

Johnson Matthey Enforcement A Local Perspective

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Johnson Matthey focuses on catalysts, precious metals, fine chemicals and process technology. Gold and silver refining serves mining industries and recycles secondary scrap material.

Johnson Matthey has operations in over 30 countries and employs around 8,700 people. Its products are sold across the world to a wide range of advanced technology industries. In Utah Johnson Matthey's principal activities are in the refining gold and silver.



- Based on the material's composition (gold, silver and base metal content) the refining route can vary. Each step shares a fundamental goal--to separate the precious metal from the other, undesirable metal.
- Dore (The metal bearing material) containing less than 25% gold and greater than 60% silver can be directly refined into 99.9% pure silver using the electro-refining cell. In such a cell, the crude silver dore (usually containing some gold, copper and selenium) is placed in a small tank containing a silver and copper nitrate electrolyte.

- If 99.99% pure gold is to be made, the crude gold must undergo electro-refining. Pure elements are formed at the cathode. Gold electro-refining is nearly identical to the silver electro-refining with minor differences in equipment and materials of construction. Gold sponge is harvested from these cells.
- Having refined the metal to a high purity, it must now be made into a marketable form. Several products are cast and minted throughout the world, JM's product line includes small and large bars as well as grain.

- Gold is melted and cast into bars weighing 1-kilogram, 100-oz or 400-oz. These bars must be made to very particular appearance and shape standards. Samples are taken from the casting melt. These samples will be assayed to within 100 part per million. The type and size of product poured is dictated, mostly, by market and/or customer demand.
- Silver is produced to either the ASTM standard and/or, the London Bullion Market Association (LBMA) standard. This fine silver is cast into grain or bars of varied weight.

- The crude silver is made to be the anode in the electrochemical cell, a plate of stainless steel the cathode. Current flows from the anode to the cathode, dissolving the anode and plating silver crystal on the cathode plate. The silver crystal is constantly scraped and harvested for product casting. Un-dissolved metals will simply slough off the anode and sink down into a bag. These metals (mainly gold, silver and selenium) will be transferred to the gold refinery for further processing.

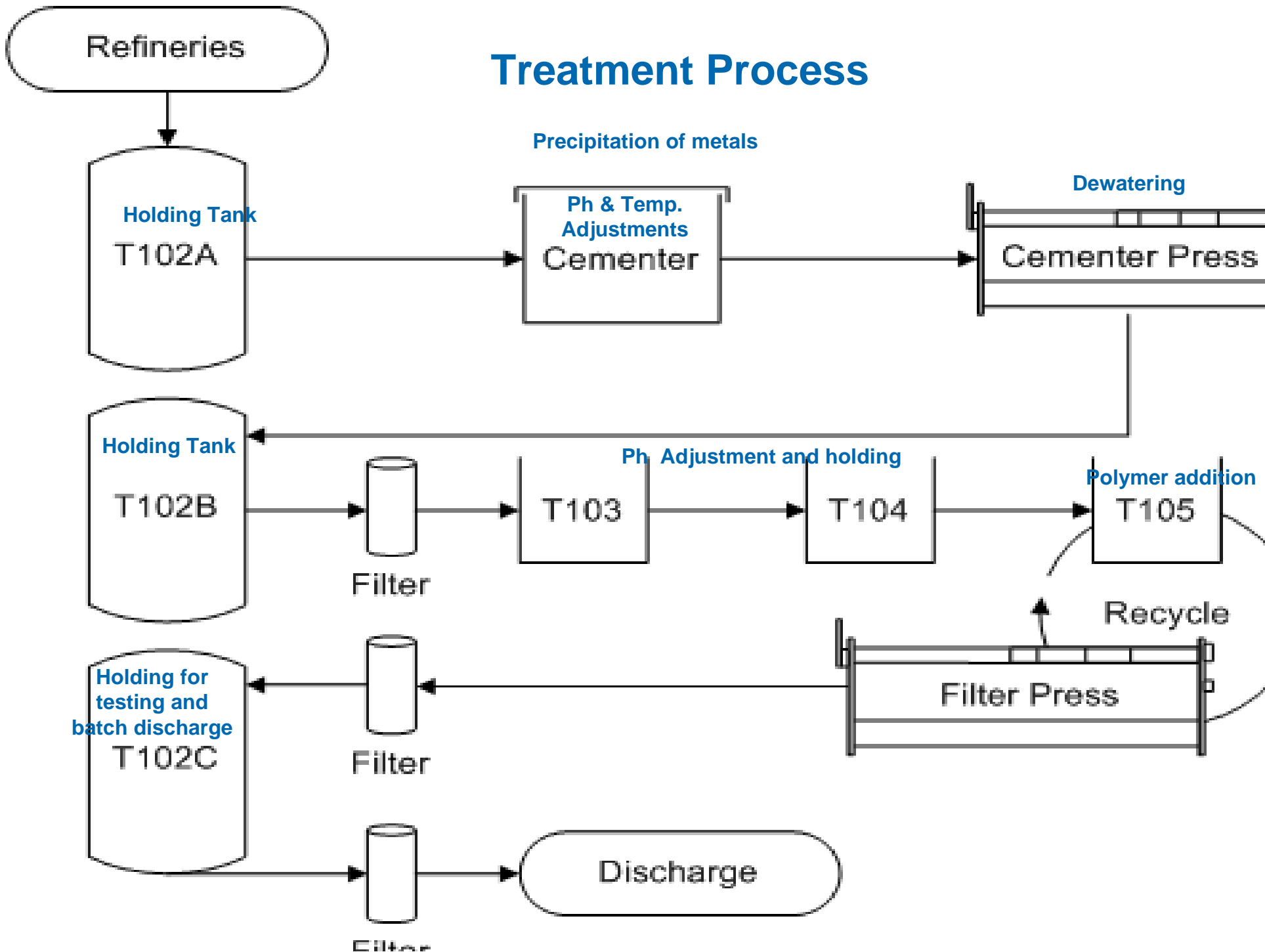
Sources of Selenium:

- Air pollution scrubbers fumes from the smelting
- Electrolytic process (pollutants go into solution at the anode plate oxidize in ion form..)
- Rinse waters
- Process overflow water

Challenges:

- Selenium is not a heavy metal and does not respond well to chemical treatment .
- Variation in concentration of ore will change treatment demands.

Treatment Process





Process Flow

1. Tank 102A is the collection point for Plant wastewater. This tank is sampled daily.
2. Treated refinery solution is discharged to 102A. 102A is also fed from the Pollution Control sump, which takes in scrubber discharge.



pH probe in cementer

Cementers. Cementation involves adding iron and heat in an acid environment for the purpose of precipitating gold and other elements, most notably selenium, as recoverable solids. This activity takes place in tank called a *cementer*.

When the filling sequence is completed, the system automatically begins heating the solution. This process typically runs overnight. Steam turns off and on to regulate the temperature.

The pH is tested. Cementation is most effective within a specified pH range. Caustic and HCl feed lines are used to make adjustments as needed.

Cementer press. Water from a cementer passes through a press. This extracts solids from the water. Cementer solids are taken to Incineration for heat treatment.



Tank 105 canister filter set. Three canisters filter the discharge
The filters are checked at the beginning of every Treatment cycle and changed out several times a day. The first canister has a 5-micron filter and the other two have 1-micron filters.



Sampler and Flow Metering Shelter



Selenium limits and Enforcement

- CIU under 40CFR421, gold, silver, lead, mercury, zinc
- Early 90's a local limit of 1.0 was established.
- Changed in 1992 to 5.0 mg/L based on water quality technical analysis
- 1995 based on technical evaluation including new 503 regulations limit was changed to 1.27 and then to 3.47 mg/L.
- Limit violations in late 1990's led to two fines from Central Valley.
- Suspicions arose on many occasions, when confronted they vehemently denied any wrong doing.
- Criminal Investigation started in 2002.

Central Valley Involvement

- Researched Files
- Produced documentation from
 - 1) inspection and correspondence records,
 - 2) analytical data,
 - 3) permit history,
 - 4) notes from day planners referencing phone calls and meetings,
 - 5) archive files

Central Valley Involvement

- Our local limits were challenged in court. We responded by issuing a notice of violation.
- The local court found fault with the se local limit because we did not accomplish a revised evaluation incorporating the 503 standard change.
- No relief was given on the criminal issues.

Permit language that can make a difference


- “In no case shall dilution water or non-process waste water ever be used to achieve compliance with these standards.”
- “Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.”
- “Bypass is prohibited unless it is unavoidable to prevent loss of life, personal injury or severe property damage or no feasible alternatives exist.”

- "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or people who manage the system, or those people directly responsible for gathering the information submitted is to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including a possibility of fine and imprisonment for knowing violations."

Changes and Improvements at JMI

- New General Manager and Environmental Mgr.
- Corporate resolve to be more transparent.
- Improvements to the gold refining process involving the oxidation/reduction process, pH and temperature adjustments in the cementers and ore management. These were not expensive.
- Se discharge levels average less than 1.0 mg/L. Previous levels varied, many above 10 mg/L.

Some Lessons Learned

- So much depends on trust of the company and their cooperation.
 - Decisions to manage risk by deception is hard to sustain over the long term when several people are involved.
 - The more knowledgeable staff becomes the more difficult it is for companies to deceive.
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Lessons Learned cont'd

- Regulatory agencies having a high profile with company officials and staff helps in developing cooperation.
- Attitudes on environmental laws still differ from court to court and from judge to judge
- Crimes involving willful deception are far greater than strictly violating limits.
- Document, Document, Document

NOTICE

WARNING!

DUE TO

Enforcement ACTION

THIS TOILET WILL BE CLOSED

TOMORROW

**SO DO AS MUCH
AS YOU CAN**

TODAY

SIGNED

Sewer Authority

