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THE AMERICAN MANUFACTURING RENAISSANCE

Opportunities and Challenges for Pretreatment Permitting

AGENDA

The Industrial Pretreatment Program

The Changing Drivers

Case Studies

Secondary Impacts

Wrap-up

Q&A

GEOSYNTEC TEAM

Lisa Andrews,
PE (ME, MN)

Beth Toot-Levy

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THE INDUSTRIAL PRETREATMENT PROGRAM

As we know it today….

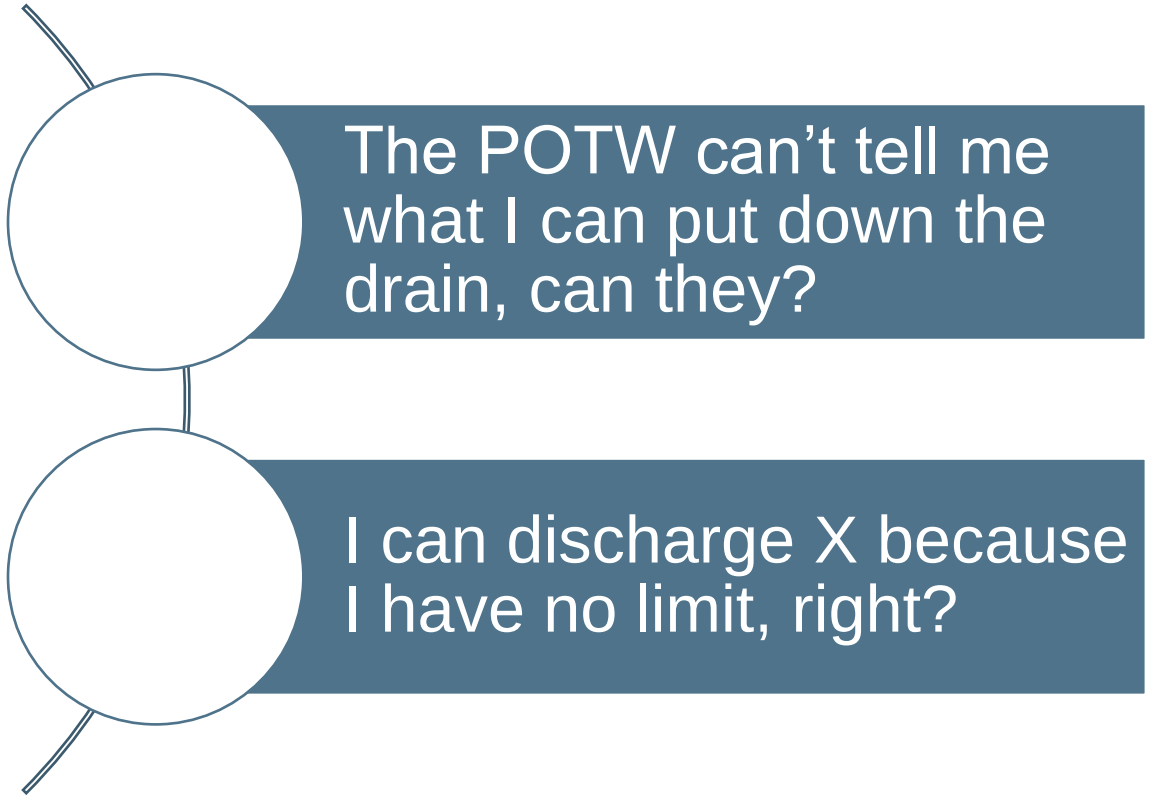
PRETREATMENT STANDARDS

- General and specific prohibitions
- Categorical pretreatment standards
- Local limits

EPA'S POLLUTANTS OF CONCERN

Arsenic	Cadmium	Chromium	Copper	Cyanide
Lead	Mercury	Nickel	Silver	Zinc
Molybdenum	Selenium	BOD5	Total Suspended Solids	Ammonia

ADDRESSING "NEW" POLLUTANTS



- Local limits are not limited to the 15 pollutants
- New parameters of concern from new production processes may require additional study
- The General and Specific Prohibitions can cover A LOT!
- May be moving to more site-specific limits

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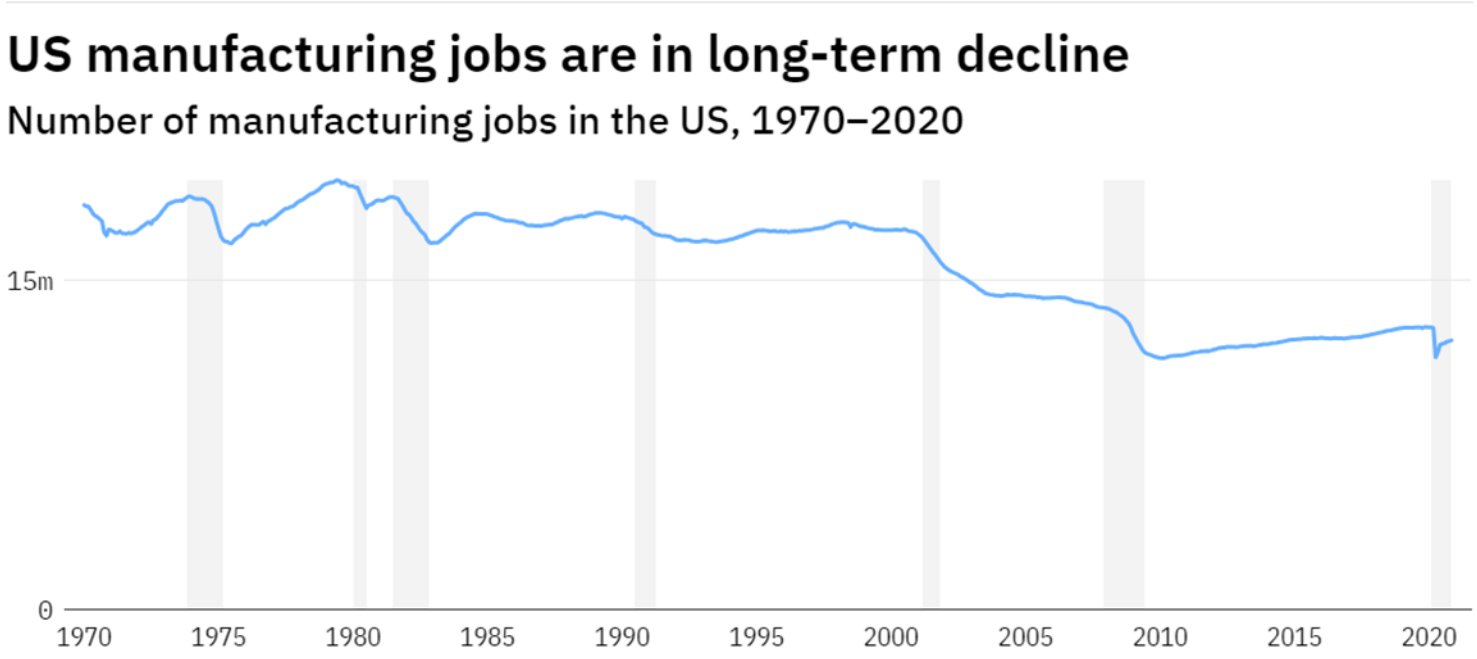
THE CHANGING DRIVERS

50 YEARS OF CHANGE

1945, more steel was produced in the state of Pennsylvania alone than in Germany and Japan combined.

Between 1969 and the present day, nearly every aspect of the country's workforce has changed.

Between 2000 and 2010, when the US lost one-third of its manufacturing jobs (6 million jobs)

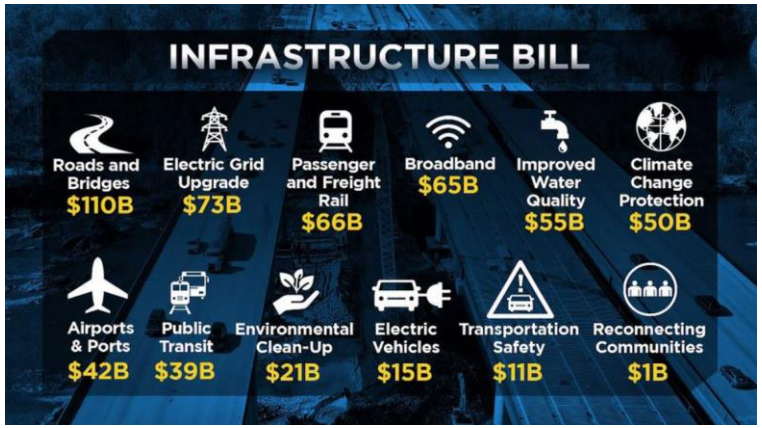


Source: https://www.investmentmonitor.ai/manufacturing/who-killed-us-manufacturing/

50 YEARS OF CHANGE

- Industries like computer programming, coding, and alternative energy sectors were all but unimaginable half a century ago
- Computer and electronics manufacturing grew by 2,607% between 1987 and 2017
- The rapid adoption of technology over the past 10 years has meant a majority of firms are now technology-focused
- Wider range of industries means more specialized training
- the rise in adoption of digital technologies will be a driver for transformation for industry
- more jobs require specialized training in computers, coding, or fluency in social media.

TODAY'S INDUSTRIAL DRIVERS



MAY 09, 2022

Using Additive Manufacturing to Improve Supply Chain Resilience and Bolster Small and Mid-Size Firms

IMPACTS ON PRETREATMENT

These changes are impacting local pretreatment programs

What pollutants are in these discharges?

How do the existing categorical limits apply to the new industries?

How can we protect the POTW if the federal rules don't cover the constituents of concern?

CASE STUDIES

SEMICONDUCTORS

- Economic and community impacts
- Water and wastewater demand
- Applicability of the categorical standards
- Applicability of other categorical standards
- NPDES/Pretreatment permitting

BATTERY MANUFACTURING

- Impacts of EVs
- Changes in battery technology
- Applicability of the categorical standards
- NPDES/Pretreatment permitting

SECONDARY IMPACTS

- Centralized waste treatment
- Community growth associated with industrial growth

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SEMICONDUCTOR MANUFACTURING

THE SIGNIFICANCE OF SEMICONDUCTORS

Global Semiconductor Silicon Wafer Market Size is Predicted to Achieve USD 15 Billion by 2030, Showing Steady Growth at a 3.6% CAGR from 2022 to 2030

Silicon wafer production and demand are growing due to increased demand for compound semiconductors, analog optics, power devices, microelectromechanical systems (MEMS), and discrete semiconductors.

October 05, 2023 11:40 ET| Source: **Straits Research** Follow


wshu | Public Radio

Connecticut News

$200 million expansion of Wilton semiconductor facility breaks ground

WSHU | By Michael Lyle Jr.
Published September 13, 2022 at 8:08 AM EDT

- **Over 60 new semiconductor ecosystem projects announced across the U.S.**, including the construction of new semiconductor manufacturing facilities (fabs), expansions of existing sites, and facilities that supply the materials and equipment used in chip manufacturing
- **Over $210 billion in private investments announced across 22 states** to increase domestic manufacturing capacity
- **44,000 new high-quality jobs announced in the semiconductor ecosystem** as part of the new projects, which will support hundreds of thousands of additional jobs throughout the broader U.S. economy

U.S. semiconductor companies

Among the biggest semiconductor companies, a large proportion are based in the United States. In addition to Intel, notable U.S. semiconductor vendors include Micron Technology, Qualcomm, and Broadcom. As a whole, U.S. semiconductor companies account for around 50 percent of the global market, ahead of several Asia-Pacific countries such as South Korea, Japan, Taiwan, and China.

CHIPS AND SCIENCE ACT OF 2022

Creating Helpful Incentives to Produce Semiconductors for America (CHIPS for America)

- Signed into law August 9, 2022
- Bolster US semiconductor capacity, increase global competitiveness, and improve national security
- Increase research and development into leading edge technologies
- Create regional high-tech hubs
- Develop STEM workforce

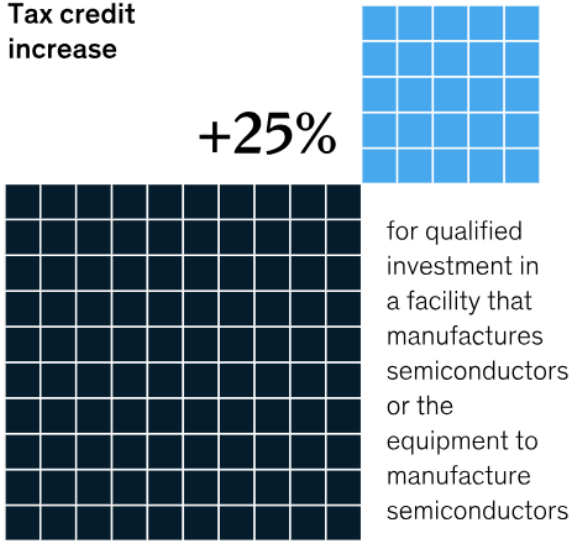
THE NUMBERS $$$

- $280 billion over 10 years
  - $200 billion for scientific research and development to increase commercialization
  - $52.7 billion for semiconductor manufacturing, R&D, and workforce development
  - $24 billion worth of tax credits for chip production
  - $3 billion for programs aimed at leading-edge technology and wireless supply chains

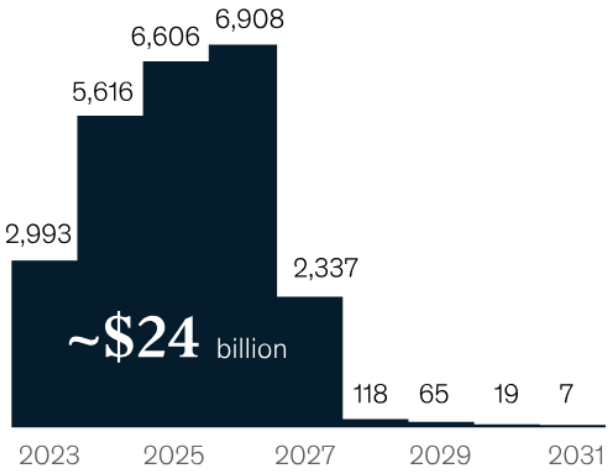
PRIVATE INVESTMENT FUNDING

Semiconductor investment tax credit of $24 billion for private investment through the end of 2026

Advanced manufacturing investment tax credit



Estimated outlays of advanced manufacturing investment tax credits by US Treasury, $ million



Source: Congress.gov; Congressional Research Service; Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act of 2022, H.R. 4346, 117th Cong. (2022); "Estimated budgetary effects of H.R. 4346, Divisions A and B," Congressional Budget Office; William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021, Public Law 116–283

McKinsey & Company

INTEL EXAMPLE

Intel Announces Next US Site with Landmark Investment in Ohio

Intel will invest more than $20 billion to build two new factories and to establish a new epicenter for advanced chipmaking in the Midwest.

intel newsroom

INTEL IN OHIO

Largest single private-sector investment in Ohio history

- 3,000 jobs at Intel
- 7,000 construction jobs
- Additional long-term jobs for suppliers and partners
- Construction has begun
- Production slated to begin in 2025
- Will be the largest consumer of water in Columbus
  - Initial use at 5 MGD

$20B
Economic Impact

3,000
Ohio Employees

$100M
Education

100%
Renewable Energy

WHERE DOES ALL OF THE WATER GO?

Semiconductor production has traditionally required significant amounts of water

- Production of one CHIP can use as much as 2,200 gallons of ultra pure water

Globally Intel is reducing water usage globally

- Currently still producing a significant amount of wastewater, much of which is sent to municipal wastewater treatment plants
- Regulated as part of the Industrial Pretreatment Program
- Federal Categorical Standard (40 CFR 469) is applicable to some semi-conductor manufacturing
- Local pretreatment programs are regulating via 40 CFR 469, traditional local limits and site-specific limits

40 CFR 469 - ELECTRICAL AND ELECTRONIC COMPONENTS POINT SOURCE CATEGORY

Subpart A: Semi-conductor Subcategory

(PSES).

Except as provided in 40 CFR 403.7 and 403.13, any existing source subject to this subpart which introduces pollutants into a publicly owned treatment works must comply with 40 CFR part 403 and achieve the following pretreatment standards for existing sources (PSES):

(a)

SUBPART A - SEMICONDUCTOR PSES EFFLUENT LIMITATIONS

Pollutant or pollutant property	Maximum for any 1 day	Average of daily values for 30 consecutive days
	Milligrams per liter (mg/l)	
TTO [1]	1.37	([2])

[1] Total toxic organics.

[2] Not applicable.

(b) An existing source submitting a certification in lieu of monitoring pursuant to § 469.13 (c) and (d) of this regulation must implement the solvent management plan approved by the control authority.

CHANDLER ARIZONA PRETREATMENT PERMIT

INDUSTRIAL USER PERMIT NO. 9, Rev. 01(d)

PART I - DISCHARGE LIMITS AND MONITORING (SAMPLING) REQUIREMENTS

A. The following process operations are conducted at the facility and result in the Discharge of Wastewater through the compliance sampling point described in Part I.B.:

40 Code of Federal Regulations (CFR) Part 433.17, Subpart A – Metal Finishing, New Source

Intel CH1 Facility – Substrate (PCB) Packaging Manufacturing Operations

Intel CH4 Facility - Semiconductor Assembly and Packaging Operations

Intel CH6 Facility - Research and Development Lab Operations

Intel CH8 Facility - Substrate (PCB) Packaging Manufacturing Operations

https://www.exploreintel.com/chandler

CHANDLER, ARIZONA

40 CFR 433.14, Subpart A PSNS

Parameter	Federal Limits	
	Daily Maximum	Monthly Average
Cadmium (Total)	0.11	0.07
Chromium (Total)	2.77	1.71
Copper (Total)	3.38	2.07
Lead (Total)	0.69	0.43
Nickel (Total)	3.98	2.38
Silver (Total)	0.43	0.24
Zinc (Total)	2.61	1.48
Total Toxic Organics[5,6]	2.13	N/A

City Discharge Limitations

Parameter	Daily Maximum[5] or Instantaneous Maximum[5]	Minimum Sampling Frequency[4,5]
Arsenic (Total)	1.83	2 / year
Boron (Total)	20.02	2 / year
Cadmium (Total)	0.50	2 / year
Chloroform	3.09	2 / year
Chromium (Total)	3.59	2 / year
Copper (Total)	12.51	2 / year
Cyanide (Total)	3.00	2 / year
Lead (Total)	3.84	2 / year
Manganese (Total)	8.34	2 / year
Mercury (Total)	0.17	2 / year
Molybdenum (Total)	0.62	2 / year
Nickel (Total)	5.00	2 / year
Selenium (Total)	0.58	2 / year
Silver (Total)	2.50	2 / year
Zinc (Total)	75.06	2 / year
Oil & Grease	834.00	2 / year
Fluoride	83.40	2 / year
Biochemical Oxygen Demand (BOD)	1,409	2 / year
Total Suspended Solids (TSS)	1,820	2 / year

RIO RANCHO, NM PRETREATMENT PERMIT

ENDORSEMENT A52

40 CFR 469 CATEGORICAL DISCHARGE LIMITS
ELECTRICAL & ELECTRONIC COMPONENTS
SUBPART A - SEMICONDUCTOR
469.16 Pretreatment Standards for Existing Sources (PSES)

COMPLIANCE REQUIREMENT: The Permittee shall comply at all times with the Code of Federal Regulations, 40 CFR Part 469.A.16, Pretreatment Standards for Existing Sources (PSES).

40 CFR 469.A.16 PSES Categorical Discharge Limits for Semiconductor Manufacture are as follows:

Pollutant	Daily Maximum Limit	Monthly Average Limit
TTO[1]	1.37 mg/L	n/a

[1]Total Toxic Organics

In lieu of monitoring for TTO, the Permittee must fill out the certification statement in endorsement TC3.

MONITORING REQUIREMENT: None required by the Permittee.

RIO RANCHO, NM PRETREATMENT PERMIT

ENDORSEMENT CE

SPECIAL WASTESTREAM POLLUTANT LIMITATIONS
FOR PERMIT 2021

COMPLIANCE REQUIREMENT:
The concentration of Cerium at the permitted sampling point shall not exceed the discharge limits shown below:

POLLUTANT	MAXIMUM FOR ANY 1-DAY	MONTHLY AVERAGE
Cerium	12.0 mg/L	3.0 mg/L

All analysis must be conducted using EPA approved methods or method approved by Industrial Pretreatment Engineer/Program (Pretreatment).

A higher limit may be considered at a later date if no issues are noted at the Southside Water Reclamation Plant (SWRP) and/or with the SWRP effluent and biosolids.

Intel will continue to cover the all sampling costs for Pretreatment and Intel sampling of Cerium.

RONLER ACRES, OREGON

The wetlands at Ronler Acres discharge to Dawson Creek, a tributary of the Tualatin River.

PERMIT CLASSIFACTION:
Categorical Industrial User: 40 CFR 469.18 subpart A and Local Limits

SOURCE COVERED BY THIS PERMIT:
Electrical and Electrical Components: Semiconductor Subcategory

TYPE OF WASTE	OUTFALL	LOCATION
Pretreated wastewater – N2	6	45.548182, -122.919670
Pretreated wastewater – PAWN	7	45.546118, -122.920073
Pretreated wastewater – WATR	8	45.548367, -122.922496
Pretreated wastewater – CALC	10	N/A
(Inactive) Pretreated wastewater – IWW	5	45.542600, -122.923735

SEMICONDUCTOR WASTEWATER

40 CFR 469 was promulgated in 1983!

Permitting Guidance for Semiconductor Manufacturing Facilities – Published in 1998

Does this adequately address today's semiconductor manufacturing?

CIUS: OLDER RULES, NEWER PROCESSES

Semiconductors

40 CFR Part 469?

40 CFR Part 463?
40 CFR Part 433?

Services

Specialty chemicals

Specialty parts

Centralized waste treatment

Technical services

40 CFR Part 437?

Organic chemicals

40 CFR Part 414?

Inorganic chemicals

40 CFR Part 415?

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BATTERY MANUFACTURING

Old Rules, New Processes

THE EV BOOM

US Added Over 188K EV-Related Jobs In Recent Years, Led By Tesla

President Biden's EV push contributed to creating EV investment and job hotspots across America.

"This is the largest transition in our industry since its inception," said Tony Totty, the president of a United Auto Workers local that represents G.M. workers in Toledo.

New electric vehicle battery plants drive manufacturing boom

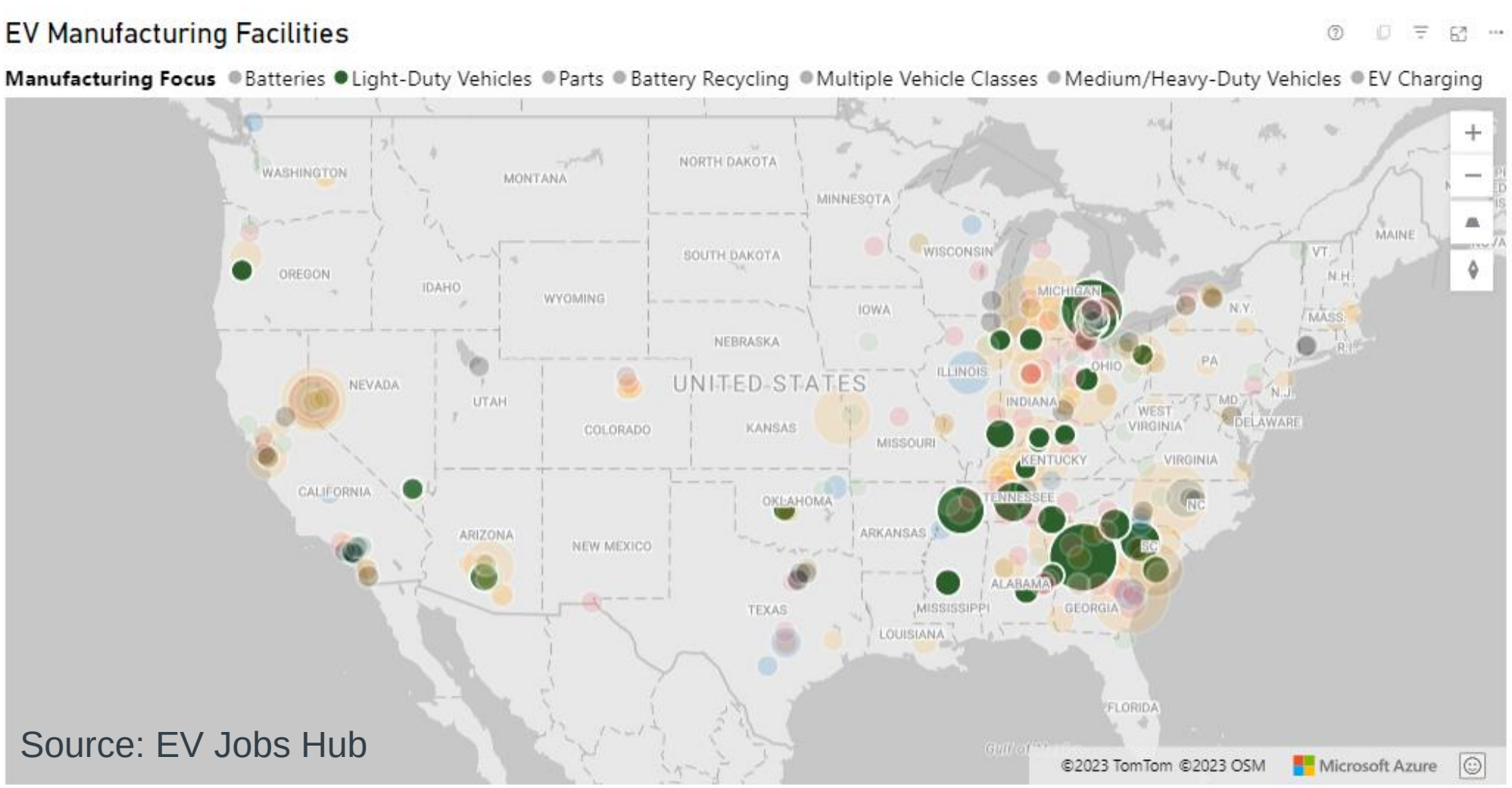
In Ohio, Electric Cars Are Starting to Reshape Jobs and Companies

The state, heavily dependent on the auto industry, is a case study in whether electric vehicles will create or destroy jobs.

The coming transformation of the auto industry

EV MANUFACTURING FACILITIES

ANNOUNCED SINCE 1/1/2018



Source: EV Jobs Hub

46

Total Facilities (Light Duty)

$32B

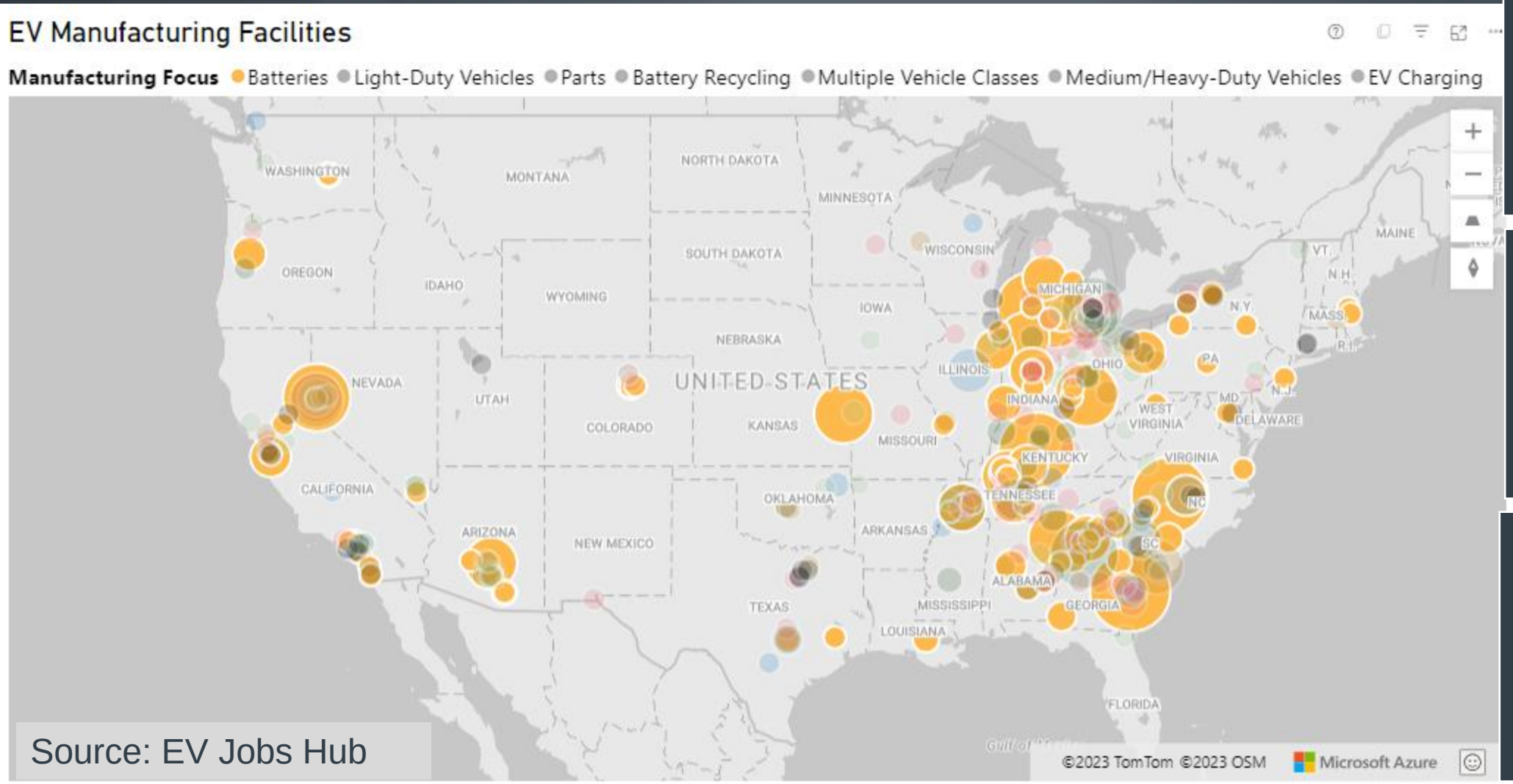
Announced EV Investment

47,000

Announced EV Jobs

BATTERY MANUFACTURING FACILITIES

ANNOUNCED SINCE 1/1/2018



Source: EV Jobs Hub

146

Total Facilities

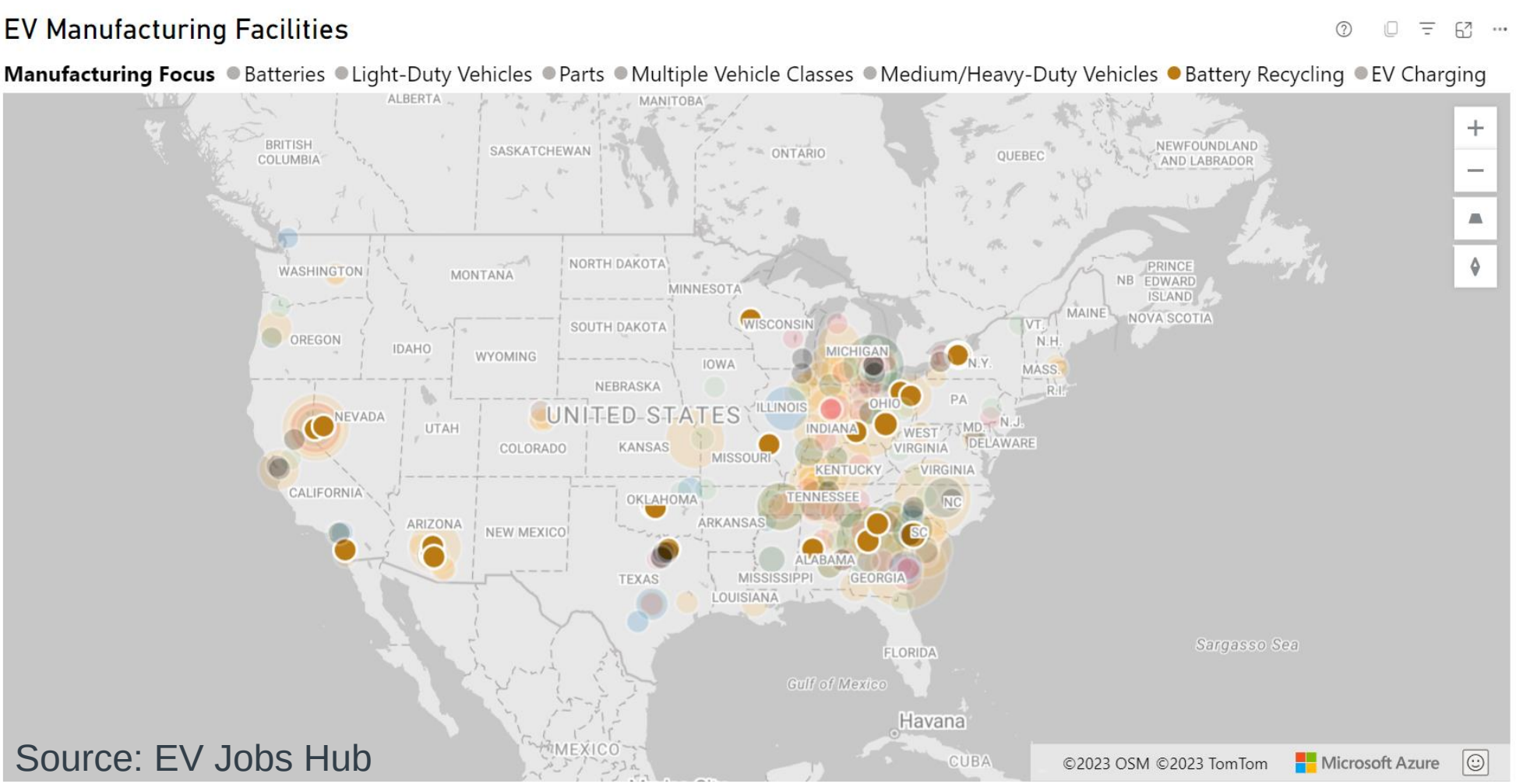
$100B

Announced Investment

83,000

Announced Jobs

EV BATTERY RECYCLING FACILITIES



Source: EV Jobs Hub

38

Total Facilities

$1B

Announced Investment

1,000

Announced Jobs

THE ELECTRIC VEHICLE INDUSTRY IS TRANSFORMING COMMUNITIES

Foreign battery manufacturers are opening dozens of new US plants to be near the automakers

- Increasing populations in small towns
- Associated industries
- Commercial services

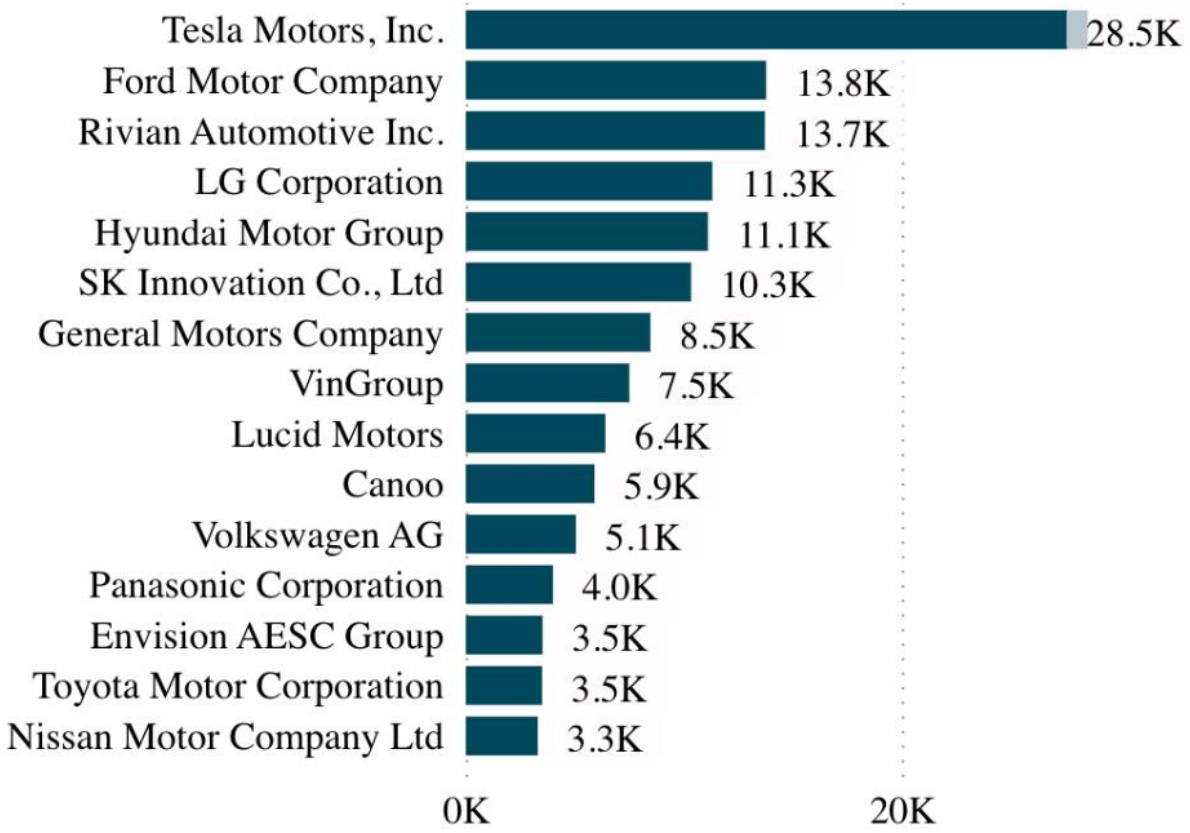
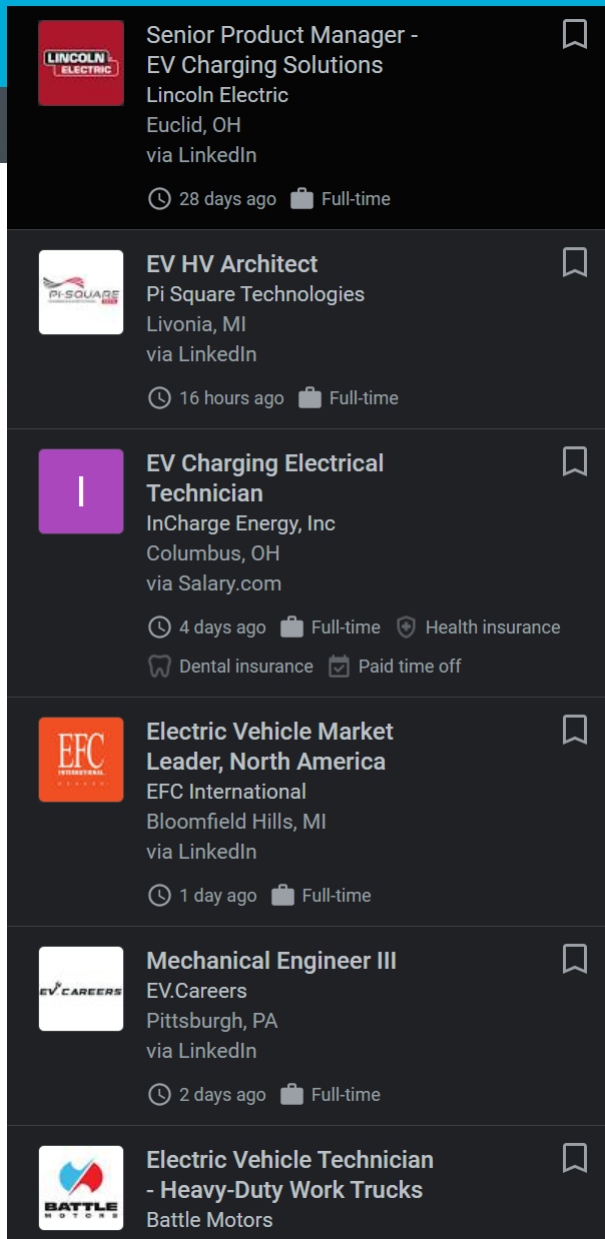


Image Credit: Blue Green Alliance Foundation/Atlas Public Policy



WHAT DOES THIS MEAN FOR WASTEWATER UTILITIES?

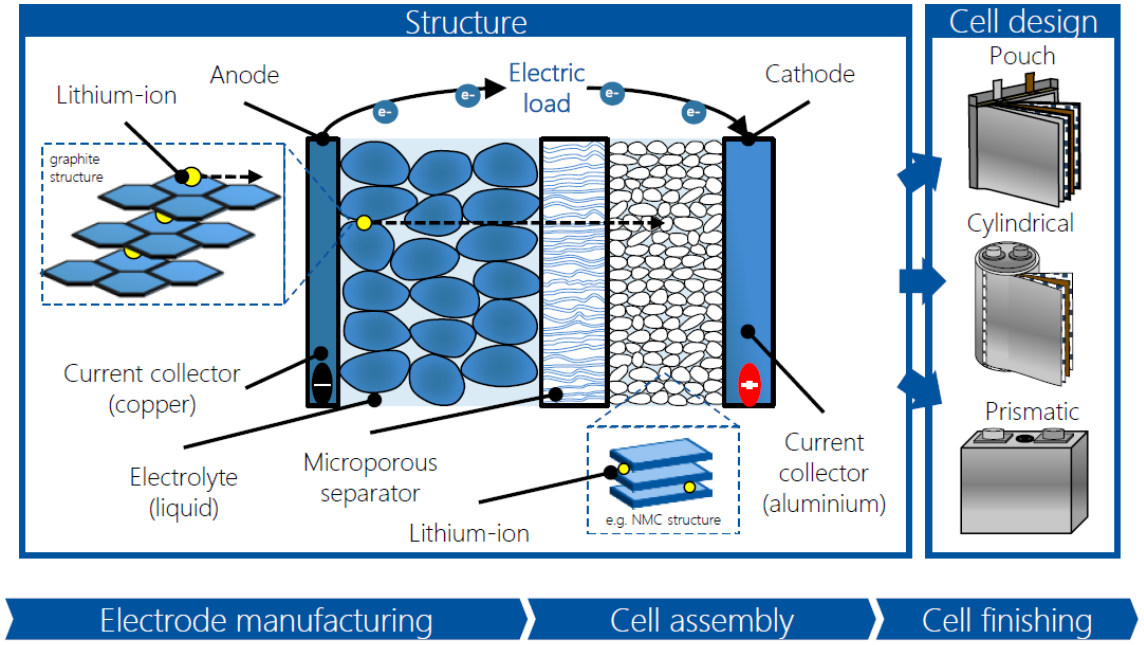
Increased Residential and Commercial Wastewater

Increased Industrial Wastewater Volume and Strength

Industrial Pretreatment Programs

BATTERIES FOR HYBRID AND BATTERY ELECTRIC VEHICLES

- Modern lithium-ion batteries
  - Cathode: $Li(Ni_xMn_yCo_z)O_2$
  - Anode: graphite-based
- Sheet metal-based current collectors
- Specialty electrolytes
- Aluminum battery housings
- Specialty organic compounds for solvents and binders



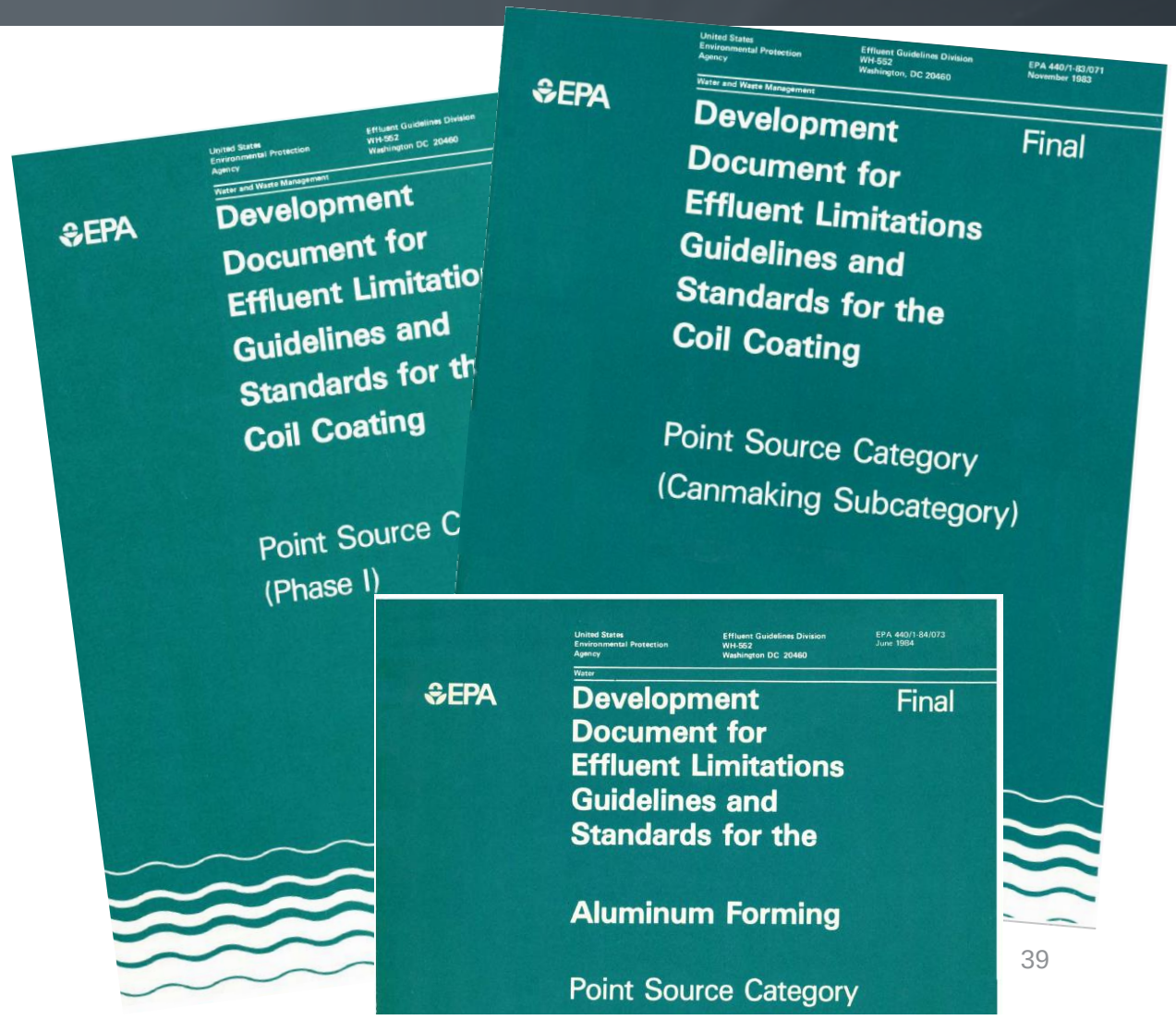
Aachen University and German Mechanical Engineering Industry Association, *Lithium-Ion Battery Cell Production Process*.

MAJOR PRODUCTION ACTIVITIES

Cathode and Anode Materials	Electrode Manufacturing	Cell Assembly	Formation	Battery Housing	Other
• Chemical mixing	• Coating • Drying	• Winding • Pressing • Electrolyte filling	• Charging • Degassing • Testing • Aging	• Sheet metal handling • Metal working	• QA/QC • Pure water • Site utilities

WORKING THROUGH THE LAYERS

- Understand the process details
- Leverage process scopes and definitions in development documents and pretreatment guidance
- Compare parameters of concern and their sources



40 CFR 461 BATTERY MANUFACTURING

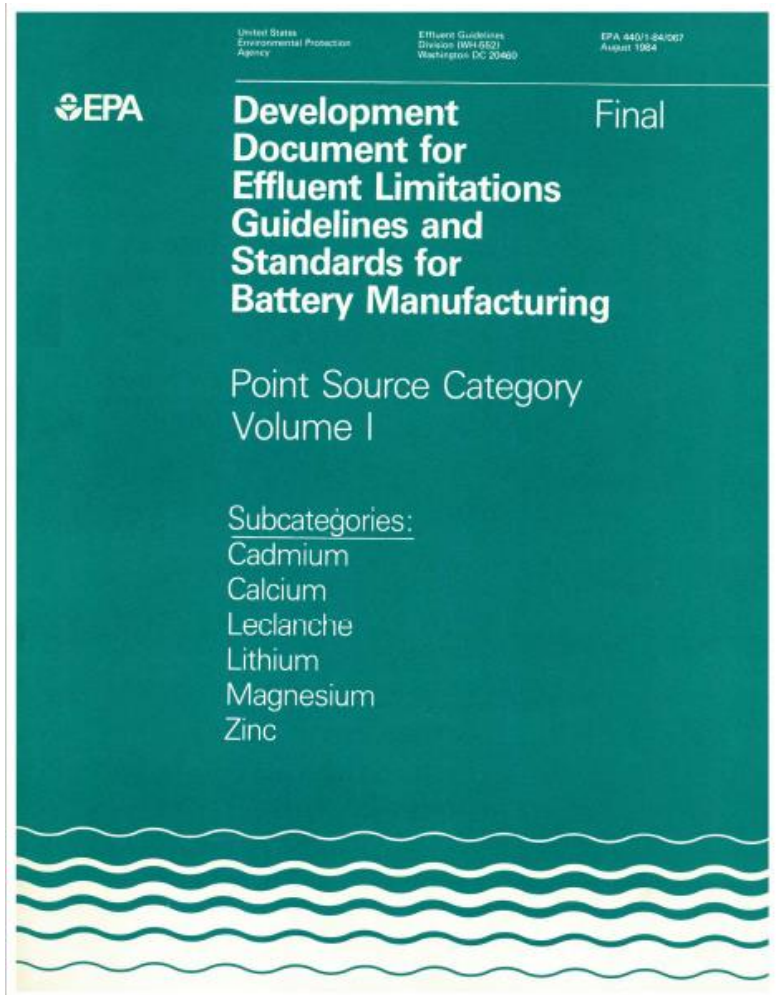
SUBPART E – PRETREATMENT STANDARDS

- PSNS for:
  - Lead Iodide Cathodes
  - Iron Disulfide Cathodes
  - Miscellaneous WW streams

- “There shall be no discharge allowance for process wastewater pollutants from any battery manufacturing operation other than those battery manufacturing operations listed above.”

LITHIUM SUBCATEGORY APPLICABILITY

- Subparts are based on anode material
- Lithium subpart materials
  - Anodes: Metallic lithium
  - Cathodes: Lead iodide and iron disulfide
- Regulated parameters: Cr, Pb, Fe, TSS, and pH



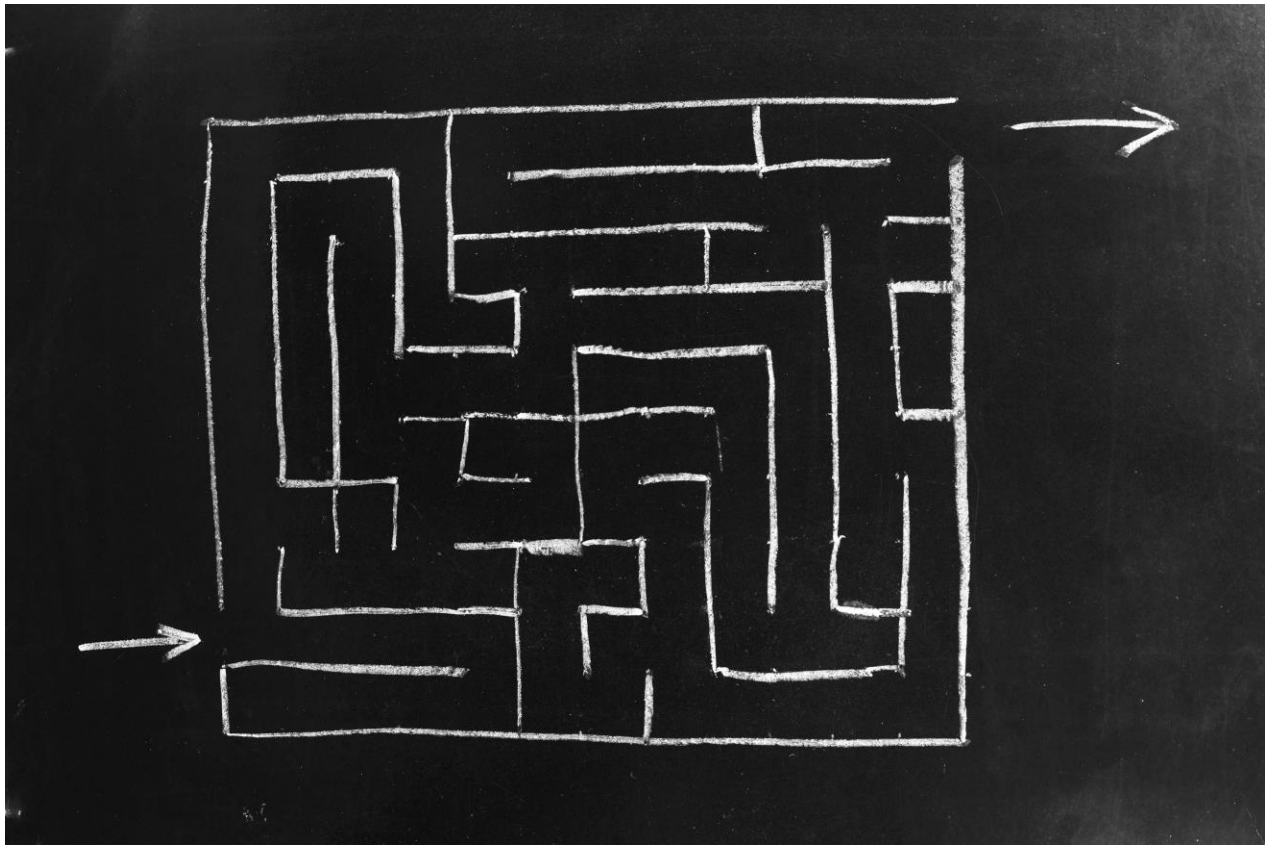
WHY SUBPART AND APPLICABILITY MATTER

- Questions
  - What specific waste streams can I discharge?
  - What will I need to provide off-site disposal for?
  - What will wastewater management **cost**?

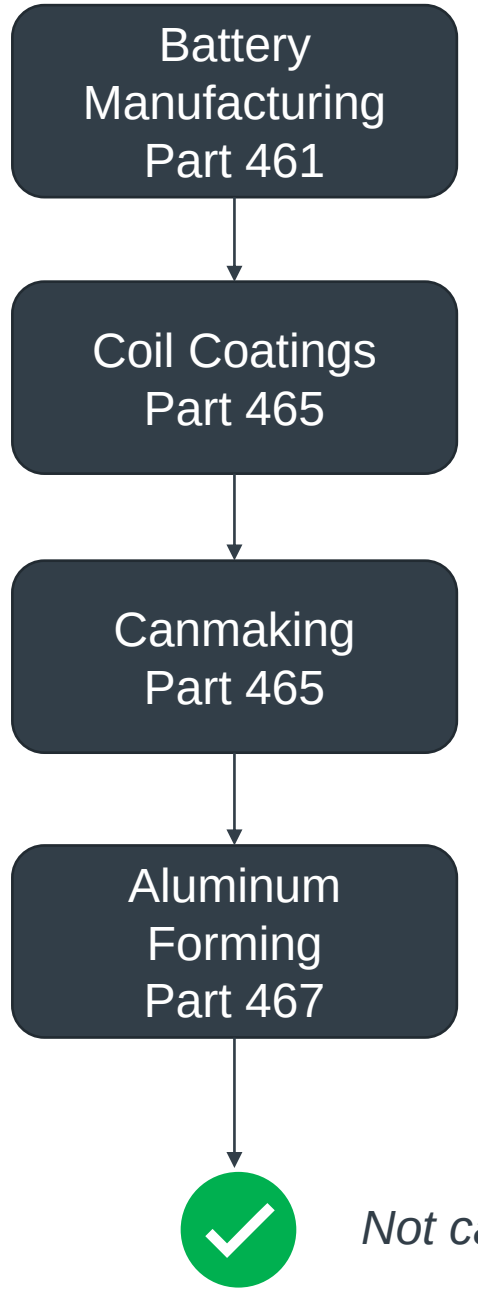
- Controls are specific to battery type, materials of construction, and production processes.

- The technical development documents describe the rule basis, including process details.

SO NOT CATEGORICAL?



BATTERY-RELATED CATEGORICAL HIERARCHY



Entire battery production process

Coating sheet metal with electrode paste or painting battery housing

Metal-working and cleaning to create battery housing

Metal-working and cleaning to create battery housing or other parts

Not categorical

CIUS: OLDER RULES, NEWER PROCESSES

Battery manufacturing

40 CFR Part 461?

40 CFR Part 465?
40 CFR Part 467?
40 CFR Part 438?

Services

Specialty chemicals

Specialty parts

Centralized waste treatment

Technical services

Organic chemicals

Inorganic chemicals

40 CFR Part 437?

40 CFR Part 414?

40 CFR Part 415?

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CENTRALIZED WASTE TREATMENT

Secondary Impacts

CENTRALIZED WASTE TREATMENT

- CWTs
  - Treat or recover hazardous and non-hazardous waste
  - Varying widely in terms of operational footprint and degree of sophistication
  - Provide important waste management services to new industries
- ELGs
  - Established in 2000, 2003
  - 40 CFR Part 437

40 CFR 437 SUBPARTS

A – Metals

B - Oils

C - Organics

D – Multiple Waste Streams

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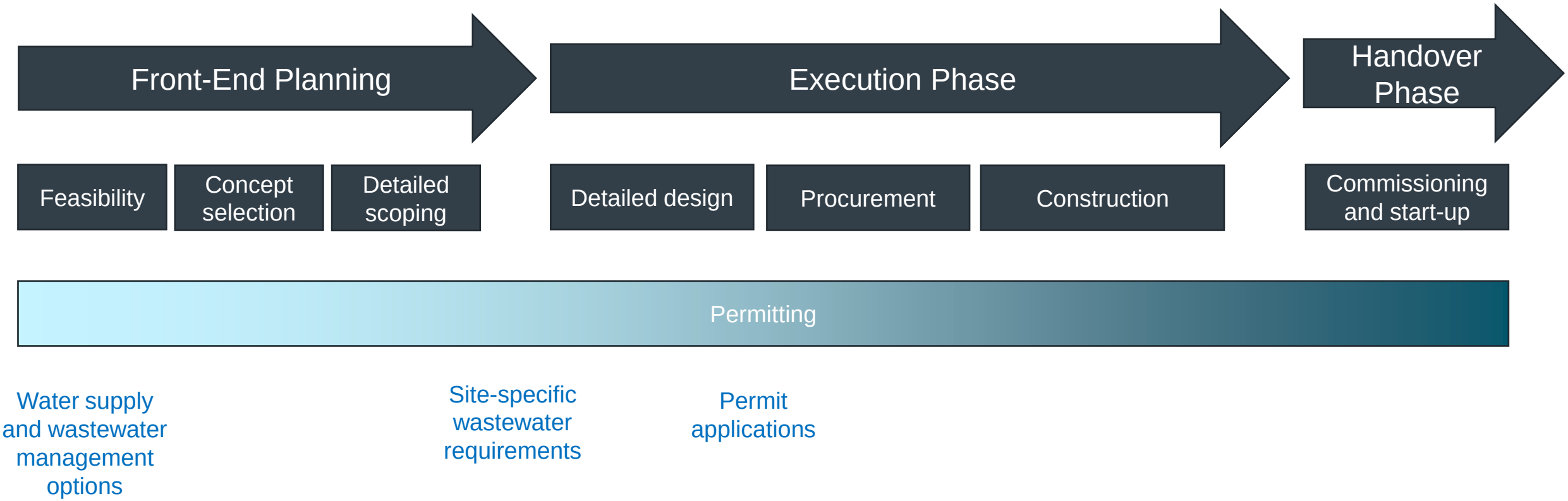
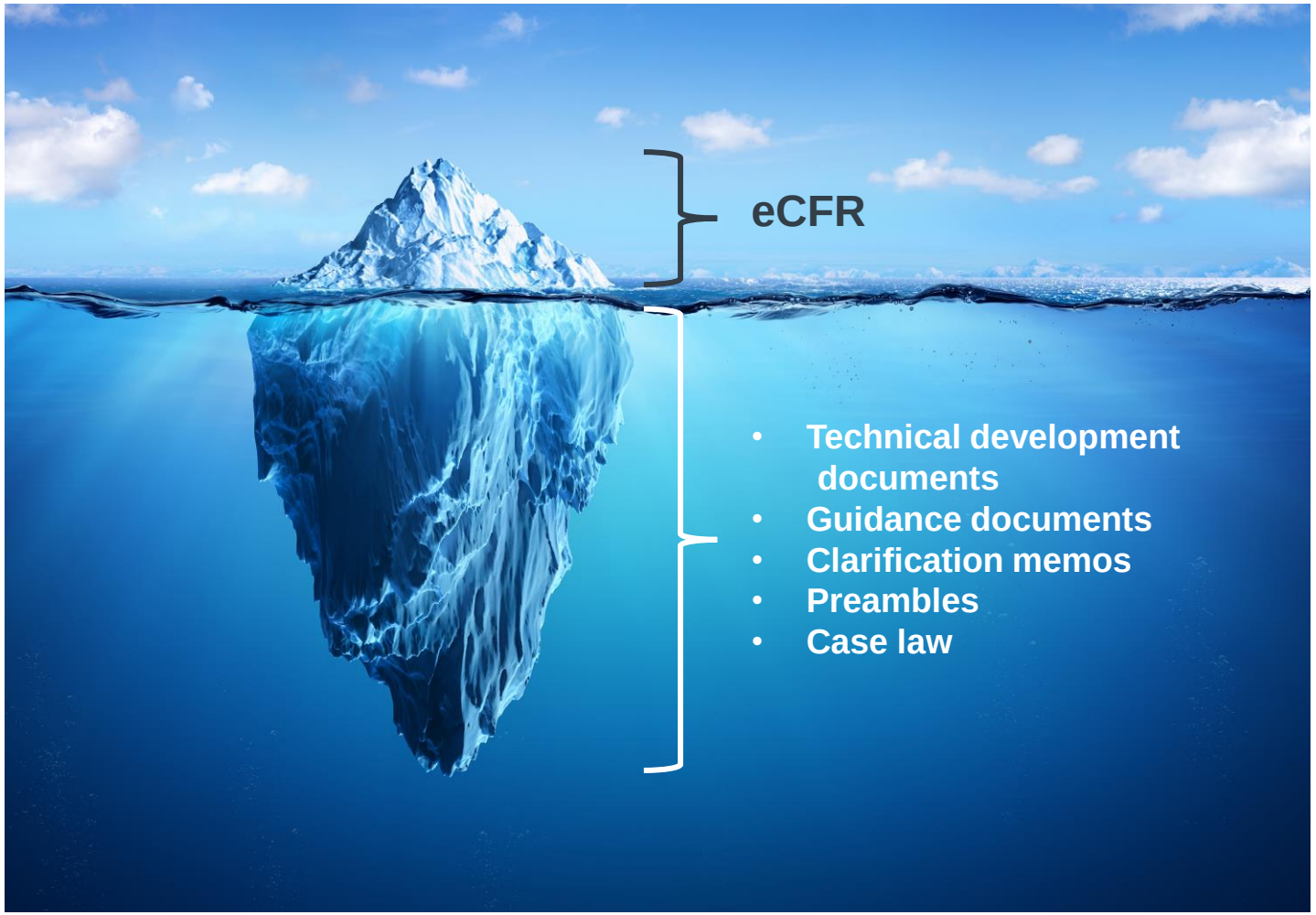
WRAP-UP AND Q&A

GREENFIELD PROJECT DEVELOPMENT



Adapted from PMI's Interface Management in the Built Environment training

CATEGORICAL STATUS



OTHER RESOURCES

- Other utilities with similar industries
- Formal and informal professional pretreatment groups
- State and Regional EPA pretreatment program coordinators
- Consultants and environmental attorneys

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THANK YOU

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