



PRESENTER TEAM

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ZYDUS OVERVIEW



LIFE CYCLE ASSESSMENT (LCA) STUDY: MESALAMINE

Project

- Life Cycle Assessment of Mesalamine API & DR Tablets
- Mesalamine is pharmaceutical product widely used in the treatment of inflammatory bowel diseases.

Objective

- To evaluate and quantify the environmental impacts associated with the production of Mesalamine.
- To identify opportunities for reduction in environmental impacts through process, raw material changes & sustainable procurement.

Duration

- Project was conducted from January to May 2025.



LIFE CYCLE ASSESSMENT (LCA) STUDY: MESALAMINE

**T.R.I.G.G.E.R.
PROJECT**



CUSTOMER REQUIREMENTS

Mesalamine is one of the high value products for Zydus and hence selected for evaluation of its Environmental impact



PRODUCT LIFE CYCLE

To quantify the real environmental footprint of a crucial therapeutic product and integrate life cycle thinking into manufacturing



SUSTAINABLE DEVELOPMENT GOALS

Zydus commitment to SDG 12, SDG 13, SDG14 and SDG15



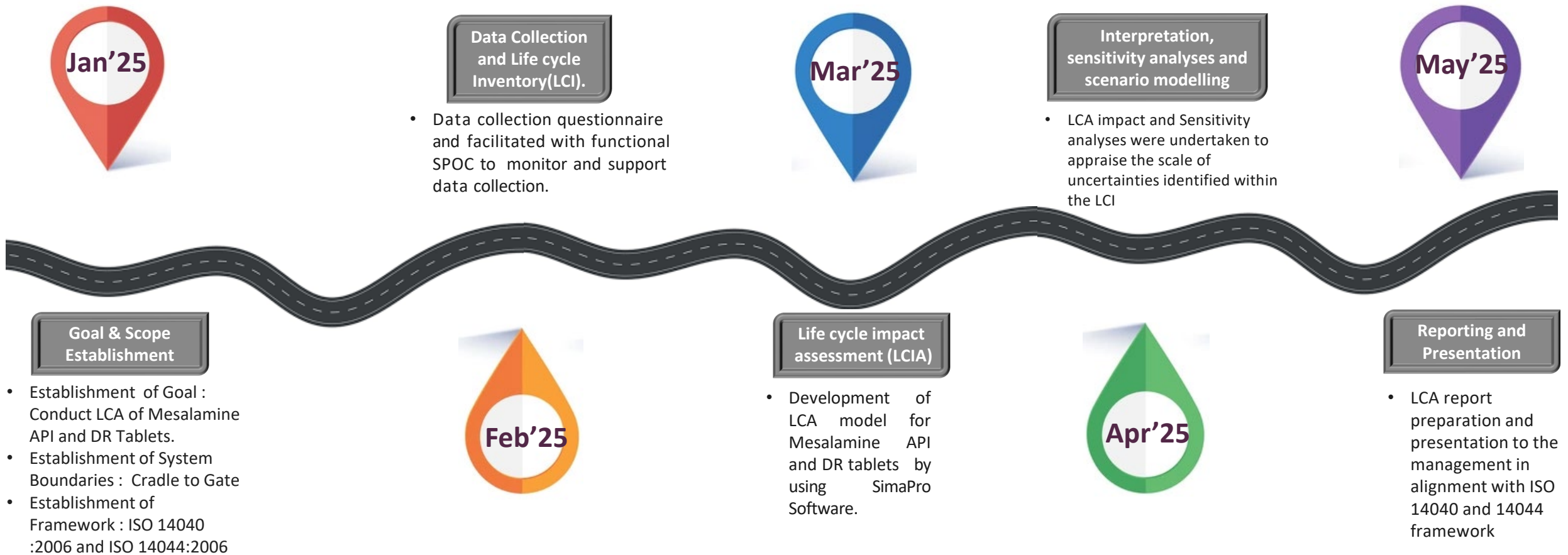
Readiness for potential regulatory requirements and rising customer expectations



Strategizing the decisions by understanding the product level environment impact across the product portfolio

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ROAD MAP



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BENEFITS

Sl. No.	Parameters	Tangible Benefits	Non-Tangible Benefits
1.	Process Optimization	New API route reduced Global Warming Potential by 15 % per kg API	Sustainable procurement practices
2.	Ecological Benefits	- Reduced fossil fuel usage (15%) 8 % reduction in land use 58 % reduction in fresh water ecotoxicity	- Alignment with SDG Goals 14 (life below water) , SDG, 15 (life on Land). - Enhanced brand image of the organization. - Improvement in ESG rating based on BRSR and CSA by S&P Global
3.	Ozone Formation, Human Health	17% reduction in ozone formation in the new route	Improvement in overall Human Health

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COMPARATIVE ANALYSIS

Sr. No	Impact category	Unit	API Old Route	API New Route	% Reduction
1	Global Warming	Kg CO2 eq	77.76	65.9	15%
2	Stratospheric ozone depletion	kg CFC11 eq	0	0	0%
3	Ionizing radiation	kBq Co-60 eq	4.04	3.22	20%
4	Ozone formation, Human health	kg NOx eq	0.18	0.15	17%
5	Fine particulate matter formation	kg PM2.5 eq	0.17	0.14	18%
6	Ozone formation, Terrestrial ecosystems	kg NOx eq	0.18	0.15	17%
7	Terrestrial acidification	kg SO2 eq	0.33	0.28	15%
8	Freshwater eutrophication	kg P eq	0.05	0.04	20%
9	Marine eutrophication	kg N eq	0.01	0	100%
10	Terrestrial ecotoxicity	kg 1,4-DCB	568.15	183.8	68%
11	Freshwater ecotoxicity	kg 1,4-DCB	7.9	3.35	58%
12	Marine ecotoxicity	kg 1,4-DCB	6.3	4.48	29%
13	Human carcinogenic toxicity	kg 1,4-DCB	13.46	10.27	24%
14	Human non-carcinogenic toxicity	kg 1,4-DCB	132.86	100.53	24%
15	Land use	m2a crop eq	2.23	2.06	8%
16	Fossil resource scarcity	kg oil eq	21.12	17.93	15%

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COMPARATIVE ANALYSIS

Sr. No	Impact category	Unit	DR Tablet of 500 mg (New Route)	DR Tablet of 800 mg (Old Route)	DR Tablet of 1200 mg (Imported API)
1	Global warming	kg CO2 eq	48.752848	98.505533	108.54373
2	Stratospheric ozone depletion	kg CFC11 eq	0.000031512	0.000064683	0.000072925
3	Ionizing radiation	kBq Co-60 eq	2.1156668	4.1110068	4.8219202
4	Ozone formation, Human health	kg NOx eq	0.10363951	0.23737573	0.23442017
5	Fine particulate matter formation	kg PM2.5 eq	0.097033903	0.19280218	0.21781716
6	Ozone formation, Terrestrial ecosystems	kg NOx eq	0.10770222	0.24561791	0.24322312
7	Terrestrial acidification	kg SO2 eq	0.18538452	0.36264365	0.42113306
8	Freshwater eutrophication	kg P eq	0.031306048	0.059539689	0.069394546
9	Marine eutrophication	kg N eq	0.002048588	0.006139091	0.004318186
10	Terrestrial ecotoxicity	kg 1,4-DCB	162.64106	562.98263	327.40744
11	Freshwater ecotoxicity	kg 1,4-DCB	2.0787389	7.0222782	4.6872108
12	Marine ecotoxicity	kg 1,4-DCB	2.7586326	5.9754357	6.2467455
13	Human carcinogenic toxicity	kg 1,4-DCB	6.8232672	13.928046	15.262805
14	Human non-carcinogenic toxicity	kg 1,4-DCB	64.581405	133.42852	145.36065
15	Land use	m2a crop eq	1.4153852	2.4751621	3.0549781
16	Mineral resource scarcity	kg Cu eq	0.20967185	0.32751716	0.48938617
17	Fossil resource scarcity	kg oil eq	13.629968	27.441746	30.038584
18	Water consumption	m3	16.028006	21.968089	38.294046

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UNIQUENESS

First of its kind full LCA for API as well as Formulation within Zydus - – covering old , new manufacturing routes and also using imported routes to quantify Environmental impacts.

Comprehensive Impact Analysis of 18 categories

Uses dual benchmarking –Comparing internal process routes and aligning results with ISO 14040 ,14044 and European Commission PEF Method

Due to unavailability of similar type of data in public domain, it is unlikely to comment / claim on this for entire pharmaceutical sector

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REPLICATION POTENTIAL

Applicable for following manufacturing sectors :

Pharma Sector

- Any company manufacturing APIs or Formulations can adopt similar approach to identify process hotspots, prioritize green chemistry, and optimize energy use.

Chemical Sector

- For chemicals, LCA highlights high- impact reaction steps and supports process redesign.

FMCG Sector

- Can identify upstream material impacts, packaging burdens and utility hotspots for eco- label compliance.

CHALLENGES

- Data collection specific to product like Energy usage , water etc.
- Understanding the process of old route, new route and import route.
- Data compilation from various department like production, warehouse, supply chain, engineering, process transfer and quality.
- Identifying the root cause that contributed to increase/ decrease in impact of specific Environmental parameter. Eg specific raw material used in process may increase/ decrease environmental impact.
- Real challenge is to implement new process/ material that will have lower Environmental impact without compromising the final product, its quality & cost economics.

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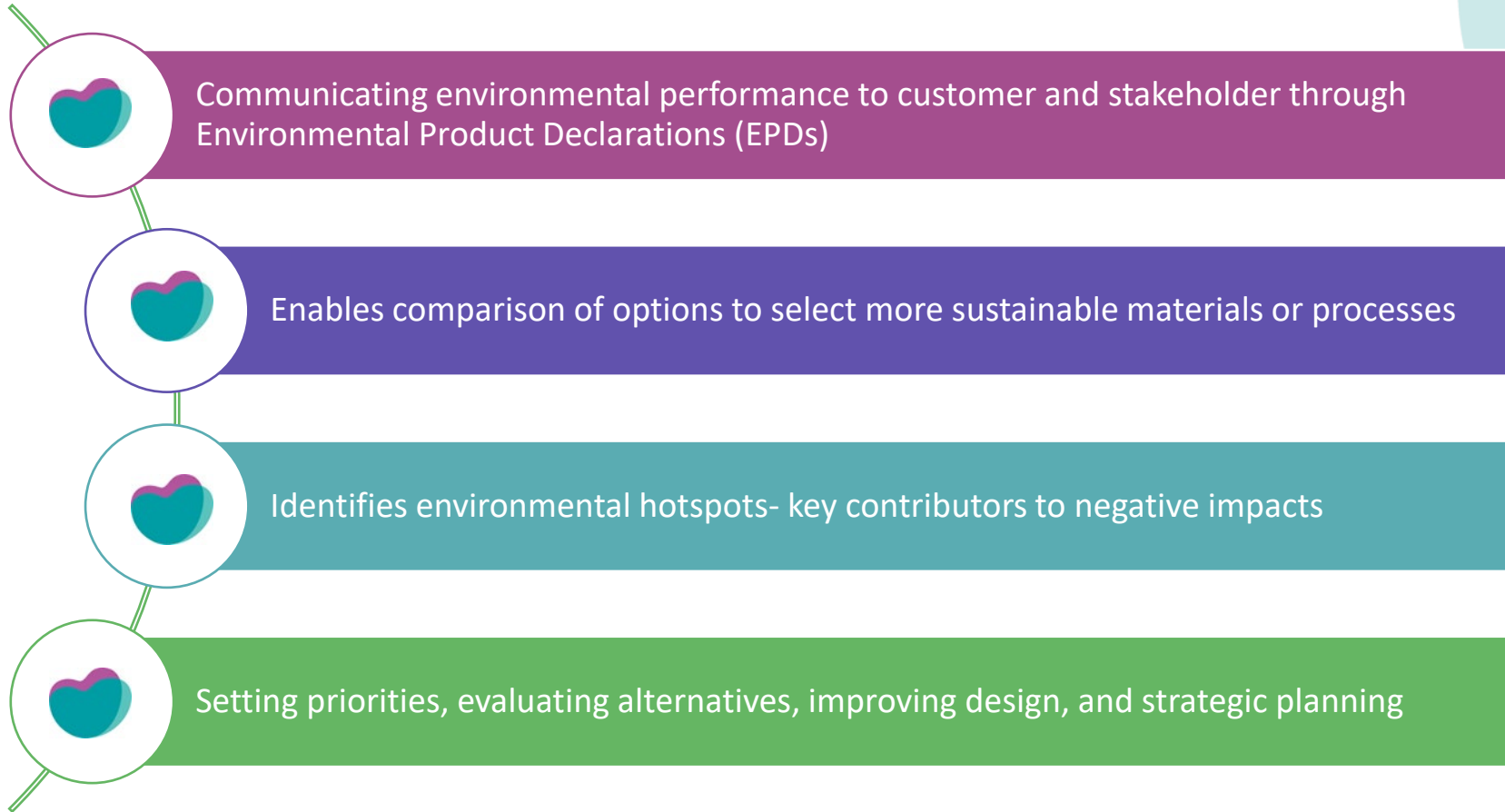
Project Contribution to achieve National/ International standards on Environmental Concern

- The 18 Environmental parameters considered for assessment are of serious Environmental concerns across the globe.
- Project gave an opportunity to evaluate & quantify various processes (old, new & import route) to arrive at option with minimum Environmental impact.
- It also helped in identifying optimum utilization of resources like energy/water and cost optimization.
- Gave insights into Sustainable procurement practices that have minimum Environmental impact.



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LONG TERM BENEFITS



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MAJOR LEARNINGS



