CITY OF ANN ARBOR

MATERIAL RECOVERY FACILITY

4150 Platt Road

Ann Arbor Michigan, 48108

PROCESS SYSTEM

INSPECTION REPORT

DRAFT

Prepared by:

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December 16, 2016

Ann Arbor – Inspection Report

On Tuesday November 9, 2016, an inspection of the Ann Arbor Material Recovery Facility was conducted by Waste Management. The purpose of the inspection and this report is to identify deficiencies (safety and operational) that should be addressed to bring the recycling system operational again in a safe manner.

This report is limited to the system and adjacent areas only. No inspections of the building or site were conducted. The system was observed in a static condition and was not operational except for the baler and infeed conveyors. All other system components were observed as best possible and deficiencies noted here-in. No safety covers, pit plates, guarding or other like items were removed during the inspection. It's worthy to note, that although some equipment was noted to have "no observable deficiencies", that doesn't mean that none exist. It's likely that once the system is energized, additional deficiencies may be discovered such as faulty alarms, safety switches, lighting, E-stops, fans, blowers, vacuums, bent shafts, hoists, speed adjustments, cylinders...etc. Also, where leaking motors are noted, it is possible oil may be coming from the breather cap as the motor heats up. These motors should be more thoroughly inspected to determine the cause before failure occurs.

Given the observable state with bent supports, improperly mounted motors, noticeably faulty safety switches, broken electrical lines, damaged belts and lack of sufficient guarding it was deemed unsafe (and would have been irresponsible) to energize the system for a full operational assessment.

This report is divided into three (3) parts:

Part A Summary of conditions and recommendations.

This section seeks to identify the minimum amount of work that should be undertaken to bring the system safely back on-line. It is not meant to be all inclusive and as noted, additional safety concerns may be realized once the system is energized.

Part-B Recommendations for improving the system (upgrading or adding equipment)

This section is designed to point out where deficiencies lie in the general design and use of old technologies. It is meant to give insight into what improvements would enhance system performance and overall sorting efficiencies.

Part-C Deficiencies by component (including surrounding areas)

This section identifies by component, observable deficiencies that should be part of daily maintenance and housekeeping and to a greater extent those that render the system unsafe to energize until corrections are made.

Photos are crossed referenced back to Part A by item number (Ref A1, A2…)

Part – A Summary of Conditions and Recommendations

In general the system is in fair condition due mainly to neglect. Poor housekeeping and lack of preventative maintenance are to blame for most of what was observed. The following steps should be taken to bring the system back on-line safely. Upon start-up, additional conditions may arise that will require attention such as bent shafts, faulty switches, belt tracking issues…

A1. Remove dust from all equipment, especially fan motor guards.

A2. Replace all worn and missing discs in all screens and return rollers.

A3. Remove material buildup and windings from all shafts (Drive, Take-up and Return), chutes and transitions.

A4. Repair/Replace and fill all oil boxes and hydraulic tanks. Drain old, add new. Fix and repair broken or missing lines.

A5. Repair/Replace all belting with torn edges, broken lacing, or with loose, missing or heavily worn cleats or other wearable parts. Check all conveyors for proper tracking.

A6. Repair all worn-thru areas of hoppers, sideboards and containment walls. Remove any temporary wood or other materials and properly close all transitions for containment of materials.

A7. Repair/Replace and secure any bent, step, post, railing, support or other structural or safety concern.

A8. Properly cover all exposed moving parts to be safety compliant.

A9. Repair/Replace all worn chains, links, sprockets and missing pins, bolts or other fasteners.

A10. Lubricate all bearings

A11. Secure all loose decking to remove trip hazards

A12. Ensure all Sort Stations have E-Stops and no sharp edges on chutes and sideboards

A13. Fix lighting where necessary

A14. Repair/Replace all faulty/missing limit and other safety switches, and broken electrical lines

A15. Properly mount equipment and remove temporary chains and supports

A16. Repair/Replace Concrete Tip Hall Wall near OCC Bunker Conveyor

Part – B Recommendations for improving the system

(upgrading or adding equipment)

1. Replace the Infeed with a Drum Feeder and eliminate the Metering Drum. This will help more evenly distribute the material and allow the loader operator more time to work the Tip Floor. It will also eliminate "black belt" making the system more efficient and consistent in throughput. This should yield more effective sorters and individual machine components.

2. Replace M-2 with two conveyors. One Chain Conveyor to bring material up to Presort and one Variable Speed Slider Bed to be Presort. This will help reduce the Burden Depth of material to Presort and allow sorters to be more productive. Burden depth using a chain conveyor due to its limited speed does not allow sorters to see more than 50% of the material. There is also the safety factor of sorting from a Slider Bed vs. Chain Conveyor where side-wings and other hinged parts can easily grab clothing.

3. Replace Cage winches with proper ½ ton Chain-falls and wire back to Control Panel. This will provide a safe means of discharging materials from the cages. It appears the previous operator was hanging workers from suspended cables attached to overhead structures which is unacceptable and violates OSHA and other safety standards.

4. Replace Eddy Current with 5 FT wide Steinert and relocate to better position. Newer technology and relocation will remove more non-ferrous metal further upstream thus reducing the burden depth and composition of remaining materials to be sorted such as plastics. The existing Eddy Current appears to be home-made and undersized. With Aluminum being the most valuable commodity, payback on a newer, bigger, more efficient Eddy Current can be very fast.

5. Replace/Reposition Sort Conveyors to be horizontal (not inclined). Providing more ergonomic sort stations increases productivity and reduces worker fatigue. The more effective and safer a sorter can be, the more effective and safer the entire process can be.

6. Reduce conveyor angles to 35 degrees (max.) wherever possible. 30 degrees preferable. This will reduce roll-back of materials and thus increase overall system throughput and performance. Conveyors over 30 degrees deliver material to the next piece of equipment (or sorter) in clumps reducing sorter and system efficiency.

7. Replace ADS with more reliable technology such as Ballistic Separator & Optical Sorter. Newer technology will provide better separation of materials thus improving overall system performance (especially for downstream equipment). The ADS technology is only capable of removing single-layer paper. The equipment supplier has utilized 3 ADS units which combined are still very inefficient. Anything stacked or 3 dimensional will ultimately make its way to the container line and then residue. A properly sized Ballistic Separator in conjunction with an Optical Sorter firing on 3D paper can be up to 99% efficient in material separation.

8. Add Bale-turn to prevent bales from hitting wall. This safety issue is commonly overlooked until it's too late. When the baler was replaced, the ejection chamber location was also changed. In the current arrangement the baler could eject bales directly into the wall causing damage to the building structure and/or the baler itself.

9. Improve Maintenance Access to all parts of the system. Ease of access will improve preventative maintenance measures and help avoid catastrophic failure of system components. Regular and proper cleaning of all machines during breaks and between shifts is paramount to keeping the system running at peak capacity and efficiency.

   The way the system is currently laid out, it is nearly impossible to safely reach many of the main system components. Not having access does impact long term capabilities of maintaining equipment. Recommendation to improve maintenance access include:

   a.) Construction of additional maintenance platforms for components that can accommodate the space but have no access.

   b.) Construction of maintenance doors with windows for less accessible components.

   c.) Relocation of some components such as the Eddy Current & Magnet. Maintenance Access would be designed-in similar to (a) & (b) above.

   d.) Replacement of outdated components with newer technology. Maintenance Access would again be design-in.

Part – C Deficiencies by Component

POS M-1 Infeed Conveyor

- Steel Belt Separating
- Guarding under head pulley missing
- Loose electrical wire on motor
- Wrappings on head pulley shaft

Ref A5

Ref A3, A9

Ref A1 ,A3, A8, A14

POS M-2 Incline/Presort Conveyor

- Guarding missing, open exposed chain accessible
- Missing link pin and worn roller wheels on chain
- Bent support, not lagged to floor
- Heavily worn sideboards at Metering Drum and below
- Belly pan under head pulley bulging apart from material buildup
- Bent cleats
- Tail Guard not secured

Ref A5, A8, A9

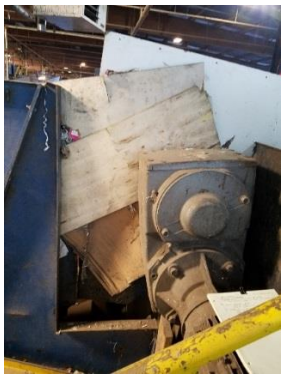
Ref A9

Ref A7

Ref A6

Ref A3, A6

Ref A3, A6, A7



Ref A6

POS M-2 Surrounding Area

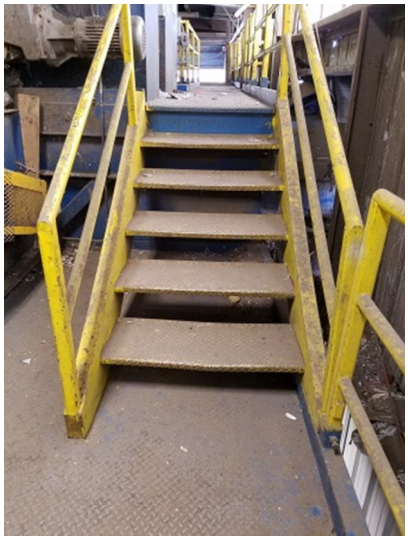
- Loose conduit hanging from wall
- Improper lighting support over Q.C. station
- Electrical Line crimped
- Chute(s) stuffed with material
- Floor deck lifting in areas
- Bottom step to presort bent

Ref A14

Ref A13, A14

Ref A14

Ref A3

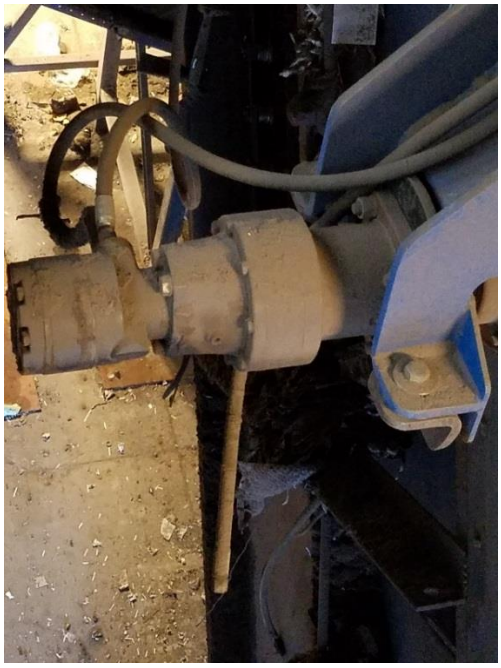


Ref A7

POS M-3 Metering Drum

- Loose hydraulic lines and leaking hydraulic power pack
- Worn drum and cleats
- Wrappings on drum shafts

Ref A4, A10



Ref A4, A10

Ref A3, A6, A10

POS M-4A Transfer Conveyor

- Loose and missing cleats
- Wrappings on head pulley
- Worn and missing Return Rollers

Ref A2, A3, A5

Ref A1, A3, A10

POS M-4B Transfer Conveyor

- Bent head pulley and wrapping on shaft
- Belt heavily worn and damaged lacing
- Return Rollers missing

Ref A3, A7, A10

Ref A2, A5

Ref A2

POS M-5 Trash Transfer Conveyor

- Wrapping on head pulley
- Gearbox possibly leaking
- Belt not tracked and cutting sideboard

Ref A3, A5, A6, A10

Ref A3. A5, A6

POS M-6 Large Plastic Transfer Conveyor

- Lacing torn & ripping
- Tracking off

Ref A5

POS M-7 OCC Screen

- Bearing bolt missing
- Gearbox leaking
- Oil reservoir missing/broken
- Motor fan cover missing screw
- Motor seal-tight damaged
- Teeth on Discs heavily worn
- Transfer plate at Infeed worn thru
- Additional Fall Protection needed on right side ladder (overlooking Tip Area)

Ref A8, A9

Ref A4, A14

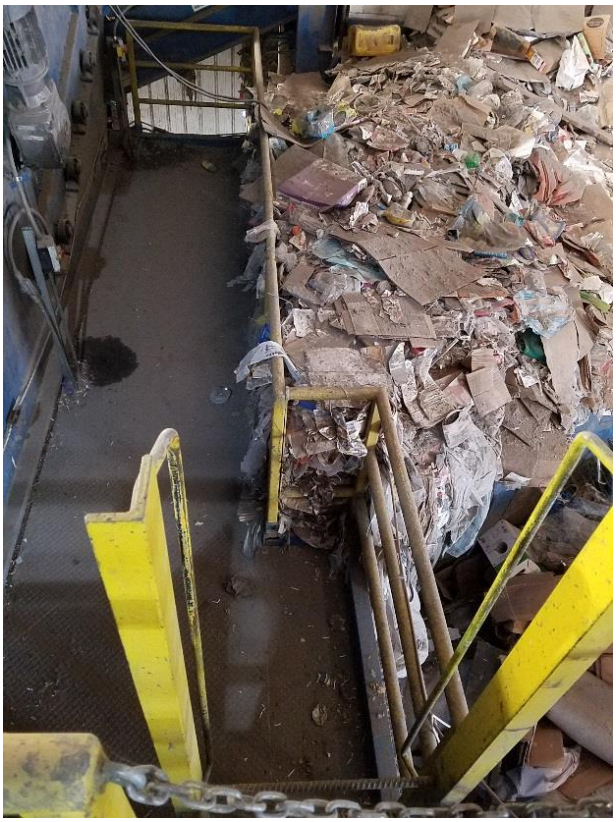
Ref A1, A14

Ref A14

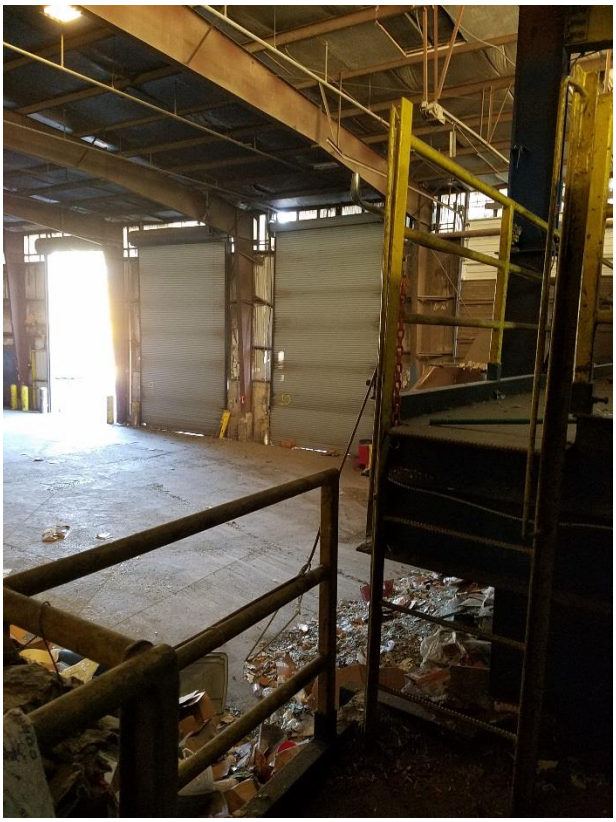
POS M-7 OCC Screen (cont.)

Ref A2, A3

Ref A6



Ref A4, A8



Ref A8

POS M-8 OCC Transfer Conveyor

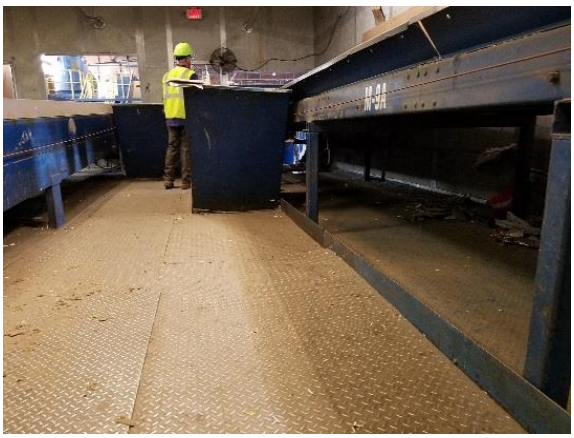
- Belt Cleats missing and loose
- Threshold to Pos M-9A trip hazard

Ref A5

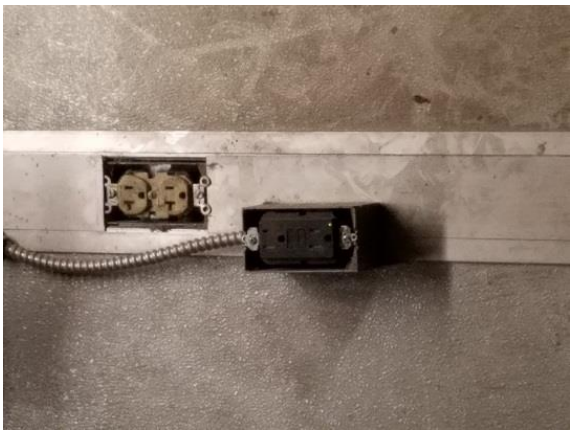
Ref A11

POS M-9A OCC Q.C. Conveyor

- Missing Belly Guard
- Open electrical box (no cover)
- Motor drive guard damaged
- Missing/Loose Sideboards
- Damaged Sort Chutes
- Deck lifting at Sort Station



Ref A11, A12



Ref A14

Ref 8

Ref A6, A8, A12

Ref A11

POS M-9B OCC Transfer Conveyor

- Bent/Leaning support
- Bolted connection incomplete
- Missing/Worn Return Rollers
- Add Right-side Transition Plate to Contain Material

Ref A2, A7

Ref A2, A7

Ref A2, A3

Ref A6

POS M-10A OCC Storage Conveyor

- Missing E-stop
- Missing Tail Guard

Ref A14

Ref A8

POS M-11 Screen Thrus Transfer Conveyor

- Belly Guards missing
- Self-cleaning Tail Pulley packed with material
- Windings on tail shaft
- Return Rollers worn
- Feed chute packed with material and worn
- Upturn Return Roller missing from radius

Ref A8

Ref A3, A8, A10

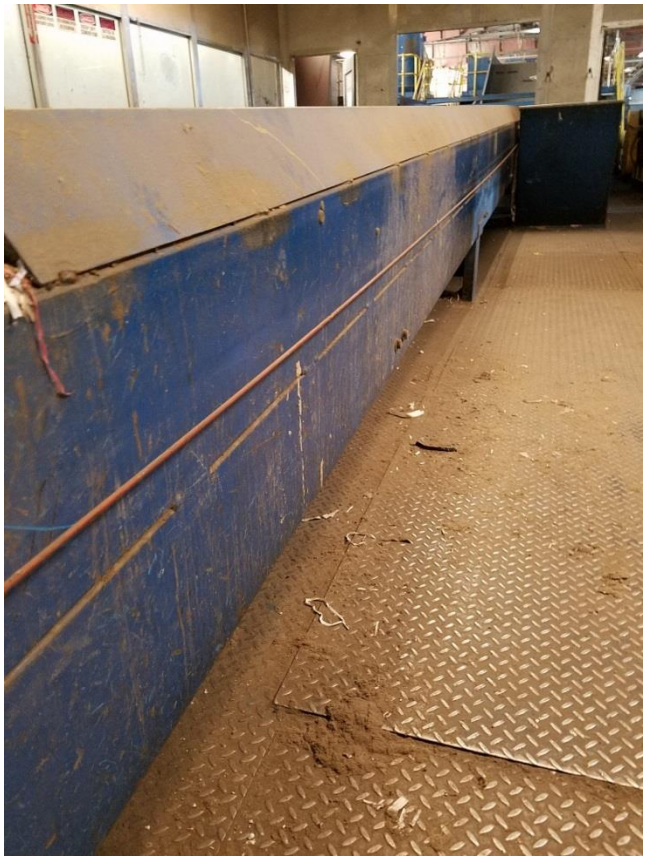
Ref A3, A6

Ref A2

POS M-12 Mixed Transfer Conveyor

- Return Rollers missing
- Damaged Sorting Chutes with sharp edges
- E-Stop Pull Cord missing eye-loops along conveyor

Ref A6, A11, A12



Ref A11

POS M-13 Scalping Screen Presort Conveyor & Surrounding Area

- No guarding to belt underside
- Open electrical box (no cover)
- Motor drive guard damaged
- Distorted chutes with sharp edges

Ref A6, A8, A12

POS M-14 Scalping Screen

- Leaking Drive Motor
- Bent Handrail adjacent
- Heavily worn discs

Ref A1, A4, A7

Ref A2

POS M-15 Scalping Screen – Post Sort

- No observable deficiencies

POS M-16A OCC Transfer Conveyor

- Tail Bearing Guard missing

Ref A8

POS M-16B Trash Transfer Conveyor

- Drive leaks

POS M-16C Trash Transfer Conveyor

- Open Electrical Box
- Return Roller buildup

Ref A10, A14

Ref A2, A3

POS M-17 ONP Screen

- Worn Sprocket
- Hydraulic Power Pack Leaking

Ref A9

Ref A4

POS M-18 Fiber Transfer Conveyor

- Belt edge torn
- Wrapping on Return Roller
- Tail Bearing Guard missing
- Missing Belly Pan at Tail
- Bearings worn
- Tail Shaft worn

Ref A5

Ref A2, A3

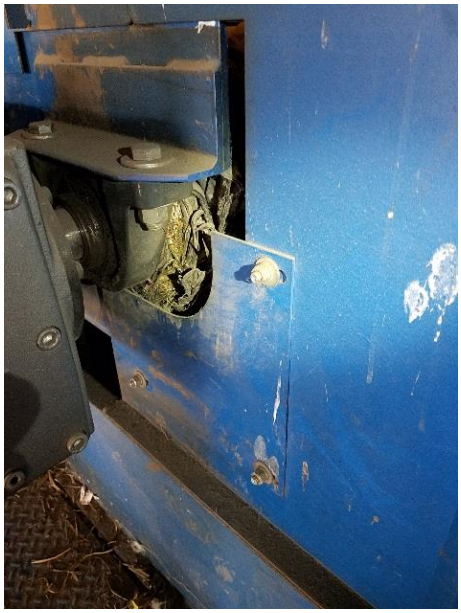
Ref A8, A10

POS M-19 (not used)

POS M-20 Fiber Sort Conveyor

- Belt torn along edge
- Wrappings on Head Pulley
- Missing Belly Guard

Ref A5

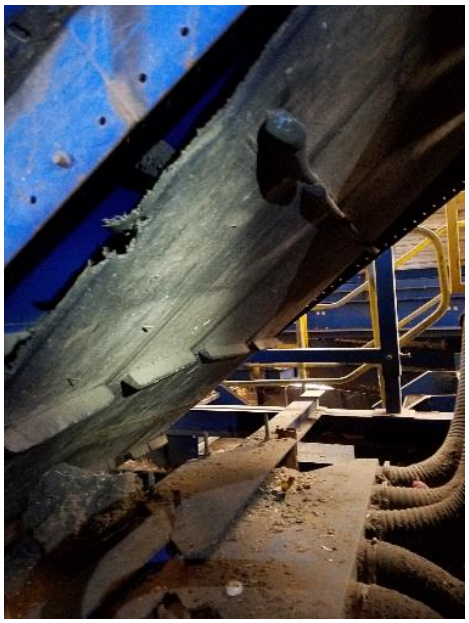


Ref A3

Ref A8

POS M-21 CP Screen Feed Conveyor

- Torn belt edge
- Missing cleats and return rollers
- Motor leaking
- Missing Dust Cover on oiler



Ref A2, A5

Ref A4

Ref A8, A14

POS M-22 CP Screen – Mid Fiber Cut

- Blower Motor heavily covered in Dust
- Open electrical & Oiler
- Coupling missing shock absorber & not guarded

Ref A1, A4

Ref A5, A8

POS M-23 Mid Fiber transfer Conveyor

- Tail Bearing Guard missing
- Missing Tail Belly Pan
- Bearings worn
- Questionable OSHA compliant guarding

Ref A8, A10

Ref A8

POS M-24 Fiber Sort Conveyor

- No observable deficiencies

POS M-25 (not used)

POS M-26 Containers Transfer Conveyor

- Missing proper Belly Protection
- Floor Deck on Tip Hall side bouncy

POS M-27 Containers Transfer Conveyor

- No observable deficiencies

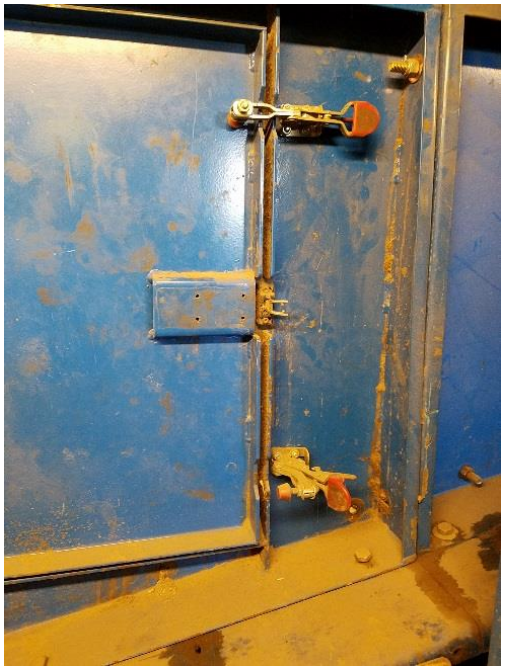
POS M-28 Fiber Transfer Conveyor

- No observable deficiencies

POS M-29 Glass Breaker

- Motor Drive Leaking
- Missing/Inoperative Disconnect Switches
- Empty Oil Reservoir

Ref A14

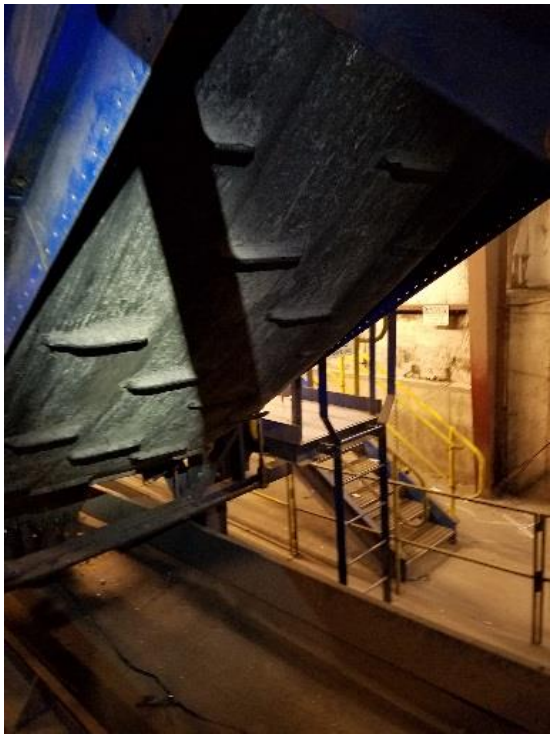


Ref A14

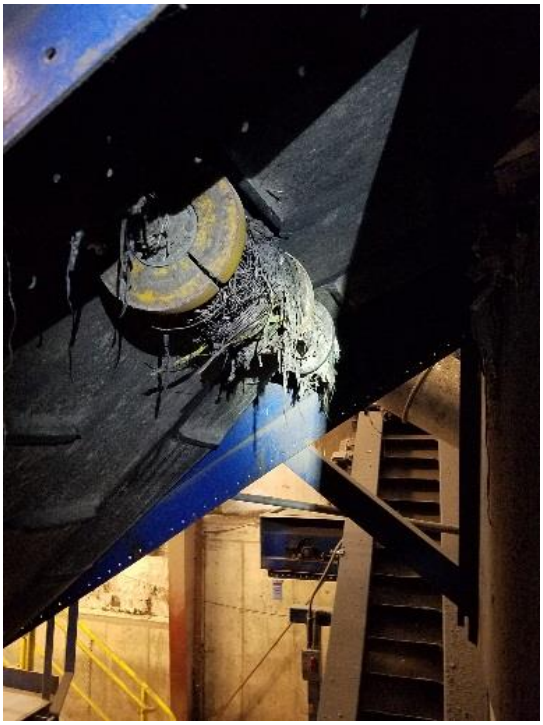
Ref A4

POS M-30 ADS Feed Conveyor

- Worn Cleats
- Missing/Damaged Return Rollers
- Missing Belly Guards



Ref A5, A8



Ref A2, A3, A8

POS M-31A & M-31B Air Drum Separator

- No observable Deficiencies

POS M-32 Fiber Transfer Conveyor

- Drive leaking
- Worn Return Rollers
- Broken electrical conduit

Ref A2, A3

Ref A14

Ref A14

POS M-33 Fiber Transfer Conveyor

- Missing Tail Guard
- Loose/Worn/Patched Belting

Ref A8

Ref A2, A5, A8

POS M-34 ADS Feed Conveyor

- Worn Return Rollers

Ref A2, A3

POS M-35 Air Drum Separator

- Drive leaking oil

POS M-36 Fiber Transfer Conveyor

- Drive leaks
- Lacing Torn

- Chain Binder used as motor support

Ref A15

POS M-38 Trash Bunker Conveyor

- Inaccessible, not inspected

POS M-39 Small OCC Bunker Conveyor

- Inaccessible, not inspected

POS M-40 OMP Bunker Conveyor

- Inaccessible, not inspected

POS M-41 Office Paper Bunker Conveyor

- Inaccessible, not inspected

POS M-42 ONP Bunker Conveyor

- Inaccessible, not inspected

POS M-43 ONP Bunker Conveyor

- Inaccessible, not inspected

POS M-44 B&C Transfer Conveyor

- Missing Tail Guard
- Wear on Tail Pulley sides due to poor tracking
- Missing Return Rollers
- Loose Seal-tight at motor

POS M-45 B&C Transfer Conveyor

- Questionable guarding material
- Buildup on Return Rollers

Ref A8

Ref A2, A3

- Offset Take-up, Belt not tracking

Ref A5

POS M-46B B&C Transfer Conveyor

- Belly Pan Spacing to be closed
- Worn Return Rollers and belting

Ref A6, A8

Ref A2, A3

POS M-47 Non-FE Transfer Conveyor

- Drive leaking
- Insufficient Belly Guard

POS M-48 Magnet

- No observable deficiencies

POS M-49 FE Transfer Conveyor

- Drive Leaks
- Missing Return Roller

Ref A2, A4

POS M-50A Accelerator Conveyor

- Missing Tail Guard
- Missing Belly Guard

Ref A6, A8

POS M-50B Optical Sorter

- No observable deficiencies

POS M-51 PET Q.C. Conveyor

- Insufficient Belly Guarding

Ref A8

POS M-52 PET Silo Blower

- No observable deficiencies

POS M-53 Pass Fraction Transfer Conveyor

- Heavily worn Return Roller
- Insufficient Guarding where conveyor comes thru platform

Ref A2, A3

Ref A8

POS M-54 Container Sort Conveyor

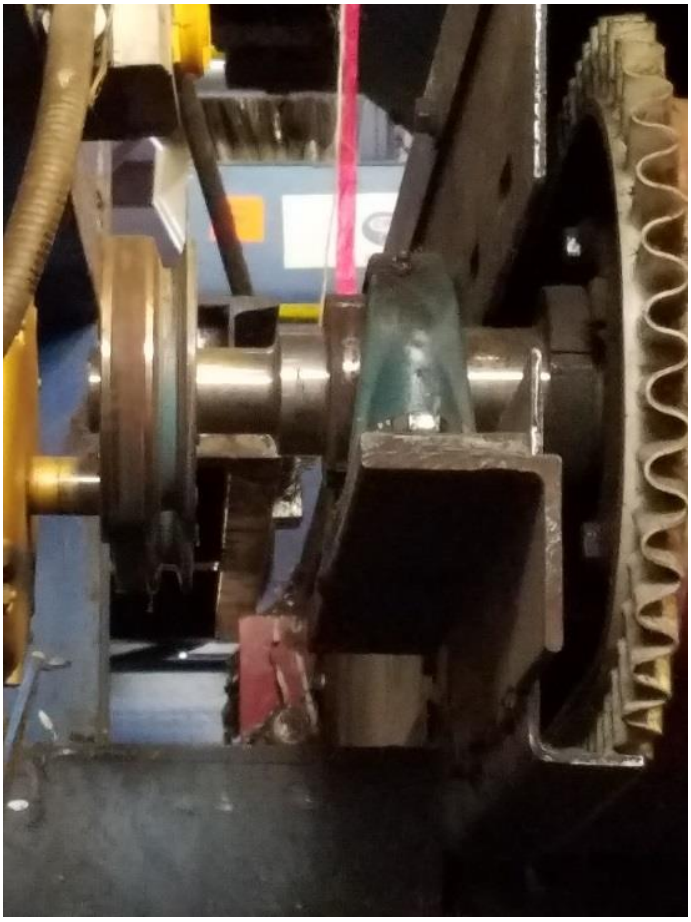
- Missing Belly Guard
- Missing Return Roller, others ground flat
- Torn Belting at lace and shredded edge

Ref A3, A8

Ref A5

POS M-55 Eddy Current

- Missing one (1) Drive Belt
- Missing Bearing Cover



Ref A5, A8, A10

Ref A3, A8, A10

POS M-56 Alum Q.C. Conveyor

- Missing Belly Guard
- Drive leaks

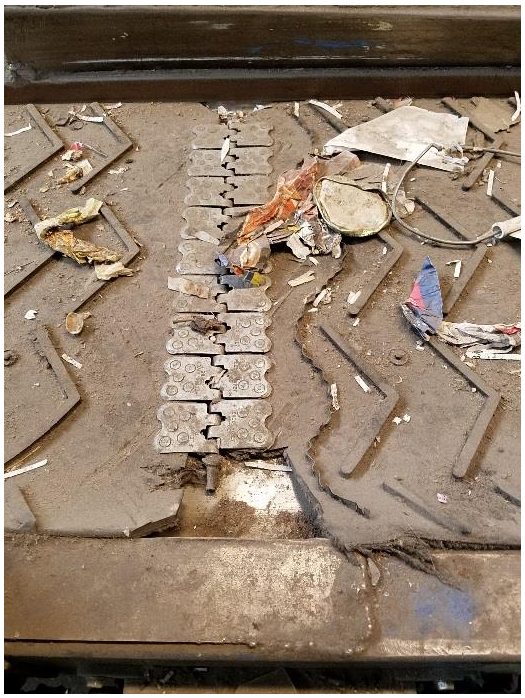
Ref A4, A8

POS M-57 Alum Silo Blower

- No observable deficiencies

POS M-58 Pass Fraction Q.C. Conveyor

- Belt torn at lace
- Missing Return Rollers
- Missing Belly Guard
- No E-Stop at Sort Station



Ref A2

Ref A8, A12

POS M-59 Trash Transfer Conveyor

- Return Roller Buildup
- Heavy Belt Wear

Ref A2, A3, A5

POS M-60 (not used)

POS M-61 Glass Transfer Conveyor

- Missing Tail Guard over bearing
- Missing Return Rollers
- Drive leaking

Ref A2, A4, A8

POS M-62 Glass Transfer Conveyor

- Tail Pulley wearing thru take-up
- Belt heavily worn
- Missing Tail Guard
- Belt Return Roller Jammed & Bypassed
- Wood used to hold up belting
- Broken electrical conduit

Ref A8, A10

Ref A8

Ref A8

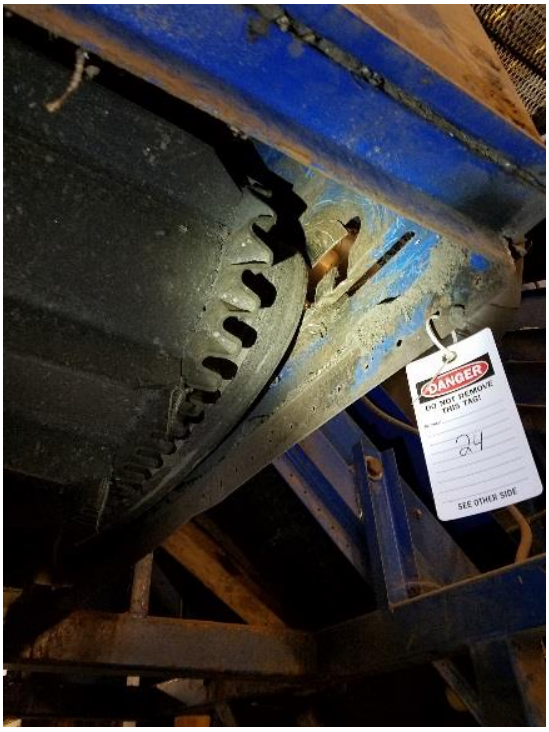
Ref A2, A8

Ref A6

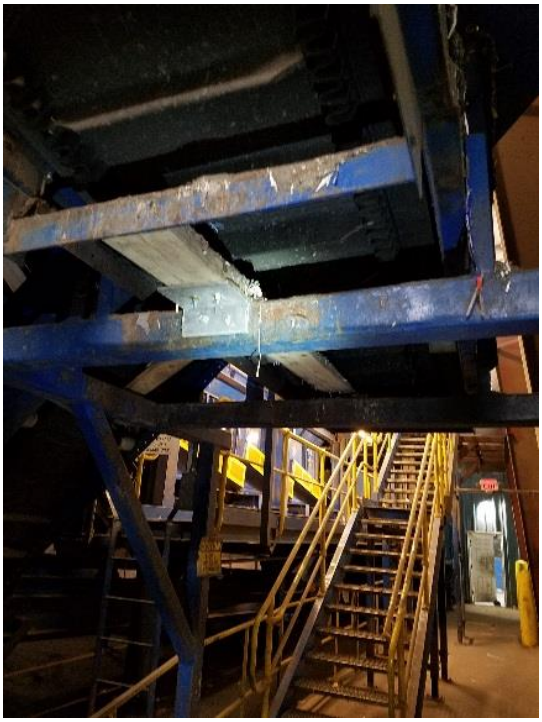
Ref A14

POS M-63A Glass Transfer Conveyor

- Tail Pulley worn thru Take-up
- Wood used as Return Guide
- Missing Belly guards
- Drive Leaks oil



Ref A6, A



Ref A6

POS M-63B Glass Transfer Conveyor

- Torn Belting
- Missing Tail Guard
- Missing Idler guards

Ref A5

Ref A8

POS M-64 Glass Cleanup System

- No observable deficiencies

POS M-64A Glass Cyclone Blower

- No observable deficiencies

POS M-64B Rotary Valve

- No observable deficiencies

POS M-64C Glass Transfer Conveyor

- Missing Tail Guard
- Heavily worn Return Rollers
- Drive Leaks

Ref A2, A8

Ref A2, A3, A8

POS M-65A Glass Transfer Conveyor

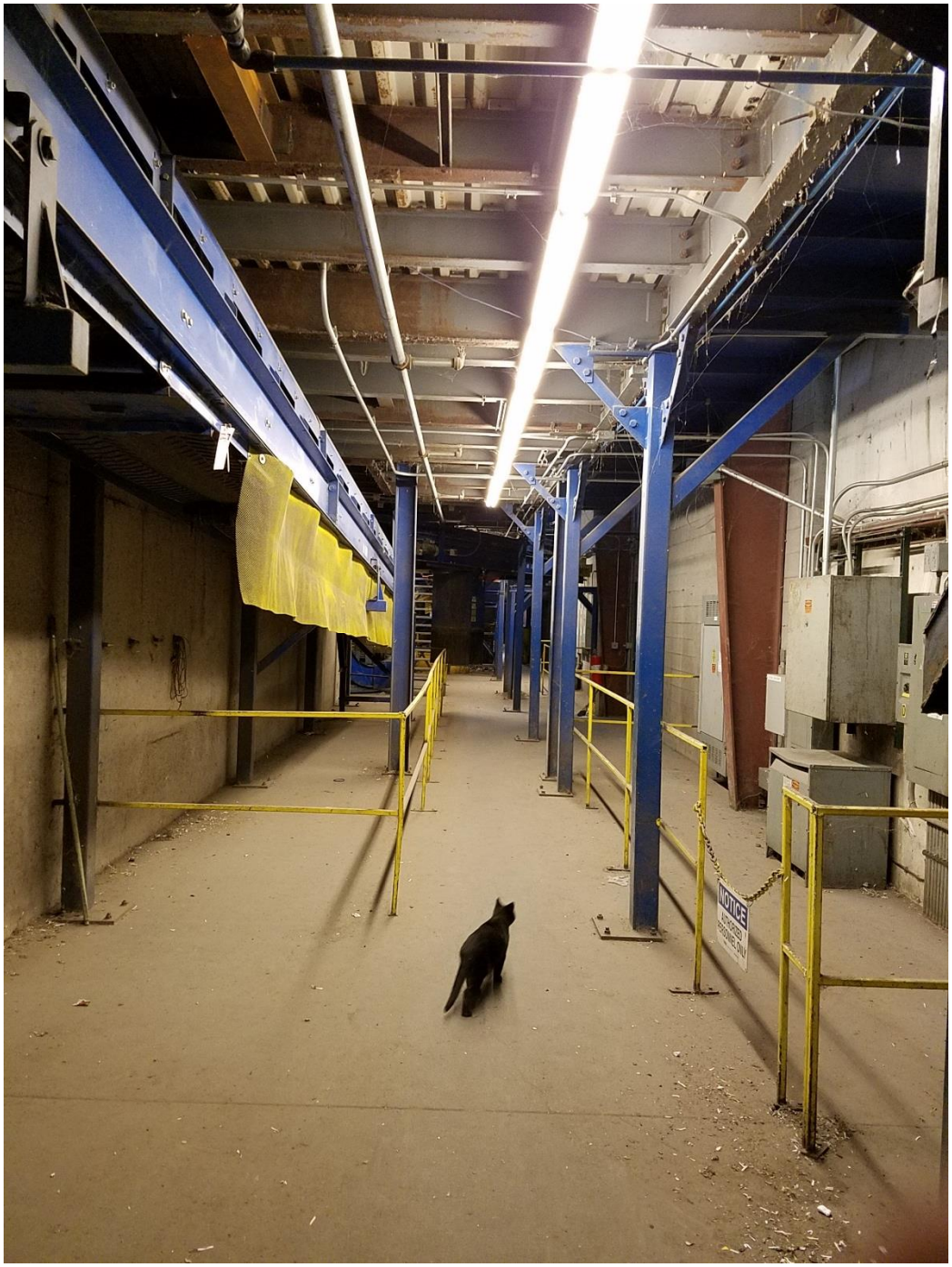
- Missing Return Roller(s)
- Damaged Belt due to drag on chute
- Belt tracking right
- Tail Pulley heavily worn
- Drive leaks oil

Ref A2, A3, A5

Ref A5

POS M-65B Glass Transfer Conveyor

- Heavy wear on belt
- Belt tracking right



Ref A5

POS M-65C Glass Transfer Conveyor

- Drive leaking
- Belting too loose

POS M-66 (not used)

POS M-67 Glass Transfer Conveyor

- Buildup on Return Rollers

Ref A3

POS M-68, 69 & 70 (not used)

POS M-71 Silo & Bunker Upload Conveyor

- Sideboards worn thru at Head Pulley (both sides)

Ref A6

POS M-72 Baler Feed Conveyor

- Automatic Oiler empty and disconnected
- Torn Sideboard on incline portion
- Some Chain Rollers not turning

Ref A4

Ref A6, A9

POS M-73 Baler

- No observable deficiencies

POS M-74A, B, C, D, E, F, G, H, J Silos

- Inaccessible, not inspected

POS M-75 Glass Transfer Conveyor (to bunker)

- Head Pulley supported by chain-fall

Ref A15