Brookhaven National Laboratory

Integrating Pollution Prevention into Work Planning Processes using ISO 14001 EMS and ISM

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BROOKHAVEN NATIONAL LABORATORY

Presentation Overview

Purpose:

- Share information with other DOE Sites

Topics:

- Background: Overview of BNL
- Leveraging EMS and ISM
  - Using the Work Planning Process
  - Engaging scientific staff
- Targeting efforts using Process Maps
- Results
- Summary & Resources

BNL Facilities, Programs, Operations

- BNL MACHINES
  - Collider-Accelerators
  - Synchrotron Light Source
  - PET, MRI, BLIP
- FACILITY OPERATIONS
  - Physical Plant Operations
    - Sewage Treatment Plant
    - Central Steam Facility
    - Major Petroleum Facility
  - Waste Management Facility
  - Environmental Restoration
- SCIENTIFIC ACTIVITIES
  - Medical Research Operations
  - Material Science Research
  - Bench-top Experiments
  - Terrestrial Research
- SUPPORT PROCESSES
  - Radiation Source Material Storage
  - Machining Operations
  - Photography
  - Fleet Operations
  - Bulk Chemical Distribution Operations

Process Evaluation:
Industrial Processes & Experiments

- Industrial Processes (157 and growing)
  - Infrastructure (steam plant, sewage treatment, water treatment, site maintenance, heavy equipment and fleet maintenance, craft shops, etc.)
  - Experimental Support Systems (cooling water systems, vacuum systems, equipment maintenance, metal cleaning, staff shops, etc.)
  - Technical Support Operations (photography, graphic arts, glassware cleaning, analytical laboratories, waste management, etc.)
  - Manufacturing Operations (machine shops, magnet fabrication, electronics assembly, printed circuit boards, mechanical assembly operations, etc.)
- Experiments (1,870)
  - 370 on-going experiments in BNL Depts
  - 1500 short-term experiments in NSLS

Integrating P2 in Work Planning

ISMS and EMS: Plan, Do, Check, Act

ISMS

- Identify the hazards
- Control the hazards
- Work within controls
- Provide feedback to improve safety

EMS

- Identify environmental aspects
- Control significant aspects
- Monitor, measure, assess and provide feedback for continual improvement

BNL Work Planning and Control

- Experimental Safety Review
- Work Planning for Operations
- Guests and Visitors Performing Work
- Offsite Work

EMS Overview

Significant Environmental Aspects

Laboratory Aspects

- Waste Generation
  - regulated industrial
  - hazardous
  - radioactive
  - mixed
  - medical waste
- Atmospheric Emissions
  - Radioactive or non-radioactive
- Liquid Discharges
  - Chemical or radioactive
- Storage/Use Chemicals or Radioactive Materials
- Natural Resource Usage
  - Water and power usage

Facility Specific Aspects

- Historical/Cultural Resources
- Endangered species/ Sensitive habitats
  - Habitat destruction, wetland disturbance, land clearing (5 or more acres)
- Environmental Noise
- Historical Contamination
- Soil Activation
- TRU waste
- Other, e.g.., asbestos research

Technical Assistance

Environmental Compliance Reps (ECRs)

- Field Deployed Environmental Experts
  - "Embed environmental compliance expertise in BNL Departments and facilities to identify environmental aspects and pollution prevention opportunities at the earliest stage of project development"
- Qualifications
  - Minimum of five years compliance experience, B.S. Science or engineering, demonstrated problem solvers, pollution prevention
- Deployment
  - Program is fully staffed (5), with an ECR assigned to every facility on-site
  - Fully integrated into the departments they serve, participating in work planning, experimental review, inspections, facility design, etc.
- <u>Key Contributors in Work Planning, ISM and EMS</u>

Tools of the Trade for Industrial Processes
Process Mapping Technique

- Helps visualize the process, target opportunities
  - Break processes down into steps
  - Identify inputs/outputs (similar to mass balance)
  - Use shapes to distinguish between outputs

Packaged Waste sent to Waste Mgmt

Effluent discharged permitted outfall

Air Emission released to atmosphere

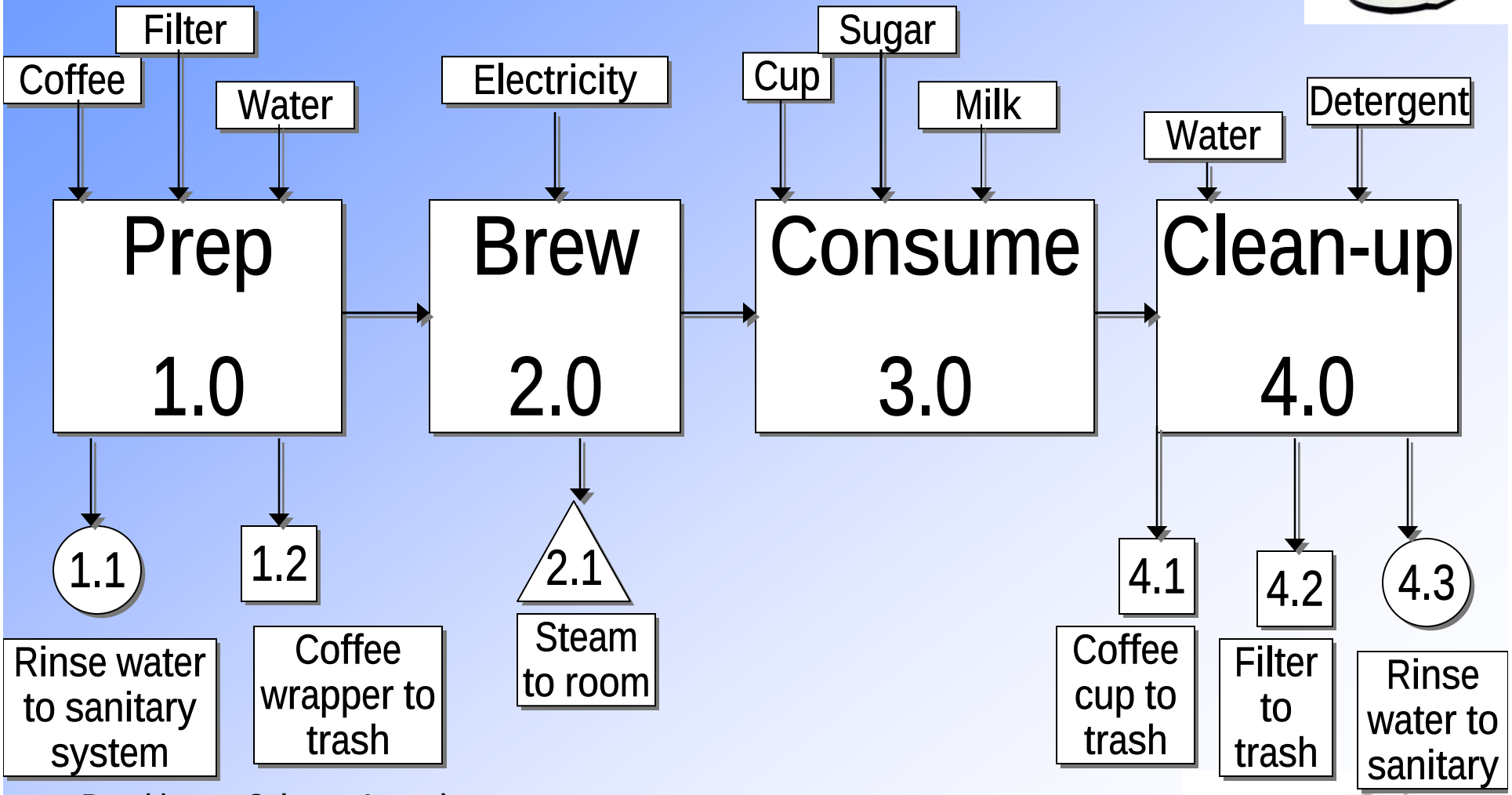
Tools of the Trade
Process Mapping Technique

The "process" of Making Coffee

Prep	→	Brew	→	Consume	→	Cleanup
1.0		2.0		3.0		4.0

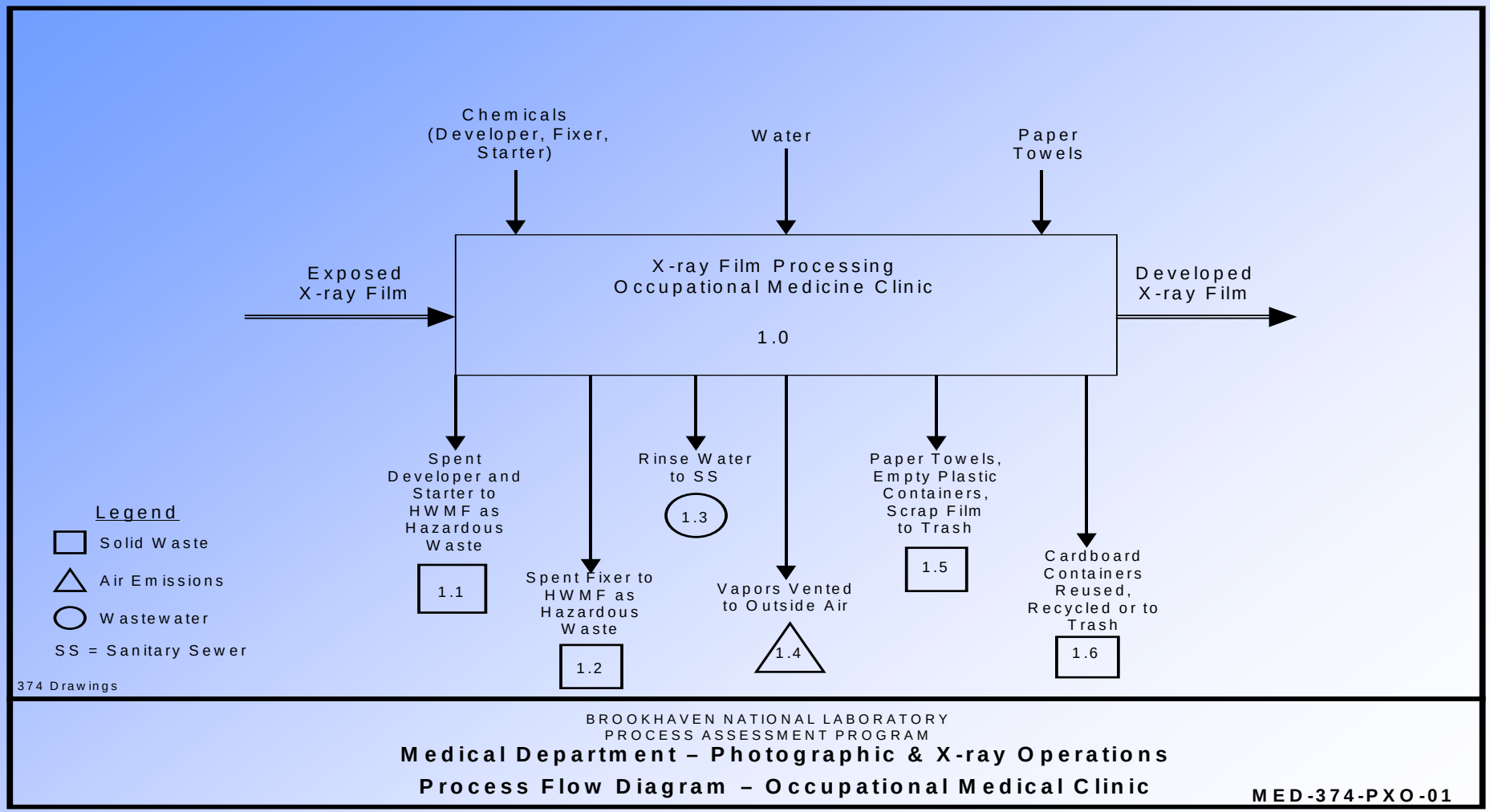
Any process can be evaluated using this technique

Tools of the Trade
Process Mapping Technique



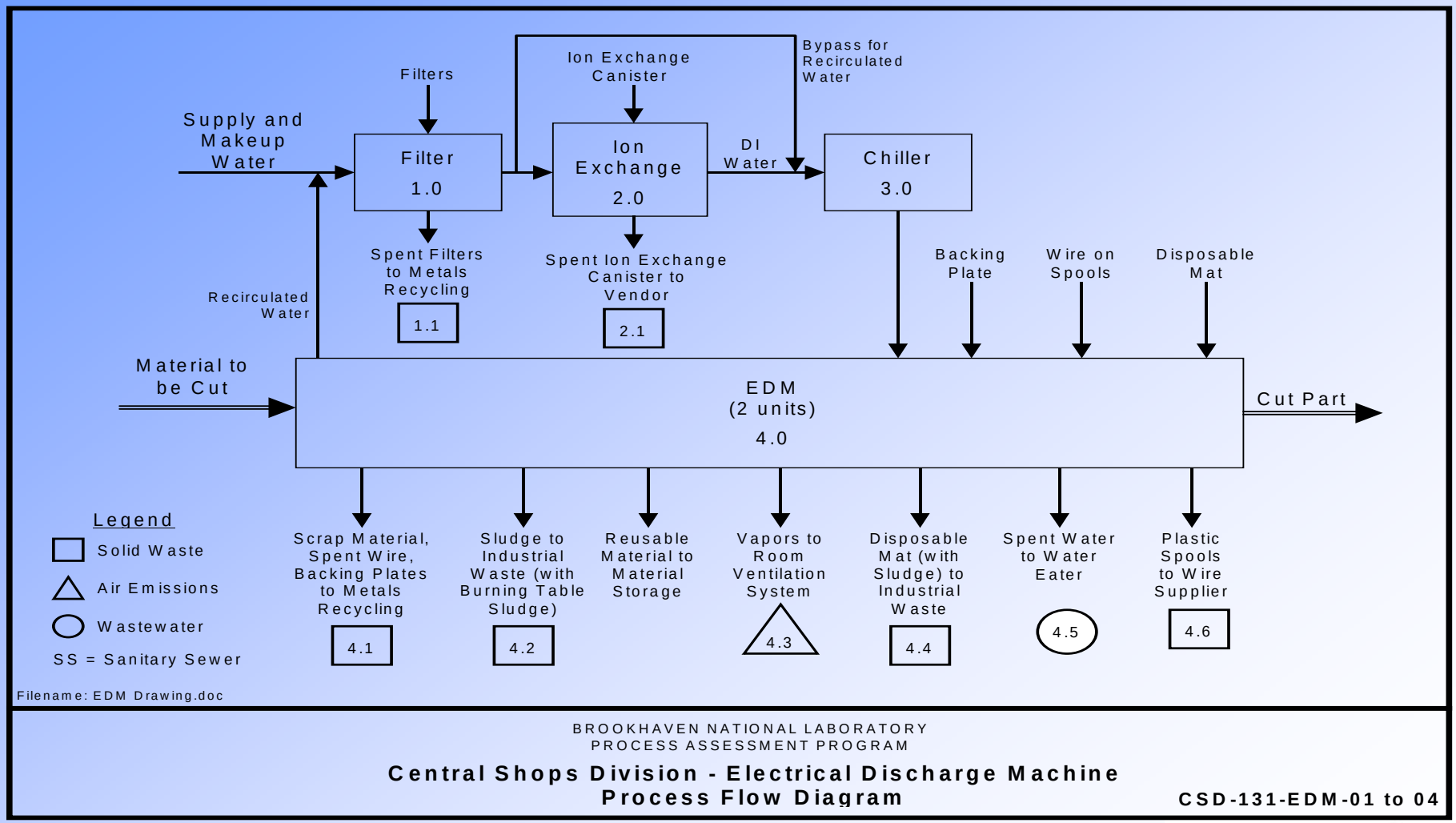
Tools of the Trade
PET Scanners, X-ray, Photographic Operations

Tools of the Trade
X-ray Film Developing Operations Process Map



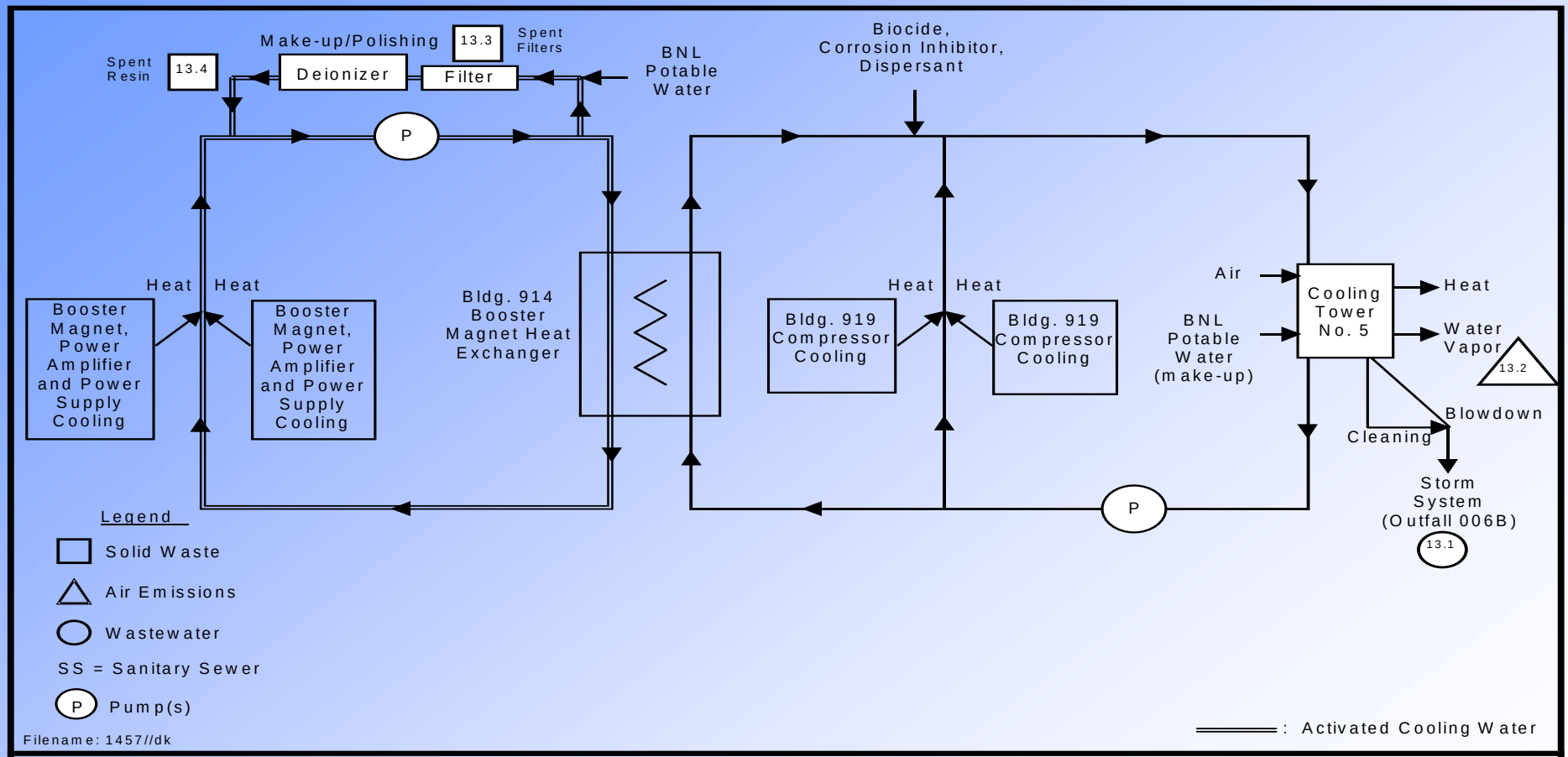
Tools of the Trade
Electric Discharge Machining

Tools of the Trade
Metal Shop EDM Machine Process Map



Tools of the Trade
Cooling Water Systems

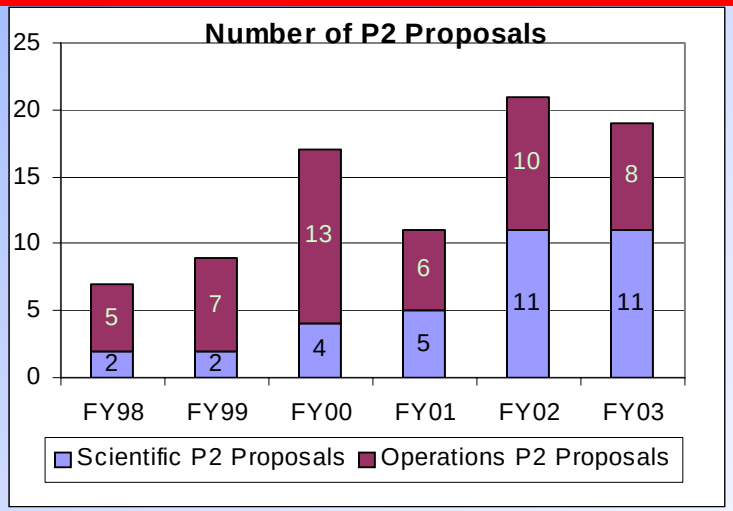
Tools of the Trade
AGS Cooling Water Loop Process Map



BROOKHAVEN NATIONAL LABORATORY
PROCESS ASSESSMENT PROGRAM
Alternating Gradient Synchrotron – Cooling Water Systems
Process Flow Diagram – Booster Magnet System and Cooling Tower No. 5 (Bldgs. 919/914)
AGS-004-CWS-13

Work Planning for Experiments:
Engaging Scientific Staff in P2

- EMS increasing participation labwide
  - Objectives & Targets drive improvement
  - ROI program invests for future
- Work Planning Processes
  - Experimental Review generating new ideas
  - ECR involvement spreads good ideas
- Annual cost savings from P2 projects
  - $88,000 in FY03
  - $268,000 in FY02
- P2 Program is Expanding
  - Awareness and participation is increasing
  - Cost savings are accumulating
  - Capabilities are improving



P2 Proposal Trend

- Note increase from Science
- Cultural breakthrough

FY02 Funded P2 Proposals

Rank	Project Name	Directorate, Dept/Div and POC	Cost	Savings
1	Minimization of Silver Waste from Silver-Staining Electrophoretic Mini-Gels	Life Sciences, Biology (B. Sutherland)	$1,670	$30,860
2	Retrofit of Garbage Truck Hydraulics With Steel-braded Hydraulic Lines and a Vegetable Based Hydraulic Oil	Finance & Admin, Staff Services (K. Mohring)	$7,500	$15,000
3	Evaluation of CO2 Snow Cleaning for NSLS, Instrumentation and CAD applications	NSLS, Instrumentation, and CAD (D. Bauer)	$5,000	see text
4	Retrofit of Hydraulic Lift Bays in Motor Pool Shop to Vegetable Based Hydraulic Oil	Finance & Admin, Staff Services (K. Mohring)	$8,000	$25,000
5	Sewage Treatment Plant (STP) Drying Shed	Facilitis & Operations, Plant Engineering (G. Olsen, G. Flett)	$25,000	$120,000
6	Replacement of Film-based Autoradiography and other radioisotopic imaging with a Phosphor Imager	Life Sciences, Medical (A. Gifford)	$25,000	$22,000
7	Reduction of hazardous, radioactive and industrial waste with a digital imaging system	Life Sciences, Biology (Dax Fu)	$25,000	$25,000
8	Development of a fluorescence-based assay for the DNA-dependent protein kinase (DNA-PKcs) to replace current 32P assay	Life Sciences, Biology (J. Flanagan)	$22,000	$30,000
	TOTAL INVESTED		**$119,170**	
	TOTAL SAVINGS			**$267,860**
	AVERAGE PAYBACK PERIOD			

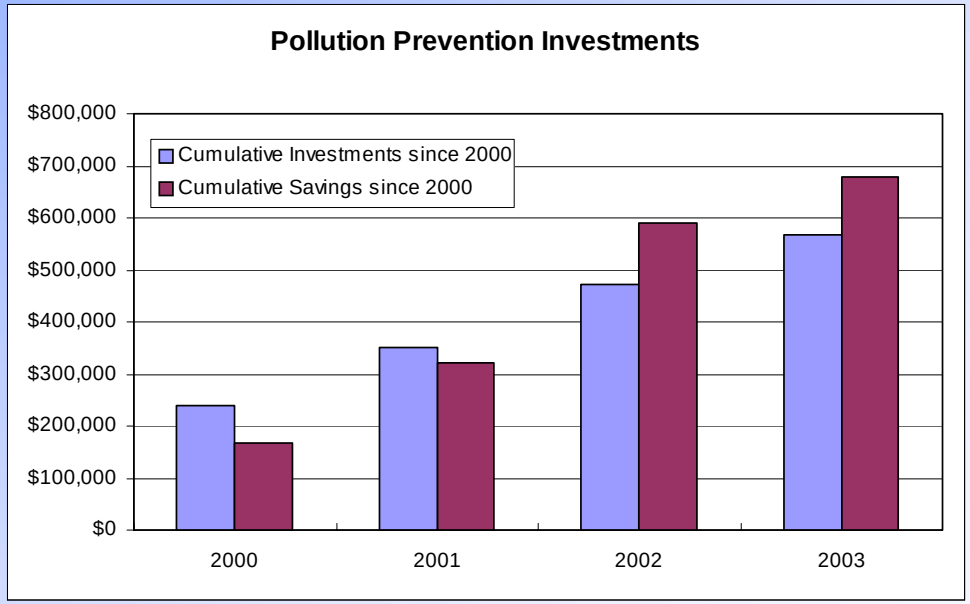
FY03 Funded P2 Proposals

Rank	Project Name	Directorate, Dept/Div and POC	Cost	Savings	Payback (Years)
1	Radioactive Waste Sorting Table	High Energy Nuclear Physics, CAD (J. Scott)	$2,500	$5,000	0.5
2	Reducing Dose From BLIP Air Emissions	Life Sciences, Medical (L. Mausner)	$13,400	$13,450	1
3	Kinetic Phosphorescence Analyzer	EENS, Environmental Sciences Dept. (J. Gillow)	$20,000	$22,556	0.9
4	Scintillation Vial Crusher	Life Sciences, Medical (A. Gifford)	$3,795	$2,168	1.75
5	Microplate Scintillation Counter	Life Sciences, Biology (J. Shanklin)	$35,000	$27,690	1
6	RTF Photoprocessor	Life Sciences, Medical (L. Wielopowski)	$13,860	$16,489	0.8
7	Oil-free Vacuum Pumps and new Catalyst	EENS, Environmental Sciences Dept. (L. Nunnermacker)	$6,000	$3,516	1.7
8	Bulk Motor Oil	F&A, Staff Services (H. Hauptman)	$4,000	$2,200	1.8
	TOTAL INVESTED		**$96,055**		
	TOTAL SAVINGS			**$88,069**	
	AVERAGE PAYBACK PERIOD				**1.2**

Return-On-Investment Program

http://www.bnl.gov/esd/pollutionpreve/P2ROI.htm

- BNL invested $120K/yr in FY02 & FY03, $60K in FY04
- ROI Program invests in projects that
  - Reduce waste via process changes, substitution, etc.
  - Support strategic objectives
  - $ave money and improve capabilities
  - Reduce risk (safety, regulatory, public)
- P2 Council
  - Ranks proposals and Votes on how to allocate investments



Average project returns investment in about one year

The Bottomline

- Use EMS/ISM systems to find Win:Win Situations
  - Reduce waste, cut costs, improve capabilities, reduce regulatory requirements, save time and materials
- Invest for Improvement
  - Important source of improvement funding
- Share the power
  - Create a P2 Council, with broad representation, decision authority
- Track and Report the Results
  - Track and publicize the cost savings and waste reduction
- Recognize the Superstars

Compliance ... Pollution Prevention ... Cleanup ... Community Outreach ... Continual Improvement

Next-Generation

Environmental Management System

EMS Implementation at BNL
Resources

- BNL
  - EMS Web Page, http://www.bnl.gov/esh/ems/
  - George Goode: goode@bnl.gov, 631-344-4549
  - John Selva: selva@bnl.gov, 631-344-8611
  - Jerry Granzen, BAO: granzen@bnl.gov, 631-344-4089
- BNL Environmental Management System Manual
  - https://sbms.bnl.gov/program/pd02/pd02d011.htm
- BNL Environmental Aspects
  - https://sbms.bnl.gov/standard/0m/0m00t011.htm
- BNL Work Planning and Control
  - https://sbms.bnl.gov/standard/3k/3k00t011.htm