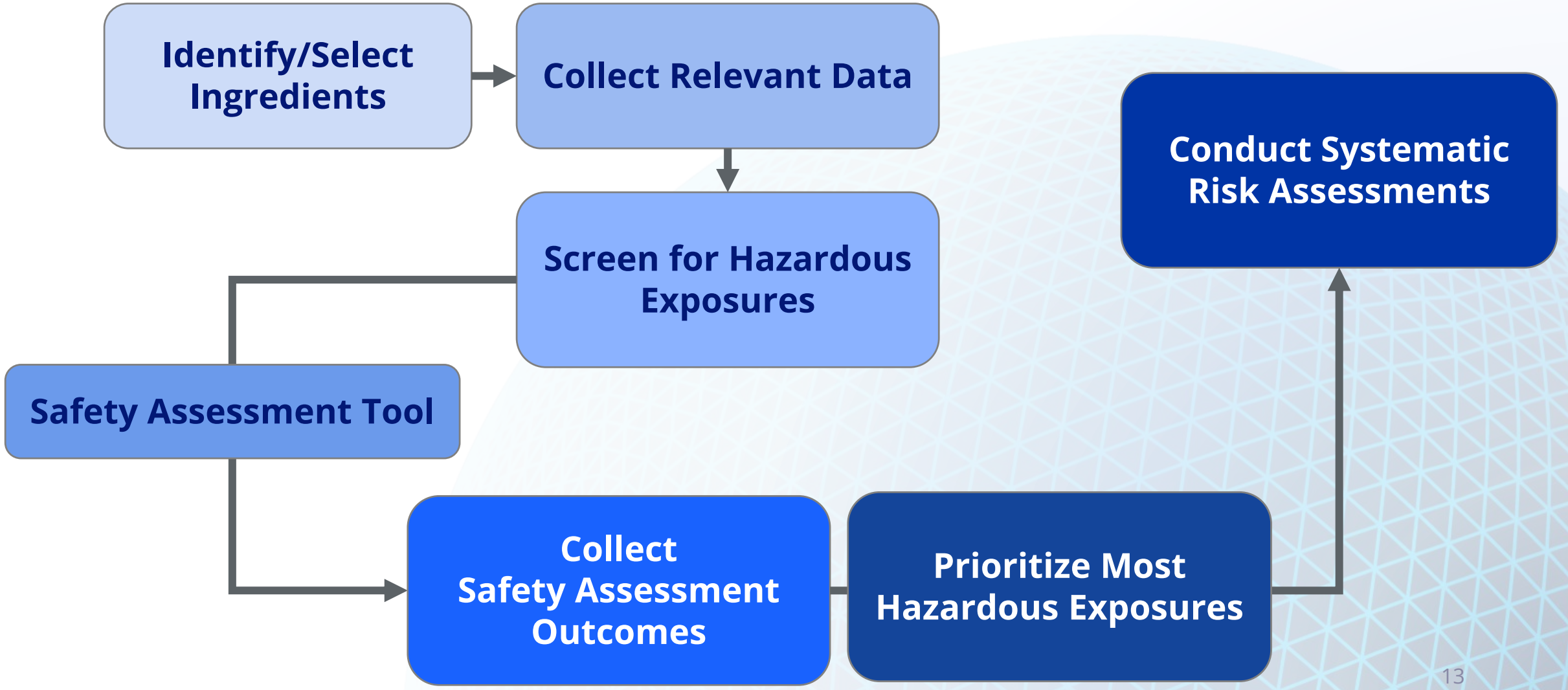
- Food and beverage manufacturer with extensive R&D laboratory operations
  - >1,000 R&D employees located around the globe
- Needed consistent, rapid, and science-based hazard, risk, and control decisions
- **Objective: develop modular, interconnected, and automated tools aligned with internal risk tolerances**
- Framework designed to evolve over time and integrate across business units
  - Including units that do not communicate often


Hazard
EXPOSURE
Risk

R&D Hazard Screening Framework

- Hazard screening framework integrates SDS data, hazard codes, and predictive tox modeling outputs
- Developed for R&D labs that use hundreds of small-volume chemicals, many with limited toxicological or hazard data
- Decision logic assigns hazard tiers and links to exposure potential to guide control recommendations
- Enables automatic screening for new chemicals, providing immediate outputs
- Embedded within internal OEHS systems for real-time evaluation and traceability across R&D sites

Screen and Prioritize Hazardous Exposures



Minimum Control Recommendations

- Hazard tiers link directly to control recommendations
  - Provide immediate guidance for handling and experimental setup
- Logic matrix considers exposure route, task type, and material form to define minimum required controls
- Integrated into the hazard screening tool
  - Recommendations appear automatically when a material is screened
- Adaptable framework
  - Can be updated as risk tolerances, data, or operational practices evolve

R&D Informing Downstream Integration

- Dustiness testing during formulation quantifies aerosol potential for new seasonings and ingredients
- Results feed directly into control banding logic and exposure modeling tools
- Enables early collaboration between R&D, IH, and Engineering to refine formulations or controls
- Adaptable framework supports new or improved test methods as science advances.

Exposure Modeling & Automation

- Predictive models estimate exposures for R&D and pilot tasks, including hand batching of food and beverage recipes
- Automated hazard quotients use physicochemical properties and task parameters to quantify risk
  - Leverage NIOSH OEB in absence of OELs
- Results feed directly into control banding tools, refining guidance for formulation and scale-up
- Framework evolves with new data and models, ensuring alignment with science and operations

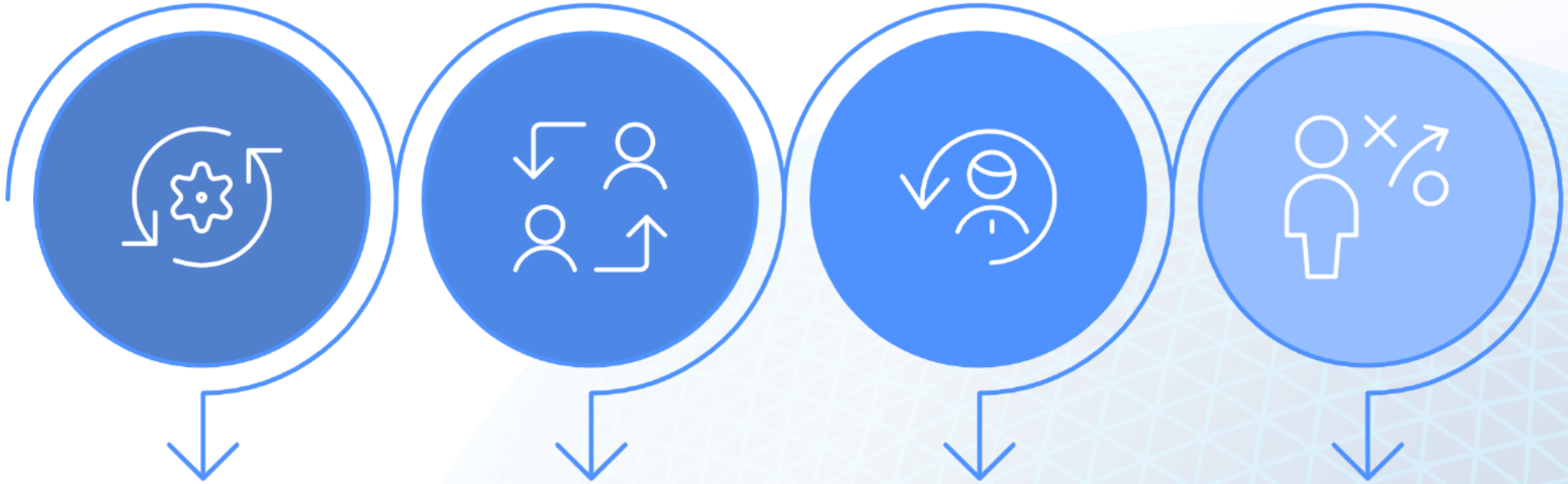
Integration Across the R&D Lifecycle

- Unified process connecting hazard screening, dustiness testing, exposure modeling, and control recommendations
- Feedback loops ensure updates in one component automatically refine others
- Consistent logic and data structure across R&D, pilot, and global operations
- Creates a living system that evolves with science, materials, and organizational needs

Utilizing and Aligning Solutions Across Operations

- Earlier implementation used automated SDS screening for fleet and maintenance operations
- Served as a proof-of-concept for the R&D hazard logic and automation framework
  - Now linked with R&D, creating a consistent risk logic from labs to field operations
- Supports enterprise integration, ensuring unified decision-making and traceability across business units
  - Helps align internal risk policies and tolerances across divisions and business units

Lessons Learned and Strategic Value



Automation

Increases efficiency and consistency, reducing manual effort

Integration

Connects R&D and operations, aligning OEHS with strategy

Adaptive Design

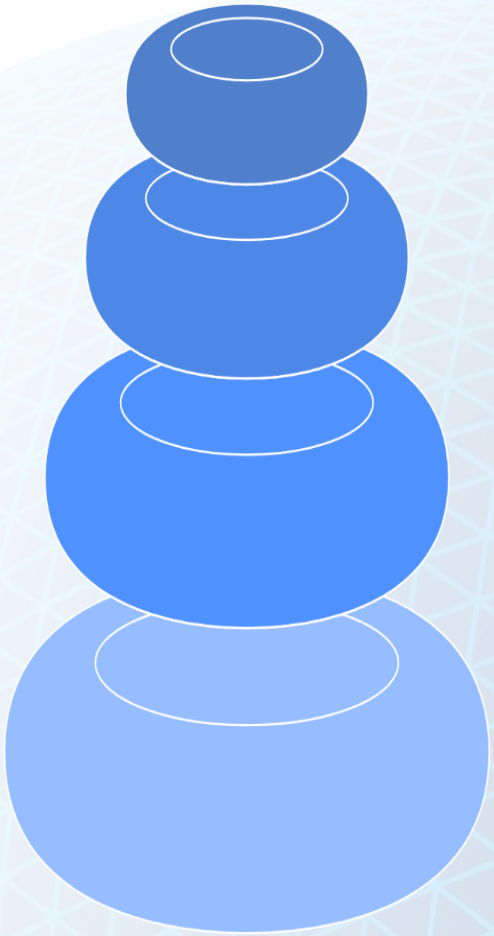
Enables continuous improvement as science and data evolve

Strategic Function

Positions OEHS into a strategic function, supporting innovation

Broader Application and Future Direction

- Scalability applicable to R&D, manufacturing, and enterprise-level risk systems
- Bridges scientific tools and governance
- Supports emerging technologies through modular design and adaptable data inputs
- Drives continuous refinement as methods, materials, and risk insights evolve



Continuous Learning

Enables data-driven refinement of practices

Governance Alignment

Aligns with global EHS governance models

Tool Integration

Supports integration of new tools

Sector Adaptability

Framework adaptable to diverse sectors

Summary

- Integration builds alignment, connecting R&D processes with broader organizational risk strategy
- Automation enhances efficiency and consistency, enabling real-time, data-informed decisions
- Flexibility ensures longevity, allowing the framework to evolve as science and operations advance
- Collaborative design strengthens engagement, bridging R&D, OEHS, and corporate strategy

Questions