

HIGH PRODUCTION VOLUME CHEMICALS – UNDERSTANDING THE POLLUTION PREVENTION IMPLICATIONS

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Perspective on the Universe of Chemicals in Commerce

- General definition - >1 mt/yr in production
- Origin is the New Source Registration Program at USEPA, FDA, and US Dept. of Agriculture

- ~ 100,000 chemicals
- Of which ~ 30,000 are polymers
 - ~ 10,000 are drug-related (FDA)
 - ~ 10,000 are agricultural chemicals (USDA)
- Grows at about 1%/year

Commodity Chemicals

- Designation in the Chemical Industry for the high product volume in commerce
- Usually these are 50 in number
 - 60% are organics (in the range or 1.5 – 15 million metric tons per year)
 - 40% are inorganics (in the range of 1-45 million metric tons per year)

- Chemicals in commerce tend to be linked in supply chains
- These links are to achieve molecular building
- A complex chemical might be a drug with about 200 chemical plants linked
- There are also biosynthetic supply chains
- There are also simpler extraction routes

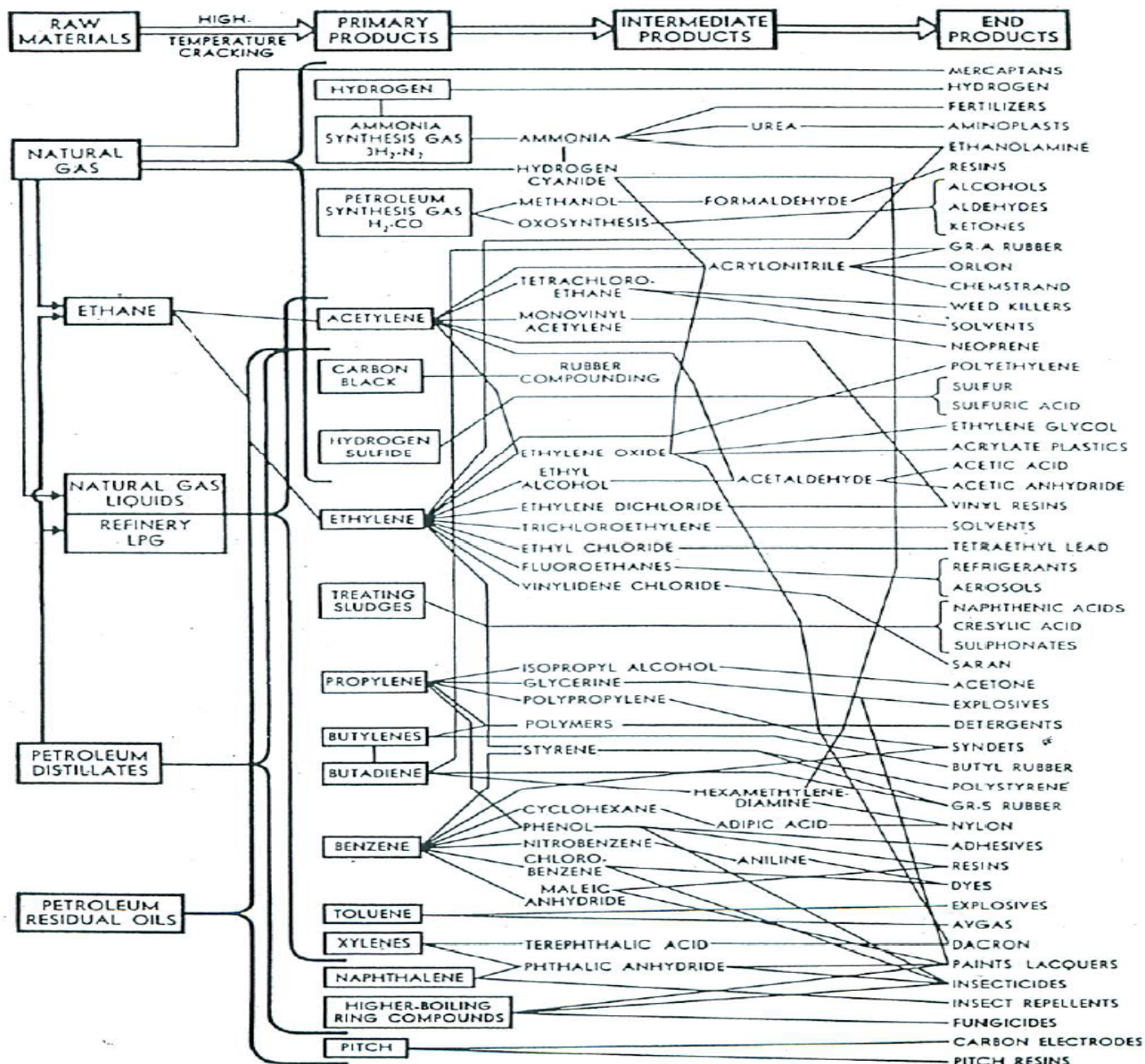


FIG. 20-1. Some of the petrochemicals that can be produced from natural gas, natural-gas liquids, and petroleum. (Pet. Refiner.)

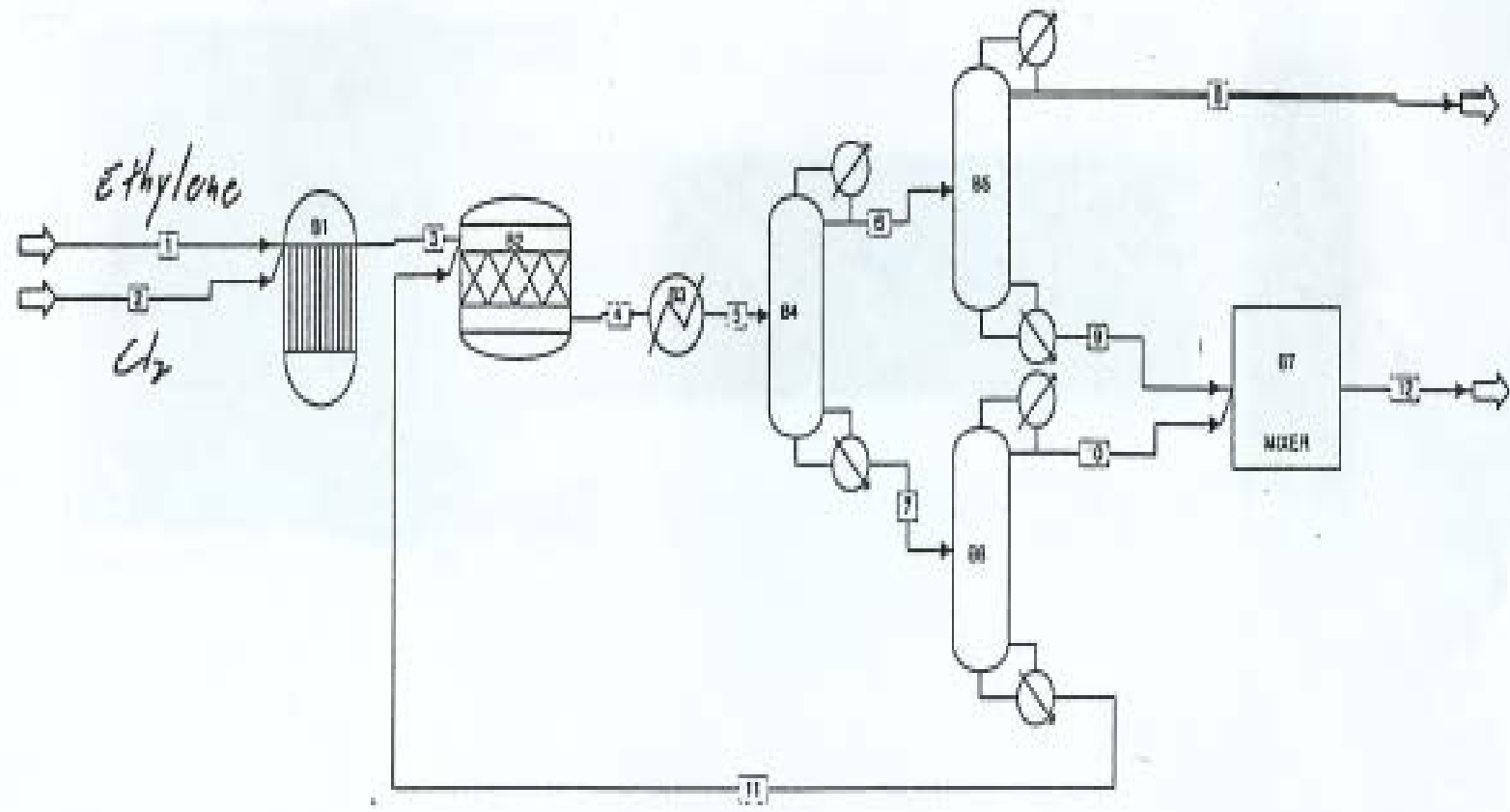
High Production Volume Chemicals

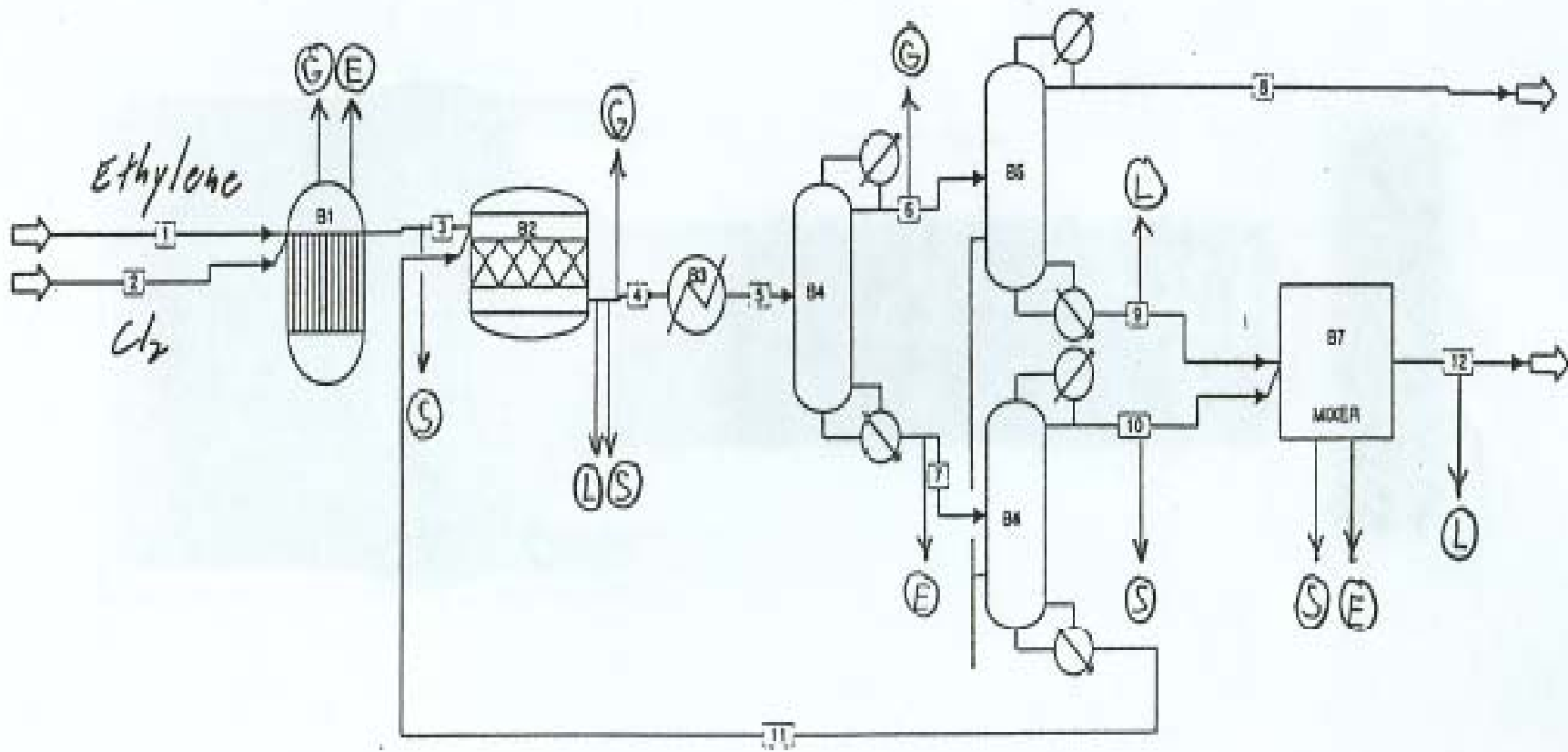
- About 2800 chemicals
- Appear to be almost all organics
- Not yet developed correlations with other lists used in industry or in research

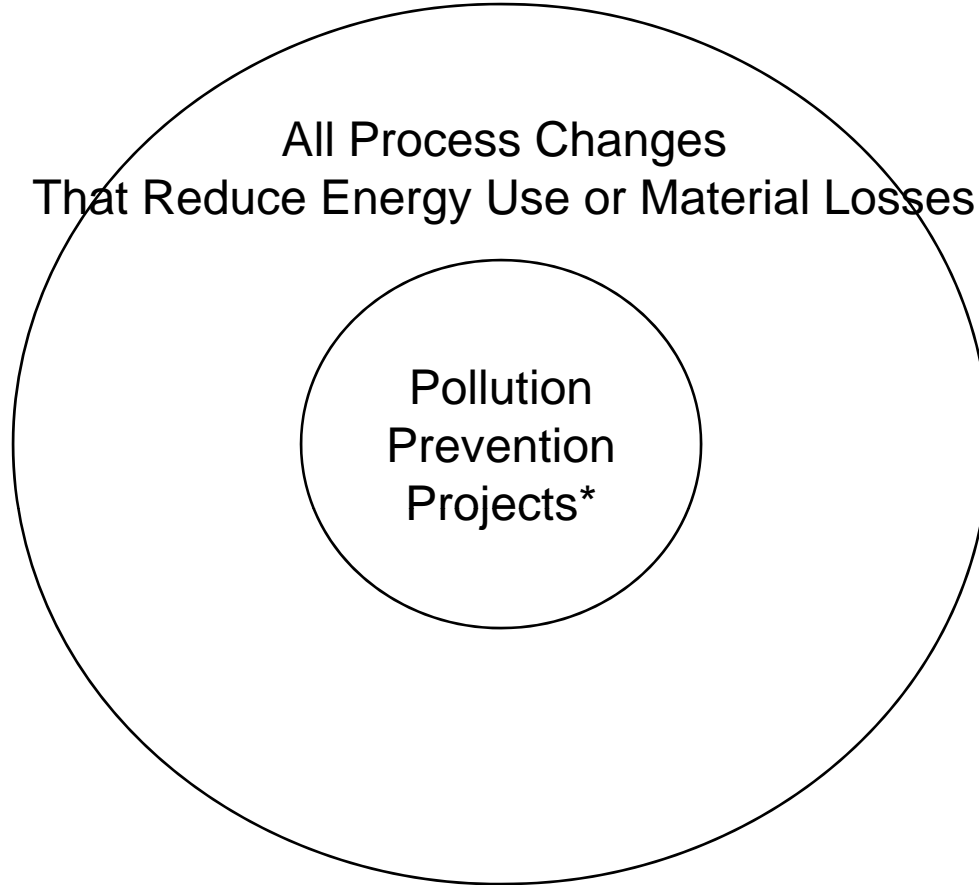
Perspective on Pollution Prevention

SIMILAR CONCEPTS

- **POLLUTION PREVENTION (P2)**
- **CLEAN PRODUCTION**
- **WASTE REDUCTION**
- **CLEANER TECHNOLOGY**
- **WASTE MINIMIZATION**
- **ENVIRONMENTALLY-CONSCIOUS
MANUFACTURING**
- **ENVIRONMENTALLY BENIGN DESIGN AND
MANUFACTURING**
- **GREEN CHEMISTRY**







* Cost-Effective Changes

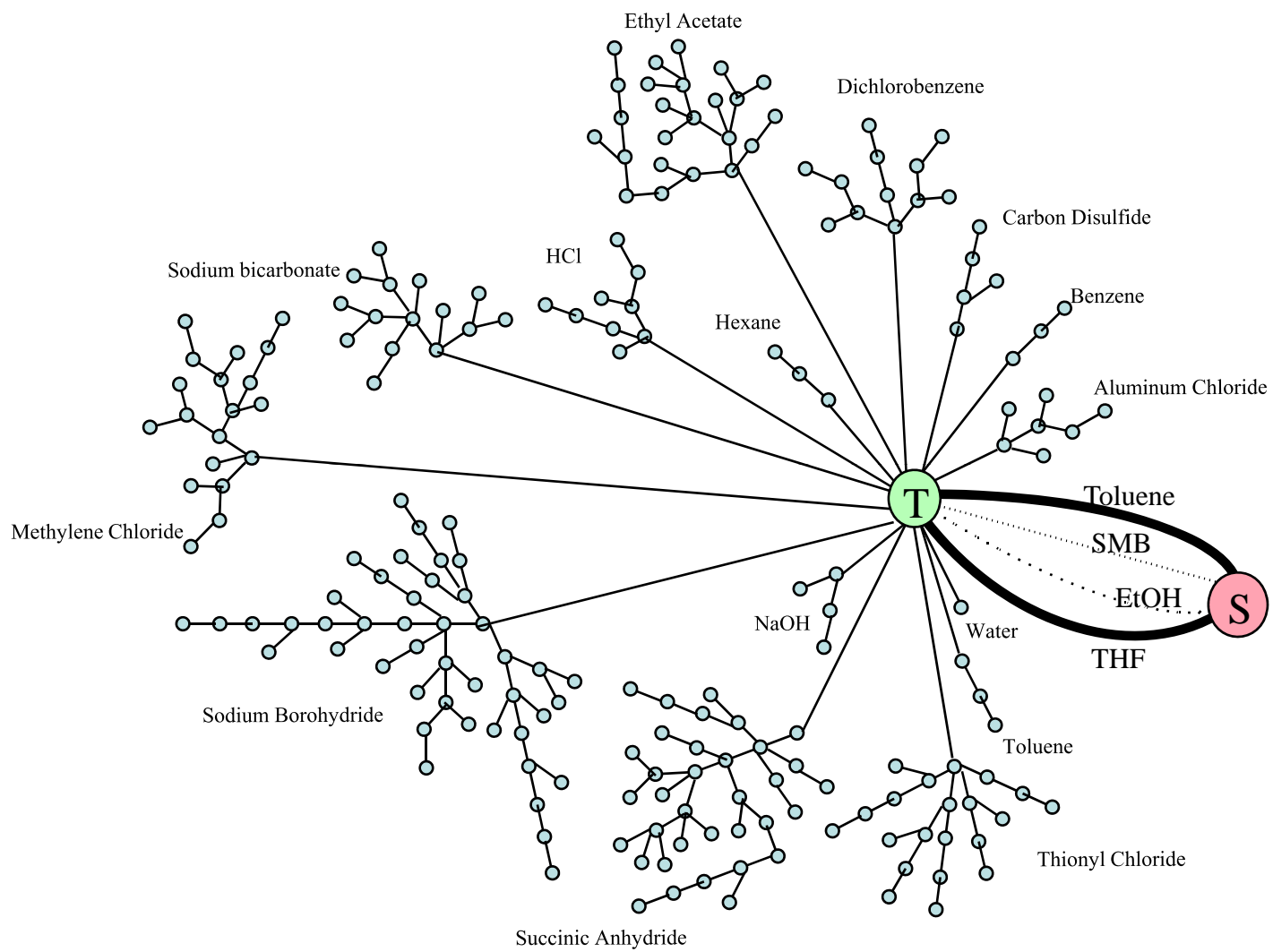
Context of Pollution Prevention Within All Possible Process Changes

Sources of P2 Case Studies

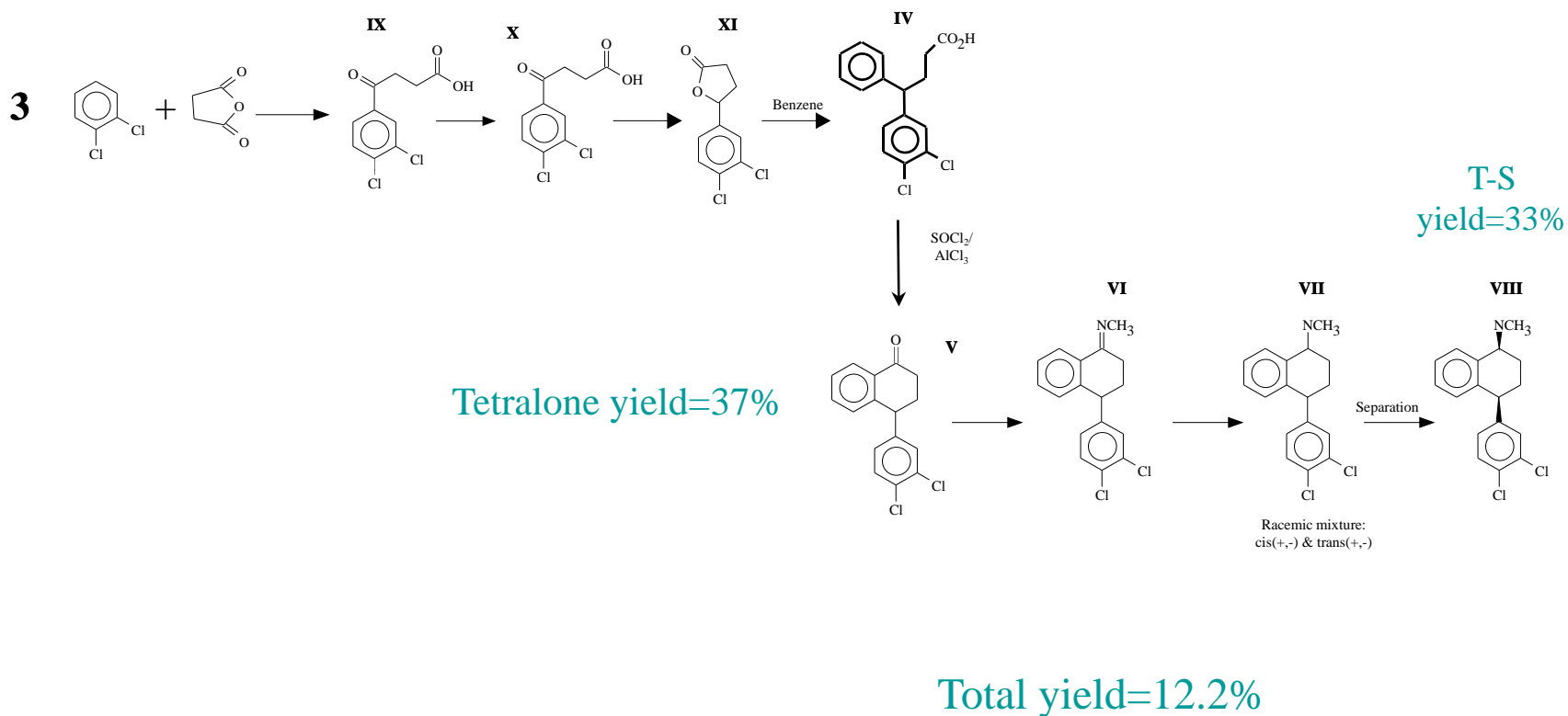
- Pollution Prevention Library of Case Studies (North Carolina Office of Waste Reduction) – About 35,000 On-line Papers or Reports (2006)

– <http://www.P2PAYS.org>

- Third Perspective on This Field
 - REACH (Registration, Evaluation, and Authorization of Chemicals)
 - Similar Programs in US and Japan
 - Provide information on chemicals
 - toxicity, environmental impact, ecological (short term)
 - Life cycle information (long term)
 - Stimulate changes to reduce adverse impacts
 - Pollution prevention will often be used

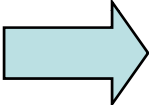


“Carbon frame” efficiency



10% IMPROVEMENT IN CARBON UTILIZATION EFFICIENCY

- **WITHIN THE COMPANY (kg/kg Sertraline):**

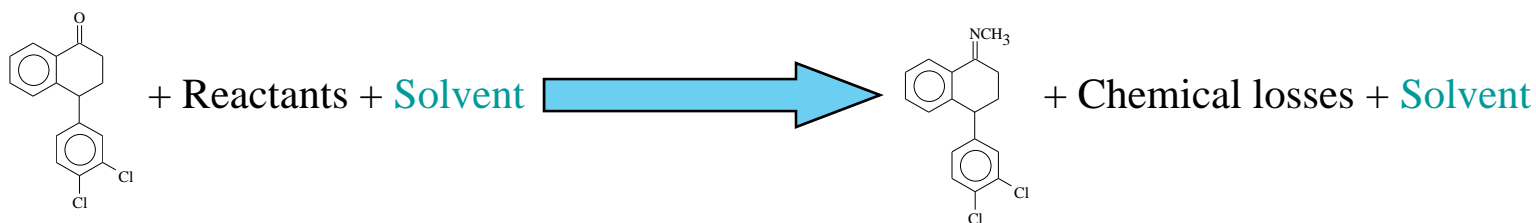
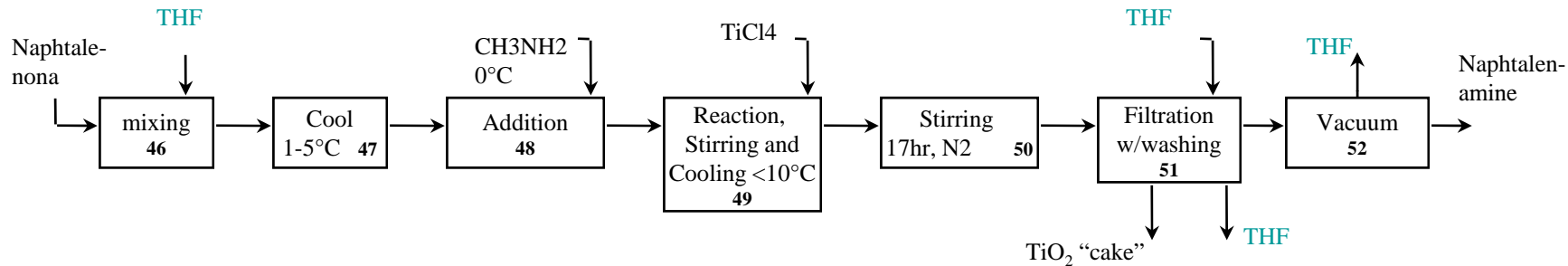
97  96 \leftrightarrow 1 (most waste is solvent)

- **THROUGHOUT THE PHARMACEUTICAL COMPLEX (kg/kg Sertraline)**

39,098  35,794 \leftrightarrow 3,304


Over 3,000-fold greater impact

Solvent usage efficiency



10% IMPROVEMENT INSOLVENT USAGE

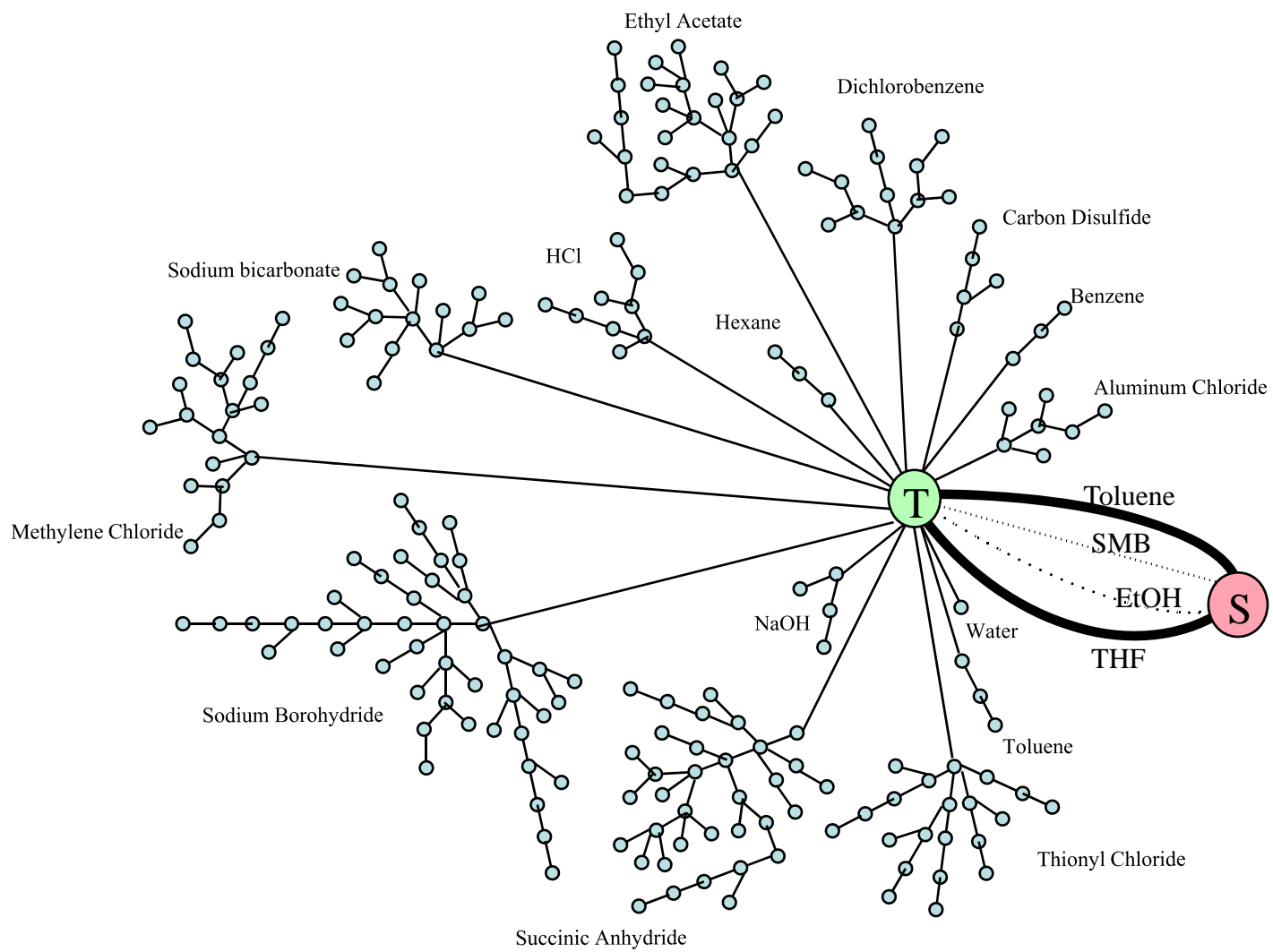
- WITHIN THE COMPANY (kg/kg Sertraline)

97  89 \longleftrightarrow 8

- WITHIN THE PHARMACEUTICAL COMPLEX
(kg/kg Sertraline)

39,098  38,493 \longleftrightarrow 605

LARGER EFFECT WITHIN COMPANY,
BUT GREATEST IMPACT IS OUTSIDE COMPANY



P2 Solutions

- Recycle – increases yield and reduces the entire supply chain
- Prevention – substitution leads to introduction of a new segment of the supply chain
 - increased yield and reduces the entire supply chain
- Reuse – eliminates the production of the reused material thus improving the impact of the product incorporating the reused material
- Use of Products – chemicals affect efficiency of the next stage in the supply chain

All of these pollution prevention solutions
can have beneficial or adverse effects
as we seek to improve the situation for
HPV chemicals

Future Work

- Perform an example of life information for 1-4 HPV chemicals to help those working on improvement to see some of the hidden benefits of change.
- Examine the human health assessment (DALY's) from the supply chain versus the use of an HPV chemical to see the relative importance of information.

Conclusions

1. HPV and other chemicals are a part of the large scale societal use of “chemicals in commerce”
2. Environmental improvements for HPV from pollution prevention must also be reviewed in terms of the life cycle effects on human health and the environment
3. A challenge is to make the HPV lists more useable and searchable in the techniques used for P2