Productivity Improvements
Waste Metal & Fluid Management Processes

CIP-Metalworking and Machining Operations

Managing Waste Streams
From point of generation to recycle and reuse.
Today’s Discussion

- **Initiating** an Environmental Compliance Policy
  - Are you in compliance with (or striving to meet) Federal EPA or ISO14001 Compliance, including State and Local Regulations?

- **Identifying** the areas in your plant where “risks” can be mitigated.
  - At the point of scrap generation (or) where both the scrap metal and fluid waste streams exit the CNC Machining Centers

- **Implement- ** **CIP-Continuous Improvement Process**
  - Means implementing the latest technology and processes which will:
    - Mitigate Risk & Improve Profitability by supporting the companies Environmental Sustainability Initiatives
    - Meet or exceed Health & Safety Requirements.

PRAB
RECLAIM & RECYCLE PROCESS FLUIDS:

- Machining applications
  - Grinding/Honing applications
  - Cleaning processes
  - Wash and Mop Waters
Identify – Areas where “risks” can be mitigated

- Machining Operations

Aerospace

Automotive

PRAB
Identify—Areas where CIP can be implemented
Implement - CIP- Continuous Improvement Process

-OR-

CIP is also used for another Acronym

- **C** - Collect or Convey
- **I** - Improve Condition
- **P** - Process or Reclaim
Collect and Convey – CIP
Above floor or infloor collection and transfer
C-Collect or Convey—CIP at the CNC Discharge Conveyor: collecting materials and coolants.

Discharge from CNC Operation Self dumping hoppers & Special Carts.
C-Collect or Convey – In-Floor Chip Transfer

From Chip Carts

In-floor Hydraulic/Mechanical Transfer
Collect and Convey – CIP
Evac Systems- Positive or Negative Pressure CIP
C-Collect or Convey – Above Floor Chip Transfer

Above-floor Mechanical Transfer
C- Collect or Convey – Chip Transfer and Silo Options

- Vacuum Transfer to Cyclone and Chip Processing Area.
C- Collect or Convey

Vacuum or Negative Pressure - Chip/Coolant Transfer
C- Collect or Convey

Vacuum or Negative Pressure-
Chip/Coolant Transfer
Improve Condition—CIP

Example #1- CNC Discharge concerns
Chip and Coolant Collection

Discharge from CNC Operation Self dumping hoppers & Special Carts
Improve condition – CIP
Volume Reduction Process

Turnings Shredder
Reduce the turnings
I- Improve Condition - CIP

Reduction of scrap reduces handling time. 7-1 ratio or more.

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I- Improve Condition - CIP

Volume Reduction

*Shredder or Crusher Addition

Reduce material to a flow-able condition
Chip Wringer Systems- Over 98% of the fluid is recovered and can be sent to filtration for reuse.
Dual Compaction Technology

Highest Fluid Recovery %

- Dual Compaction: Dense briquette - 85-90% solid
- Highest reduction of scrap volumes
- Recovering of waste oils or coolants
- Reduce hazardous waste handling costs
- Generally commands a higher price for briquettes
- Latest Hydraulic designs: Dependable & low maintenance
What is the Briquetter or Chip System ROI?

-2000/hr. x 2 shifts (16hrs) = 32,000 lbs/day
-32,000 lbs/day x 5 days/wk = 160,000 lbs/week
-160,000 lbs/week x 4 weeks = 640,000 lbs/month

-96,000 lbs coolant / 8 lbs/gallon = 12,000 gal/month and 544,000 lbs/Chips

$19,200.00 Coolant Recovered / Month
Implement – CIP
Modular Chip Processing Designs

- A complete Chip Processing System in a Modular Design
- Volume reduction
- Fluid recovery 98%
Horizontal or Diagonal Shaft designs
- Empty easily
- Hinged Frontal Axis Door
- 24/7 operation
Implement – CIP
Grinding Swarf Press Technology

Processing Grinding Swarf

PRAB
Example of recovery at 2000#/hour of Aluminum Chips
- 2000/hr x 2 shifts (16 hrs) = 32,000#/day
- 5 Days/week & 4 weeks = 640,000#/month

Expected Recovery:
- 96,000# of coolant @ 8#/gallon = 12,000 gal/month
- 544,000# of wrung chips at .02¢ more / lb. = $10,880/mth
- 544,000# of briquettes at .05¢ more / lb. = $27,200/mth
CIP- Continuous Improvement Process

- Filter
- Recycle
- Waste Treatment
Processes

- Machining
- Grinding
- Die Casting
- Rolling Mills
- Heat Treatment
- Forging
- Roll Forming
- Painting
- Plating
Applications for Continuous Improvement

• **Machining and Grinding**
  – Water Soluble, semi-synthetic and synthetic coolants, cutting and grinding fluids and lubricants used in machining operations

• **Primary Metals**
  – Rolling and drawing fluids used as lubricants and coolants for ferrous and non-ferrous operations

• **Wash Waters**
  – Alkaline and acidic wash waters, rinse water and phosphatizing baths

• **Die Casting**
  – Water soluble mold release fluids and wash waters
Benefits

• **Reduction of new coolant purchases**
  – Will extend the life of coolants 2 to 5 times the present change out period

• **Reduction in disposal costs**
  – Costs associated with disposal are increasing dramatically

• **Risk avoidance**
  – Immeasurable cost of liability, public relations

• **Increased tool life**
  – Some studies have shown increased tool life up to 209%
Tramp Oil Separator
Typical Flow Schematic Coolant Sump
Tramp Oil Removal Central System
Tramp Oil Separator
TW-10 with Magnetic Separator
Coolant Recycling System
Coolant Recycling System
Filtration Equipment

- Liquid /Solid Separation
Paper Bed Filters

PFA Series
Available from 5gpm to 210pgm flowrates
Magetic Separators

Available with Ferrite Magnets or Rare Earth Magnets
Available from 5gpm to 315gpm flowrates
Magnetic Paper Bed Filters

MPFA Series
Available from 5gpm to 210pgm flowrates
Manual Centrifuges

CL-50 rated at 12gpm

CL-80 rated at 20gpm
Semi-Automatic Centrifuges

Available in flowrates from 12gpm to 40gpm
Automatic Centrifuges

Available in flowrates from 12gpm to 40gpm
Vacuum Filter – Disposable Media

Process Flow

1. Clean Coolant to Machine Tool Line
2. Vacuum Chamber
3. Swarf Plate
4. Dirty Media and Sludge Hopper
5. Lavatory
Vacuum Filter – Disposable Media

Mon-A-Vac
Vacuum Filter – Permanent Media

Mon-A-Matic
More stringent discharge requirements dictate companies do a better job of handling their process waste streams.

This can be accomplished with two primary methods:

- Microfiltration
- Ultrafiltration
Membrane Filtration Methods

• **Microfiltration**
  – Suspended particles and large colloids are rejected
  – Macromolecules and dissolved solids pass through
  – Pore sizes range from 1 - 0.1 micron.

• **Ultrafiltration**
  – Colloids, proteins, microbiological contaminants, and large organic molecules (oils) are rejected
  – All dissolved salts and smaller molecules pass through
  – Pore sizes range from 0.1 – 0.02 micron
Membrane Filtration – MF/UF
Tubular MF/UF – System Components
Before & After Ultrafiltration

Convert Oily Wastewater

To Clean Reusable Water
Membrane Filtration – NF/RO

• Nanofiltration
  – Particles in the approximate size range of 1 nanometer are rejected
  – Dissolved salts are rejected in the range of 20-98%.
  – Salts with monovalent anions (e.g. NaCl or CaCl2) have rejections of 20-80%
  – Salts with divalent anions (e.g. MgSO4) have higher rejections of 90-98%.
  – Organic molecules with molecular weights greater than 200-400 are rejected.

• Reverse Osmosis
  – Finest level of filtration available
  – All dissolved salts and inorganic molecules are rejected
  – Organic molecules with a molecular weight greater than approximately 100 are rejected.
  – Rejection of dissolved salts: 95% to >99%
NF/RO – System Components
Evaporation:
• natural phenomenon
• clean separation technology
• recognized as **Best Available Technology** in several wastewater treatment processes

Vacuum evaporators are industrial systems accelerating the natural evaporation process.
Oily Waste Vacuum Evaporation - Process

- 100% oily waste
- 2% coalescent separator
- 97% vacuum evaporator
- 87% distillate
- 2% concentrate
- Exhausted oil emulsion
- Sedimentable
Vacuum Evaporation - Heat pump - PC

- Vacuum conditions, low temperature
  - 7-9 kPa, 30-40°C
  - 0.4 - 0.6 PSIA, 80 - 120 °F

- Heat transfer medium - refrigerant gas
  - R 134

- Electrical consumption
  - 150 kWh/ton of distillate
  - 0.5 kWh/gal of distillate
Vacuum Evaporation – PC – R Series

- **R Series** - Heat pump evaporator with scraped heat exchange surfaces
Vacuum Evaporation – AC – EW Series

- **EW Series** – Hot water/steam evaporator with forced circulation and external shell & tube heat exchanger.
**Vacuum Evaporation – MVR – TC & RV Series**

- **TC & RV Series** - Mechanical vapour recompression evaporators with forced circulation and external shell & tube heat exchanger.
EVALED – Series Specs

PC - heat pump

- Electrical consumption
  0.5 kWh/gal
- Evaporation conditions:
  0.4 – 0.6 PSI, 80 - 120 °F
- Reduced fouling and scaling with forced circulation
- Operate under a vacuum to recover thermal energy and reduce the boiling point – saving valuable energy dollars
- Designed for continuous operation 24/7
- Capacities 0.3 – 7 gpm
- Ozone friendly refrigeration gas
  (R 134 A)
- Low maintenance costs

AC - hot water

- Evaporation conditions: 0.4 – 2 PSI, 80 - 140 °F
- Electrical energy (cooling and heating circulating pumps): 0.05 kWh/gal
- Energy from hot water/steam: 1/2 kWh/gal distillate
- Heat energy from cogeneration plants

RV – Mechanical Vapor Recompression

- Evaporation conditions: 7-11 PSI, 175 - 195°F
- Electrical energy (compressor, circulating pumps):
  0.1-0.2 kWh/gal of distillate
- Suitable to treat large flow rates with a low energy consumption

Ozone friendly refrigeration gas

(R 134 A)

Low maintenance costs
Questions?