LIFE CYCLE ASSESSMENT OF NICKEL PRODUCTS

UNEP/SETAC Workshop on LCA and Metals

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STUDY DRIVER

Request from European Stainless Steel Industry to contribute data on the production of nickel, for inclusion in an LCI/LCA study on stainless steel.

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Study Goals and Intended Uses

Goals:

- **LCA of nickel products**
- **Meet ISO Standards on LCA (i.e. ISO 14040-42)**
- **Critical Review (5 members representing Europe, North America, and Australia)**

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Study Goals and Intended Uses

Intended Uses:

- assist process and product improvement
- assist with supporting and improving environmental management
- assist with internal and industry-wide benchmarking of environmental performance
- assist in development of environmental performance indicators
- assist companies with investment decision-making and the integration of environmental criteria in corporate business plans
- provide information to internal and external stakeholders

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Study Scope

- **Three nickel products:**
  - **Class 1 Nickel (i.e > 99% Ni)**
  - **Nickel Oxide (i.e. ~ 75% Ni)**
  - **Ferronickel (i.e. ~ 35-65% Ni)**

- **55% of world nickel production and 98% of the output of the participants (Falconbridge Ltd., Inco Ltd., Nippon Yagin Kogyo Company Ltd., Outokumpu Oy, QNI Pty. Ltd., Sherrit International, Sumitomo Metal Mining Co. Ltd., WMC Ltd., Societe Eramet)**

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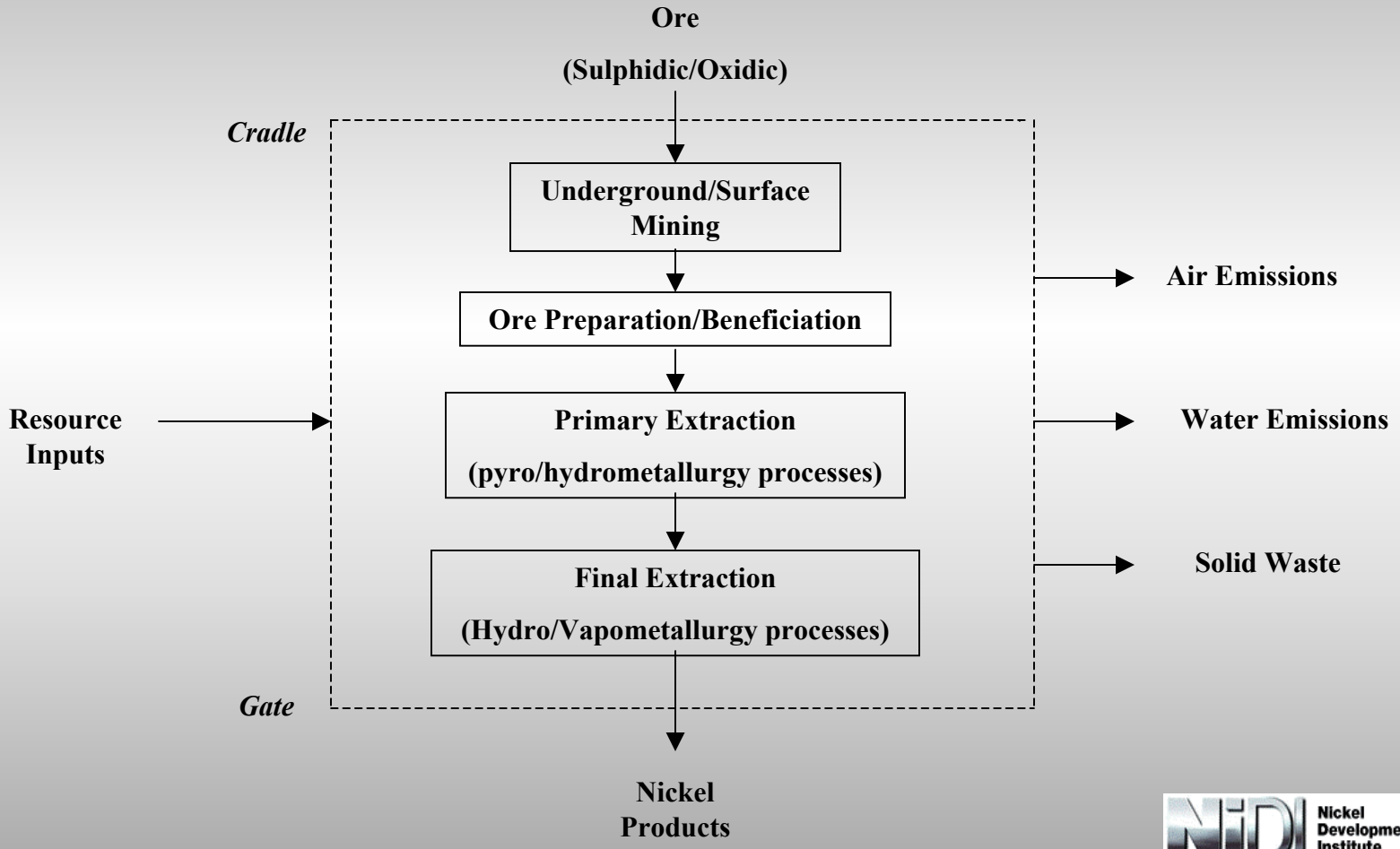
Study Boundary and Methodology

- **Cradle-to-gate study**



Study Boundary and Methodology

Cut-off Criteria

- 99.5% of collective mass of inputs (e.g. ore, fuels, intermediate products and ancillary materials) - achieved
- 99.5% of ancillary materials, only - achieved
- all environmentally relevant materials - achieved

Key Flows

- those intrinsic to impact categories selected (ISO mandated)
- those of interest to the industry and/or customers
- total of 72

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Study Boundary and Methodology

Co-Product Allocation

- **mass basis and partitioning**
- **used conservative allocation decisions to err on keeping burdens on nickel products rather than siphoning onto co- and by-products.**

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Study Boundary and Methodology

Impact Categories

- Global Warming
- Acidification
- Photochemical Smog
- Water Eutrophication
- Solid Waste
- Natural Resource Depletion, but with reservations
- Alienation of Land, methodology changed

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Study Boundary and Methodology

Exclusions

- Nickel Chemicals (i.e Nickel chloride, nickel sulphate)
- Product packaging – impact negligible
- Capital Equipment – impact negligible
- Human Activities – adds to complexity with no benefits
- Certain Impact Categories
  - Stratospheric ozone depletion – not relevant to nickel production
  - Eco- and Human Toxicity – no reliable and consistent methodologies for indicators
  - Biodiversity – no reliable indicators

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Difficulties and Challenges

Data Collection, Data Quality, and Data Manipulation:

- **Ancillary materials information difficult to collect**
- **Uneven – emissions data driven by jurisdictional legal requirements**
- **Estimates (i.e. Surrogates)**
- **Exclusion of Russian (and other) production**

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Difficulties and Challenges

Allocations

- **Treatment of marginal value co-products and by-products (e.g. sulphuric acid/liquid SO2 production)**

- **Treatment of high value by-products (e.g. Ammonium Sulphate production)**

- **Slag**

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Difficulties and Challenges

Modeling:

- **Unlike some metals, nickel production encompasses numerous processes (e.g. hydrometallurgical, pyrometallurgical, vapometallurgical)**
- **Different ore types (oxidic versus sulphidic)**
- **Tailings effluent**
- **Impact Categories**
  - **Natural resource Depletion**
  - **Eco- and Human Toxicity – no reliable and consistent methodologies for indicators**
  - **Biodiversity – no reliable indicators**

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Path Forward

- **Best available information at the time**
- **Steering Committee retained.**
- **Will update when significant changes made to production technologies**
- **Decisions to be made:**
  - **expand scope to include Russian etc. production?**
  - **consider uniform emissions coverage**
  - **consider speciation**

Full report is available at www.nidi.org/environment/lca

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