

## MHSW Processor Audit Report

Facility	Inmetco
Address	1 Inmetco Drive Ellwood City, PA 16117
Report Number	SO-MHSW-BAT-01
Audit Date	23 and 24 June

## Audit Summary Summary

### Audit Information

Name of Auditor	Role in Team	Date
Paul van der Werf	Lead Auditor	23 and 24 June

### Facility Representative

Name	Position
Mr. John Onuska Jr	Manager- Environment Health and Safety
Mr. Albert Hardies	Manager – Raw Materials

### Summary

The Facility recovers 96% of alkaline battery materials and 100% of lithium battery materials. The Recovery Efficiency Rate (RE) for alkaline batteries is 72% which is below the threshold Rate of 80%. The Recovery Efficiency Rate for lithium batteries is 60% which is above the threshold Rate of 37%.

It should be noted that no battery materials are directed to landfill. As well, the production and use of "slag" materials is acceptable in PA. The production of "slag" is done so by design and has specific end markets.

The RE of alkaline batteries is expected to decrease with the installation of new processing equipment. With the new process, Mn and Cu (along with Zn, KOH) will be directed to secondary processing where it will ultimately report to IRM (a slag material). Overall, it is estimated that the Facility would have a Recovery Efficiency Rate of close to 49%. This is below the SO threshold of 80%.

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## 1. Introduction

This audit was commissioned by Stewardship Ontario (SO) under the auspices of the Orange Drop Battery Incentive Program to confirm that its processing requirements are being met and that its required *Battery Recycling Effectiveness Rate* of 80% is being met. 2cg Inc. was retained to undertake this audit on SO's behalf.

The audit took place at Inmetco (Facility), in Ellwood City, Pennsylvania, USA on 23 and 24 June 2011. This Facility accepts and recycles a wide range of batteries. This audit focused on the recycling of resident/consumer generated primary batteries and specifically on single-use dry-cell batteries (e.g. single use alkaline, zinc carbon, zinc air, lithium and button cells) as defined in SO's *Battery Incentive Program - Program Guide* (February, 2011). Meeting SO's requirements will allow the Facility to become an approved Battery Processor.

The audit included the following:

- Staff interviews to confirm Facility compliance with various SO requirements;
- Facility tour;
- Review of various documentation; and
- Research to confirm Battery Recycling Effectiveness Rate.

## 2. Overview of Processing Facility and Facility Tour

Some general audit information was provided by the Facility and is attached in Appendix 1.

The Facility, owned by Horsehead Industries and established in 1978, recycles approximately 72,000 tonnes/year of metal wastes. This includes a wide range of nickel, chromium, iron, molybdenum and cadmium bearing wastes. Some of the wastes recycled include:

- Nickel, Chromium and Molybdenum containing Sludges and Cakes;
- Nickel, Chromium and Molybdenum containing Dusts and Grindings;
- A variety of primary and secondary batteries;
- Baghouse Bags; and
- Filters from Plating Operations.

As noted this audit deals specifically with resident/consumer generated primary batteries.

### *Receipt and Storage*

Primary batteries are received by the truck load and weighed. They are directed to a large indoor storage bunker inside the main building of the Facility. There are a number of other bunkers adjacent to this bunker for other materials recycled at this Facility.

In 2010, approximately 2,300 tonnes of primary batteries were received at the Facility.

During the Facility audit, there were an estimated 900 tonnes of primary batteries on-site. Normally, the inventory of primary batteries is not this high. The Facility is upgrading primary battery processing capabilities and is awaiting the installation of new equipment (expected by mid-August).

The building, including the bunkers, has full containment capabilities in the event of any spill.

#### *Sorting*

The primary batteries do not undergo any sorting prior to incorporation into the recycling system for processing.

#### *Current Processing*

Figure 1 depicts processing of various wastes at the facility. Various additional notations describe the processing of primary batteries.

It should be noted that primary batteries are not processed as a dedicated waste stream at the Facility. They are blended in with other wastes received at the Facility.

The processing of primary batteries starts at "Cakes and Special Additives". They are initially added to a Rotary Hearth Furnace (for calcining) (Photo 1) and then to an Electric Arc Furnace (for metal recovery) (Photo 2). Plastic in the batteries is used as a chemical reagent (i.e. reductant) in the process and helps replace the "coke fines" normally used for this purpose.

Figure 1. Overview of Processing at the Facility

**INMETCO PROCESS FLOW DIAGRAM**

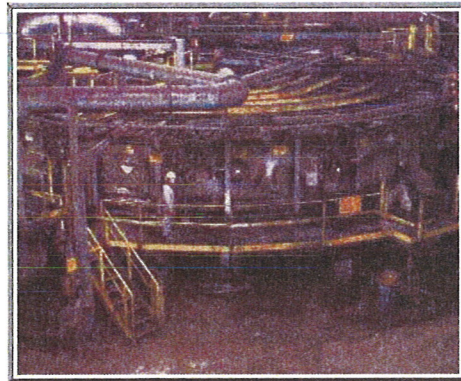
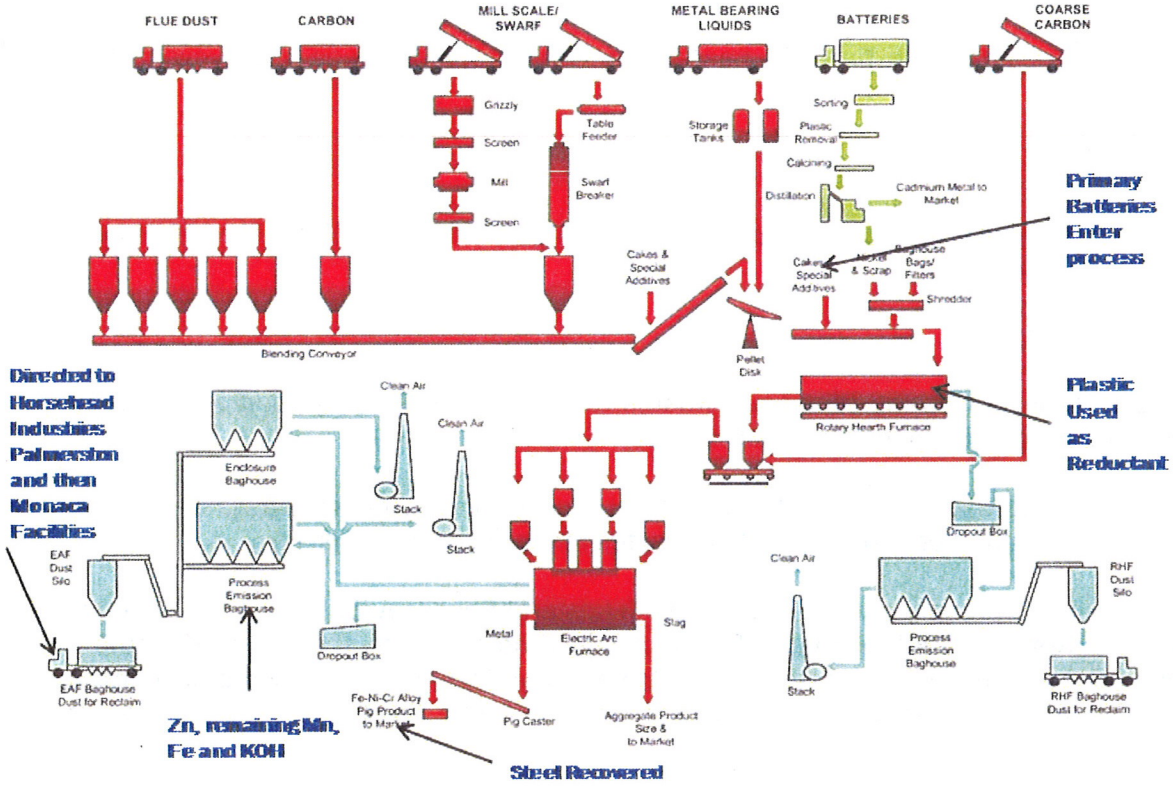
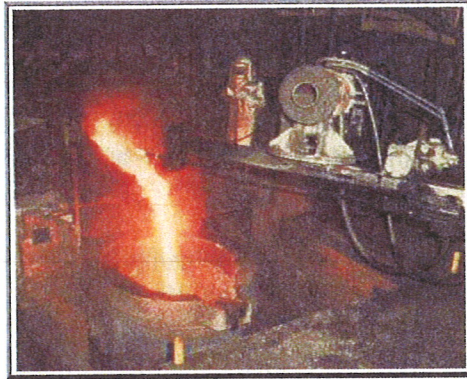


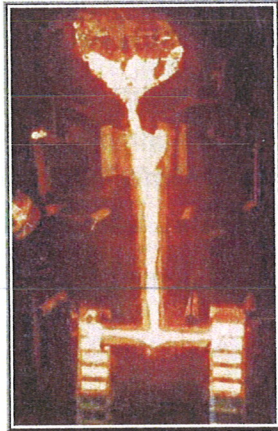
Photo 1. Rotary Hearth Furnace  
 ([http://www.inmetco.com/photo\\_gallery.htm](http://www.inmetco.com/photo_gallery.htm))



**Photo 2. Electric Arc Furnace**

([http://www.inmetco.com/photo\\_gallery.htm](http://www.inmetco.com/photo_gallery.htm))

The Electric Arc Furnace generates Fe, Ni, Cr, Mn alloy "Pigs" (Photos 3 and 4). The "Pigs" are stainless metal bars (ca. 10 kg). They are directed to market. The Electric Arc also generates Slag which is sized and directed to the aggregate market. The slag is a designed product with specific end markets. This part of the process recovers Fe, Ni and some Mn from primary batteries. Dust from the Electric Arc Furnace is directed to and filtered in the Process Emission Baghouse. From primary batteries, mainly Zn but also Mn and KOH (potassium hydroxide) are filtered out.



**Photo 3. Casting Remelt Alloy**

([http://www.inmetco.com/photo\\_gallery.htm](http://www.inmetco.com/photo_gallery.htm))



**Photo 4. Final Product (Pig)**

([http://www.inmetco.com/photo\\_gallery.htm](http://www.inmetco.com/photo_gallery.htm))

**MHSW Processor Audit Report  
INMETCO**

The dust from the Process Emission Baghouse is directed to the Horsehead Zinc Recovery facility in Palmerton, PA. Here Zn is recovered and then directed to the Horsehead Zinc Refinery Facility (see below). The Mn and any remaining Fe recovered is directed to Iron Rich Material (IRM), a slag product that is used in cement kilns. The IRM is a designed product with specific end markets. The KOH is incorporated into a PbCl (i.e. lead chloride) product that is directed to China for further processing.

The Zn is then directed to the Horsehead Zinc Refinery Facility, in Monaca, PA. It is here that Zn metal and Zn oxides are refined and directed to markets.

Table 2.1 presents an overview of the fate of the various components of a primary battery.

**Table 2.1 Fate of Main Battery Components during Processing**

Battery Component	Fate
Steel	Recovered and converted to stainless steel Pigs at Elwood City Facility.
Plastic	Used as chemical reagent in process at Elwood City Facility.
Zinc (Zn)	Collected in Process Emission Baghouse at Elwood City Facility. It is then recovered and refined at Horsehead Industries' Palmerton and Monaca PA facilities respectively.
Manganese (Mn)	Some ends up in the Pigs produced at Elwood City Facility. The rest is recovered in IRM at the Palmerton PA facility and is then directed to cement kilns.
Potassium Hydroxide (KOH)	Some likely used at the Elwood City Facility (i.e. the "O" is likely captured in furnaces). The remainder is captured at the Palmerton PA facility and becomes part of a PbCl product that is directed to China.

According to the Facility no waste is directed to landfill.

The Facility has a certificate for ISO 9001 (Appendix 1).

*Future Processing*

The Facility is presently upgrading its primary battery processing. It is installing a shredder to allow for the separation of the "metal jackets" from the internal paste (i.e. Zn, Mn, KOH, Cu) of primary batteries. The metal jackets will be processed using the system described above. The separated internal paste will be directed to Horsehead Industries Monaca, PA Zinc refining facility where the Zinc will be refined. The Mn and any remaining Fe and Cu recovered are directed to Iron Rich Material (IRM) a slag product that is used in cement kilns. The KOH is incorporated into a PbCl (i.e. lead chloride) product that is directed to China for further processing.



### *Environmental Controls*

It should be noted that primary batteries are not considered a hazardous waste in PA. The processing of primary batteries does not require an operating permit or an air permit provided that they meet federal requirements (i.e. 40CFR Section 273.32).

The processing of primary batteries is provided with additional environmental controls because they are managed under the auspices of the hazardous waste operating permit and air permit of the Ellwood City, PA facility.

A summary of Facility non-compliances are included in Appendix 2.

The Facility has a certificate for ISO 14001:2004 (Appendix 1).

### *Facility Tour Observations*

The flow of primary batteries was well explained and it was easy to follow the sequential steps from receipt, to processing, to product manufacture and discharge of materials for further processing.

A key learning is that primary batteries are blended in with other wastes during processing.

The key processing bottle neck limiting the processing of additional primary batteries is related to the "brass nail" (specifically the Cu) contained in primary batteries. That is principally why the Facility is changing its operating procedures.

### **3. Review of Documentation**

A completed and signed MHSW Incentive Transporter and Processor Audit Checklist is presented in Table 2. These represent SO's minimum requirements.

The following were reviewed.

- **Valid Business Licence;**
- **Part-B Hazardous Waste Storage Permit #PAD087561015;**

The receipt and processing of primary batteries do not require a State level operating permit because they are not deemed hazardous. If Federal requirements (i.e. 40CFR Section 273.32) are met (USEPA) a facility can accept and process primary batteries. The facility must notify State regulators. A copy of the notification letter is provided in Appendix 2.

The primary batteries, which are not hazardous, are being processed under auspices of the operating permit for hazardous wastes (that the Ellwood City, PA Facility receives). A copy of the cover page of this permit is attached in Appendix 2. This provides extra checks and balances for the processing of primary batteries.

The facility is inspected four times per year by State inspectors. A copy of the cover sheet for the most recent inspection is attached in Appendix 2.

- PADEP Title V Operating Permit, #37-00-243 (Air);

A copy of the cover page of this permit is attached in Appendix 2. The facility is inspected once per year by State inspectors. A copy of the cover sheet for the most recent inspection is attached in Appendix 2.

**Table 2 Completed and Signed MHSW Incentive Transporter and Processor Audit Checklist**



Thinking beyond the box

Stewardship Ontario

**MHSW Incentive Transporter & Processor Audit Checklist**

	Standard	Initial	Comments
1	Possess a valid business license.	<i>JW</i>	See the attached documents
2	Possess a valid Ministry of the Environment Certificate of approval for all planned MHSW-related activities (as applicable).	<i>JW</i>	Part B Hazardous Waste Storage Permit PAD087561015 Air Permit PADEP Title V Operating Permit #37-00243. Primary batteries are not a hazardous waste in the United States, per 40CFR260, Inmetco has filled notice to the regulatory agencies of its battery activities as required.
3	Required to be Dangerous Goods Act compliant, including CSA and TDGA Drum Standards (where applicable).	<i>JW</i>	NA
4	Required to be registered with Ontario Hazardous Waste Information Network (as applicable).	<i>JW</i>	NA
5	Require WMHIS compliance, including WHMIS training.	<i>JW</i>	WMHIS is a Canadian term, We have Haz-Com in the United States
6	Possess a Workplace Safety and Insurance Board Certificate of Clearance.	<i>JW</i>	See the attached insurance documents
7	Must demonstrate compliance with O.Reg. 347 requirements, as applicable to planned activities.	<i>JW</i>	US-EPA 40CFR regulations are equal or more stringent
8	Required to have an emergency response/spill response plan in place, including associated employee training programs.	<i>JW</i>	Yes, See the attached provided electronic copy of the plan
9	All vehicles used to transport MHSW must have an enclosed cargo area and must possess a valid Commercial Vehicle Operator Registration.	<i>JW</i>	NA
10	All non-processed MHSW must be stored in a secure area. Quantities of stored non-processed MHSW cannot exceed 60 days average supply at any given time.	<i>JW</i>	Yes

	Standard	Initial	Comments
11	Required to carry a minimum of \$5,000 General Third-Party Public Liability Insurance on all vehicles/transporters of MHSW, all facilities used to store MHSW material and all Processors of MHSW material. Stewardship Ontario must be listed on the policy as an additional insured party.	JW	See the attached documents, upon request SO can be listed on the policy as an additional insured party
12	Exporting of MHSW must be done in compliance with the federal government's Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations.	JW	See the attached documents. Inmetco does not ship any primary consumer battery types off site
13	In addition to complying with the above standards and regulations, any Transporter, Processor or sub-Processor of MHSW Automotive material wishing to register with Stewardship Ontario as a Vendor, must comply with all requirements listed in the Stewardship Ontario Consolidated Municipal Hazardous or Special Waste Program Transporter and Processors Standards.	JW	NA
14	Transporters and Processors of all MHSW Automotive Materials must possess and maintain auditable records.	JW	NA
15	Transporters are required to maintain auditable records of program materials transported, stored at bulk storage facilities and records of bulk moves of the program materials to a Stewardship Ontario-approved primary processor.	JW	NA
16	Processors are required to maintain auditable records of Processing Methodology, if the materials are shipped out for further processing prior to sending to the final processing operation (if applicable). Quantities, timing and destination of processed material shipped into market (disposition reporting) must be recorded.	JW	Yes

Signature:   
 John C. Onuska Jr., Inmetco Manager Environment, Health and Safety

Date: June 24, 2011

- **Haz-Com Employee Training;**

Haz-Com is similar to Canadian WHMIS program.

Employees are provided with Haz-Com training. Employees have access to a dedicated intranet site which includes all relevant health and safe information.

- **Review of Insurance Certificates (general commercial liability, environmental liability, workers compensation);**

Insurance certificates are included in Appendix 3. SO would need to be added as an insured party if the Facility became an approved Battery Processor.

- **Review of Compliance with O. Reg 347**

As noted above, the Facility does not require a formal approval to receive and process primary batteries so long as it adheres to federal (i.e. USEPA) 40CFR Section 273.32 requirements. In essence, this is a Permit-by-Rule approach.

These requirements are different than in Ontario where a Certificate of Approval is required to process primary batteries.

However, as noted above, the Facility does have operating and air permits because of hazardous and other wastes received at the Facility. In effect, the processing of primary batteries operates under the auspices of these permits because the batteries are blended with hazardous and other wastes as part of processing at this Facility.

- **Review of Emergency Response/Spill Plan**

The Facility has an extensive Emergency Response/Spill Plan that governs all wastes received at the Facility.

A copy of the cover sheet for the most recent Emergency Response Plan is attached in Appendix 1.

- **Storage of Primary Batteries (during facility tour)**

This was inspected during the Facility tour. Batteries are stored in a secure bunker. Batteries are not stored longer than 60 days average supply time. There was a larger amount of primary batteries in storage than usual because new processing equipment will be installed (ready for operation by mid-August).

- **Exporting of MHSW**

All primary batteries are processed at the Facility with additional recovery and refining at Horsehead Industries PA facilities. Silver oxide primary batteries (<0.1 tonne/year) are sent to Yardney Technical Products in Pawcatuck CT for recovery of silver.

No resident/consumer grade primary batteries are exported to Canada for processing.

Any of the K that becomes incorporated with PbCl is subsequently exported to China where the PbCl is further processed.

- **Review of Manifest and Bills of Lading for inbound primary batteries and outbound products or materials requiring further recovery and refining.**

The following records were reviewed:

- Receipt of primary batteries "Uniform Hazardous Waste Manifest"
- Shipping of "Pigs" to market - "Straight Bill of Lading"
- Shipping Process Emission Baghouse Material to Horsehead Industries Palmerton, PA facility "Straight Bill of Lading"
- Shipping of IRM to market - "Bill of Lading"
- Shipping of PbCl to market - "Bill of Lading"

They foregoing attests to the receipt and processing of primary batteries as well as the marketing of various products.

#### **4. Battery Recycling Effectiveness Rate Measurement Protocol**

The Total Recovery Rate and the SO Recycling Effectiveness Rate, of each battery chemistry, processed was calculated. Data provided by the Facility (i.e. Annual Processing and Recovery Report from Raw Materials Company Inc., who ships some primary batteries to the Facility) and from industry information *Life Cycle Impacts of Alkaline Batteries with a Focus on End of Life* (MIT, 2011) was used to help make these calculations.

It should be noted that primary batteries are not processed as a dedicated waste stream at the Facility. They are blended with other wastes prior to processing. This means that Total Recovery and Recycling Effectiveness Rate are estimates.

As noted in Section 3, manifests and bills of lading were examined to confirm the receipt of primary batteries, shipping from the site for further processing and shipping from the site as a product.

The main battery chemistries managed at the Facility are:

- Alkaline; and
- Lithium.

Small amounts of Silver Oxide batteries are received at the Facility. They are not considered further in this report.

#### 4.1 Alkaline Batteries

The vast majority of primary batteries received at the Facility are alkaline. It was estimated by the Facility that approximately 2,300 tonnes of alkaline batteries were received in 2010.

For the purposes of this report the alkaline batteries directed to the Facility by the Raw Materials Company Inc. (Port Colborne, Ontario) were considered.

Table 4.1 depicts the Total Recovery Rate and Recycling Effectiveness Rate for alkaline batteries. This calculation is based on total alkaline batteries received net of water and contamination.

On this basis the total recovery rate of batteries is estimated to be 96%.

SO funding is based on achieving a Recycling Effectiveness Rate of 80%. Recycling is divided into "Up-cycling" in which the materials are re-used in high value applications and "Down-cycling" in which the value of materials are lost and cannot be recovered following its next use.

**Table 4.1 Total recovery and Recycling Effectiveness Rate- Alkaline Batteries**

Battery Chemistry	Alkaline Batteries			Comments
Annual Tonnage	67			
Correction Factor for Water (%)	8.5			Standard SO factor
Correction Factor for non-Program Batteries and other contamination (%)	5			Estimated from review of materials and discussions with staff
Net Input (Tonnage)	58			
<b>Outputs from Primary and Secondary Processing</b>				
<b>Primary Recovery</b>	tonnes	%		
Metal Recovery (Fe, Ni, Mn, Cu)	23.5	40.5		Estimate of tonnes recovered from Inmetco
Co-product, Aggregate (Slag)	10.1	17.4		Estimate of tonnes recovered from Inmetco
Plastic Reductant	5.4	9.3		Estimate of tonnes recovered from Inmetco. Partially replaces "coke fines" as reductant.
	38.9	67.2		
<b>Secondary Recovery (25%)</b>				Inmetco estimate. Secondary Recovery occurs at their Palmerton and Monaca PA facilities
Metal Recovery (Zn)	12.7	22.0		Zn about 19% of spent battery weight. Not recovered during Primary Recovery
Iron Rich Material-IRM (Slag) (Mn)	2.3	3.9		Mn estimated to be about 15.7% of spent battery weight. On this basis about 80% recovered during Primary Recovery
Metal Recovery (PbCl)	1.7	3.0		K about 2.6% of battery spent weight. Not recovered during Primary Recovery. PbCl directed to China for further refining
	16.8	28.9		
	55.7	96.1		Estimated total recovery rate
<b>Calculation of Recycling Efficiency (RE)</b>				
	Upcycling	Downcycling	Disposal	Total
<b>Outputs</b>	tonnes/year			
<b>Primary Recovery</b>				
Metal recovery	23.5			23
Co-product/Aggregate (Slag)		10.1		10
Plastic Reductant	5.4			5
				Partially replaces "coke fines" as reductant.
<b>Secondary Recovery</b>				
Metal Recovery (Zn)	12.7			13
Iron Rich Material-IRM (Slag) (Mn)		2.3		2
Metal Recovery (PbCl)		1.7		2
<b>Net Input</b>	41.6	14.1	0	55.7
<b>Total Tonnes</b>	58.0			
<b>Recycling Efficiency (RE)</b>	71.8%			



Overall, it is estimated that the Facility has a Recycling Efficiency (RE) of close to 72%. This is below the SO threshold of 80%. Up-cycling activities include the recovery of Fe, Ni, Mn and Cu metals and the use of plastics as a chemical reagent (i.e. reductant). A letter is attached in Appendix 4 regarding the use of plastic as a reductant.

In terms of down-cycling, slag products are produced during primary and secondary recovery. A letter is attached in Appendix 4 to PA's acceptance of slag as a product. As well, a portion of KOH becomes incorporated into a lead chloride (PbCl) product.

The RE is expected to decrease with the installation of new processing equipment. With the new process, Mn and Cu (along with Zn, KOH) will then be directed to secondary processing where it will ultimately report to IRM (a slag material).

Table 4.2 estimates the Total Recovery Rate and Recycling Effectiveness Rate for alkaline batteries using the new process. This calculation is based on total alkaline batteries received net of water and contamination.

**Table 4.2 Estimated total recovery and Recycling Effectiveness Rate- Alkaline Batteries- new process**

Battery Chemistry	Alkaline Batteries			Comments
Annual Tonnage	67			
Correction Factor for Water (%)	8.5			Standard SO factor
Correction Factor for non-Program Batteries and other contamination (%)	5			Estimated from review of materials and discussions with staff
Net Input (Tonnage)	58			
<b>Outputs from Primary and Secondary Processing</b>				
<b>Primary Recovery</b>	tonnes	%		
Metal Recovery (Fe, Ni)	10.1	17.4		Fe and Ni from estimate of composition of spent batteries
Co-product, Aggregate (Slag)	4.3	7.4		Fe and Ni from estimate of composition of spent batteries
	14.4	24.8		
<b>Secondary Recovery (25%)</b>				Inmetco estimate. Secondary Recovery occurs at their Palmerton and Monaca PA facilities
Metal Recovery (Zn)	12.7	22.0		Zn about 19% of spent battery weight.
Iron Rich Material-IRM (Slag) (Mn)	21.5	37.1		All Mn and Cu.
Metal Recovery (PbCl)	1.7	3.0		K about 2.6% of battery spent weight. Not recovered during Primary Recovery. PbCl directed to China for further refining
Plastic Reductant	5.4	9.3		Estimate of tonnes recovered from Inmetco. Partially replaces "coke fines" as reductant.
	41.4	71.4		
	55.7	96.1		Estimated total recovery rate
<b>Calculation of Recycling Efficiency (RE)</b>				
	Upcycling	Downcycling	Disposal	Total
<b>Outputs</b>	tonnes/year			
<b>Primary Recovery</b>				
Metal recovery	10.1			10
Co-product/Aggregate (Slag)		4.3		4
<b>Secondary Recovery</b>				
Metal Recovery (Zn)	12.7			13
Iron Rich Material-IRM (Slag) (Mn)		21.5		22
Metal Recovery (PbCl)		1.7		2
Plastic Reductant	5.4			5
				Partially replaces "coke fines" as reductant.
<b>Net Input</b>	28.2	27.6	0	55.7
<b>Total Tonnes</b>	58.0			
<b>Recycling Efficiency (RE)</b>	48.6%			

Overall it is estimated that the Facility has a RE of close to 49%. This is below the SO threshold of 80%.

## 4.2 Lithium Batteries

It was estimated by the Facility that approximately 120 tonnes of lithium batteries were received in 2010.

For the purposes of this report the lithium batteries directed to the Facility by the Raw Materials Company Inc. (Port Colborne, Ontario) were considered.

Table 4.3 depicts the Total Recovery Rate and Recycling Effectiveness Rate for lithium batteries. This calculation is based on total lithium batteries received net of water and contamination.

On this basis, the total recovery rate of batteries is estimated to be 100%. (Note: The calculations resulted in a greater than 100% recovery rate when standard water and contamination rates were netted out).

SO funding is based on achieving a Recycling Effectiveness Rate of 37%. Recycling is divided into "Up-cycling" in which the materials are re-used in high value applications and "Down-cycling" in which the value of materials are lost and cannot be recovered following its next use.

**Table 4.3 Total Recovery and Recycling Effectiveness Rate- Lithium Batteries**

Battery Chemistry	Lithium Batteries			Comments
Annual Tonnage	4.82			
Correction Factor for Water (%)	8.5			Standard SO factor
Correction Factor for non-Program Batteries and other contamination (%)	5			Estimated from review of materials and discussions with staff
Net Input (Tonnage)	4.2			
<b>Outputs from Primary and Secondary Processing</b>				
<b>Primary Recovery</b>	tonnes	%		
Metal Recovery (Fe, Cu)	2.4	57.8		Estimate of tonnes recovered from Inmetco
Co-product, Aggregate (Slag)	1.8	42.7		Estimate of tonnes recovered from Inmetco
Plastic Reductant	0.1	1.7		Estimate of tonnes recovered from Inmetco. Partially replaces "coke fines" as reductant.
	4.3	102.2		
<b>Secondary Recovery (2%)</b>				Inmetco estimate. Secondary Recovery occurs at their Palmerton and Monaca PA facilities
Iron Rich Material-IRM (Slag) (Mn)	0.1	2.3		
	0.1	2.3		
	4.4	104.5		Estimated total recovery rate. Exceeds 100% because of water and contamination estimates.
<b>Calculation of Recycling Efficiency (RE)</b>				
	Upcycling	Downcycling	Disposal	Total
	tonnes/year			
<b>Outputs</b>				
<b>Primary Recovery</b>				
Metal recovery	2.4			2.4
Co-product/Aggregate (Slag)		1.8		1.8
Plastic Reductant	0.1			0.1
				Partially replaces "coke fines" as reductant.
<b>Secondary Recovery</b>				
Iron Rich Material-IRM (Slag) (Mn)		0.1		0.1
<b>Net Input</b>	2.5	1.9	0	4.4
	4.2			
<b>Recycling Efficiency (RE)</b>	59.5%			

Overall, it is estimated that the Facility has a RE of close to 60%. This is above the SO threshold of 37%. Up-cycling activities include the recovery of Fe and Cu metals and the use of plastics as a chemical reagent (i.e. reductant). A letter is attached in Appendix 4 regarding the use of plastic as a reductant.



In terms of down-cycling, slag products are produced during primary and secondary recovery. A letter is attached in Appendix 4 to PA's acceptance of slag as a product. As well, a portion of KOH becomes incorporated into a lead chloride (PbCl) product.

## 5. Conclusions

The Facility recovers 96% of alkaline battery materials and 100% of lithium battery materials. The Recovery Efficiency Rate for alkaline batteries is 72% which is below the threshold Rate of 80%. The Recovery Efficiency Rate for lithium batteries is 60% which is above the threshold Rate of 37%.

It should be noted that no battery materials are directed to landfill. As well, the production and use of "slag" materials is acceptable in PA. The production of slag is done so by design and has specific end markets.

The RE of alkaline batteries is expected to decrease with the installation of new processing equipment. With the new process, Mn and Cu (along with Zn, KOH) will be directed to secondary processing where it will ultimately report to IRM (a slag material). Overall, it is estimated that the Facility would have a Recovery Efficiency Rate of close to 49%. This is below the SO threshold of 80%.

Appendix 1  
General Documents

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## General Audit Information Provided By Facility

### *ENVIRONMENTAL AUDIT INFORMATION*

**INMETCO® (The International Metals Reclamation Company, Inc.)**

**One Inmetco Drive, Ellwood City, PA 16117**

**(724) 758-5515 Fax (724) 758-2837**

**Website – [www.inmetco.com](http://www.inmetco.com)**

Inmetco is located in Western Pennsylvania, north of Pittsburgh and south of New Castle in Lawrence County.

The Inmetco property once was the site of U.S. Steel's National Tube Works manufacturing facility that operated from the early twenties to the early seventies. The construction of INMETCO began in 1976, with operations commencing in late 1978. The main facility is housed in one building being 3.2 acres, under roof, where the storage and processing of feed material is conducted. The active portion of the TSD function is approximately 12 acres of the 92 acres INMETCO owns.

#### **1. RCRA Permit Numbers**

Inmetco is a US EPA RCRA regulated as a TSD for the storage of hazardous waste. The process is an EPA RCRA exempt secondary metals reclamation operation, which reclaims nickel, chromium and iron from hazardous and nonhazardous wastes. Our process uses the only smelting furnace in North America dedicated to the recovery of nickel, chrome and iron, while producing a stainless steel remelt alloy used by virtually all of the domestic specialty steel manufacturers plus customers in Canada, Europe, China and Asia.

Inmetco is a wholly owned subsidiary of Horsehead Holding Corp., DB# 609074703, which is one of the world's largest zinc producing companies. The Ellwood City, Pennsylvania facility operates a commercial recycling, RCRA Part-B permitted hazardous waste facility. Inmetco received its Part-B Hazardous Waste Storage Permit #PAD087561015 from the Pennsylvania Department of Environmental Protection (PA-DEP) on November 6, 1992, and was revised and reissued on December 14, 2006 and it expires on July 14, 2016. Inmetco is under the jurisdiction of the Meadville regional office: 230 Chestnut Street, Meadville, Pennsylvania 16335-3494; general phone number (814) 332-6848; Dept. of Solid Waste (814) 332-6848, Mr. Chuck Byham is the PADEP contact person.

Inmetco also has air permits with PA-DEP, Bureau of Air Quality for the following areas: Rotary Hearth Furnace Baghouse, Electric Arc Furnace Baghouses, Cadmium Recovery Baghouse, Pelletizing Disc, Sludge Dryer, Raw Material Feed Preparation and Calcine Thermal Oxidizer. The individual source permits have been umbrelled through issuance of the PADEP Title V Operating Permit, #37-00243. The Company has a wastewater

treatment plant to handle contact waters from the process. The process water is under a permit-by-rule standard. Inmetco has a pretreatment agreement with the Ellwood City Sewage Treatment Authority for pH, temperature and metals.

## **2. Waste Analysis Plan Program for Incoming Hazardous Wastes**

Before any wastes are accepted, they must first pass a prescreen analysis through Inmetco's lab. Only pre-authorized wastes can be shipped to Inmetco. Before processing, all feedstocks are again analyzed and compared to the prescreen analysis. Any significant deviation from the prescreen analysis, without prior approval, may result in the rejection of the material. Rejected material is returned to the generator at their expense or, if processed, additional fees may adjust it. The Marketing and Sales Department monitors this function.

## **3. Air Permits**

Inmetco is under the jurisdiction of the PA-DEP, Bureau of Air Quality, Meadville office. Contact person is Mr. Tom Flaherty at (814) 332-6940. The local Air Quality Inspector is Mr. Scott Dyll at (724) 656-3136.

The PA DEP issued Inmetco a Title V state operating permit #37-00-243 on October 14, 2005 (expiration date is September 30, 2010). The permit encompasses all previously issued permits. In December of 2009 a permit renewal application was submitted to the PA-DEP, Bureau of Air Quality, Meadville office.

## **4. Site Security**

An outside contract firm, Allied Barton provides Twenty-four hour security. All personnel and visitors must register at the guard station. An 8-foot barbed wire cyclone fence surrounds the 92-acre facility.

## **5. Personnel Training**

INMETCO has OSHA/EPA required trained personnel.

INMETCO provides the following training to all applicable employees:

- Personal Protective Equipment
- Respiratory Protection
- Fire Training
- Hazardous Communication, CFR 29, 1910.1200 (Worker Right-to-Know)
- OSHA Lead and Cadmium Standards
- Mobile Equipment Training Program
- Lockout/Tagout
- Permitted Confined Space

## **6. Worker Compensation and Product Liability Insurance**

The insurance carrier is ACE, American Insurance Company, 436 Walnut Street, PO Box 1000, Philadelphia, PA 19106, the policy number # WLR C45706175, expires

11/01/2010.. All insurance information is available by written request through Horsehead Holding Corp. corporate representative Ms. Terri Belczyk (724) 773-2290.

**7. Manifests and Record Keeping**

Manifests are kept in the Traffic Department office for the past and current year. All others are sent to records retention (off site) for 20 years after closure or 40 years from date of receipt, whichever is longer.

**8. Financial Responsibility for the Facility**

INMETCO, a wholly owned subsidiary of Horsehead Holding Corp. Inmetco has a Closure, Post-Closure Corporate Liability insurance and a Letter of Credit with the PA-DEP. INMETCO's Letter of Credit is with PNC Bank, . #18112429-00-000 for \$5.89 million, for the facilities closure costs. INMETCO's closure cost estimate is: \$5.89 M (01/10). To confirm current status of INMETCO Environmental Ins., call Mr. Chuck Byham of PA-DEP at (814) 332-6848.

Letter of Credit:

PNC Bank, National Association  
Trade Service Operations  
500 First Avenue – 3<sup>rd</sup>. Floor  
Pittsburgh, PA 15219  
Policy # 18112429-00-000

Commercial General Liability - ACE American Insurance Company, # HDO G2493620A

Expires: 11/01/2010

Pollution Legal liability - Greenwich Insurance Company, # PEC 002640401, Expires:  
05/15/2010

**9. Weekly Inspection Records**

INMETCO performs daily, weekly and monthly RCRA inspections. Various equipment and storage areas are inspected on every shift.

**10. Environmental Monitoring (i.e. Groundwater and Air Monitoring)**

INMETCO conducts no groundwater monitoring because all wastes are stored in tanks or containers inside roofed buildings. The tanks of containers have walls on all sides and a minimum of 6" of sealed concrete, with a 30-mil PVC liner as per PA regulation 25§75.264 (b) (3).

Air emissions are monitored by process controls and settings. Stack tests are conducted as requested by the PA-DEP, or for permit renewals. The stacks are permitted for total particulate, NOx VOC's and visible emissions.

There are no known drinking water wells within 1/4 mile of the facility. Both Ellwood City and the Borough of Ellport have city water systems that draw water from the Slippery Rock Creek located 1/2 mile upstream of the INMETCO facility.

The local groundwater flow system is primarily controlled by topography. There is no known use of the groundwater in the vicinity of the INMETCO plant. The Homewood Sandstone is the first continuous water-bearing zone underlying the site and it represents an unconfined aquifer at this location. The hydraulic gradient in this aquifer is almost flat in the immediate vicinity of the facility but steepens rapidly toward the sandstone outcrop along the banks of the Connoquenessing Creek to the north of the site. The uppermost-unconfined aquifer (depth is between 30 and 36 feet) flows north-northeast toward the Connoquenessing Creek.

#### **11. Underground Tanks**

INMETCO has no underground tanks. There has been remediation of (2) underground fuel tanks (one in March of 1991, the other in September of 1990. Both tanks were left from previous owners. The tanks were removed, cleaned, cut up and sold as scrap metal. The PA-DEP has not required any groundwater monitoring for these tanks.

#### **12. Disposal of Baghouse Dust ,WWTP Filter Cake Containing Zinc, Lead, and Cadmium and scrap plastic**

At present, INMETCO's zinc, lead and cadmium by-product is manifested as K061 and sent to Horsehead Corp., Inc., 900 Delaware Avenue, in Palmerton, Pennsylvania 18071 (EPA I.D. No. PAD002395887), a reclaimer of zinc, lead and cadmium. Ms. Mary Wingert, Manager Steel and Industry Services at 610.826.8986, is the contact person at Horsehead Corp.

The scrap plastic that is generated from the processing of batteries is sent off site for disposal at VonRoll America, Inc / WTI, Heritage Environmental Services, LLC, 1250 St. George Street, East Liverpool, OH 43920. Mr. Rhue J. Mulhollen, Corporate Account Manager, for WTI is the contact person, PH 877-201-3301, FX 330-386-2167, EMAIL: [rmulhollen@vonrollwti.com](mailto:rmulhollen@vonrollwti.com)

#### **13. Liquid Processing - Wastewater Permits**

INMETCO conducts no acid neutralization. Acidic liquids and spent metal-bearing solutions are used on the pelletizing disc to make pellets. INMETCO sends its treated wastewater blow down to the Ellwood City Public Treatment Owned Works (NPDES #PA0026832) under a pre-treatment agreement with the City (effective August 1, 2003: the Borough has extended the existing permit conditions until such time as they issue a new permit. Contact can be made with the facility by calling (724) 758-4749. The discharge water to the city is between 0 and 60,000 gallons/day. Inmetco has never caused a violation at the sewage treatment plant.

**14. Residual Waste Report**

Available on the PADEP website at <http://www.dep.state.pa.us>. Go to Efacts.

**15. Notices of Violations - NOVs**

A complete list of all of Inmetco's NOV is attached as separate document. (inclusive of the years 1999 through 2009). See attached compliance history. Facility information can be verified through the PADEP website at [<http://www.dep.state.pa.us/efacts/>]

**16. Storm Water.**

INMETCO was issued a General Permit for discharge of its storm water from industrial activities on November 6, 1992 (Permit Number PAR208329). Requirements of the Permit are to monitor and report Appendix B parameters (metals) every 6 months. The Permit was issued on February 19, 1998 and expires at midnight May 01, 2012. INMETCO's storm water discharges into the Connoquenessing Creek. The confluence of the Slippery Rock and Connoquenessing Creeks is approximately one-half mile to the west, upgradient of the facility. The Slippery Rock Creek, which is 1/2 mile upstream from INMETCO, is the source of city water for Ellwood City and the Borough of Ellport. The INMETCO plant is on the city water system, operated by the West Penn Water Co. for portable water and fire protection. There are no known private or public drinking water wells within a 1/2 mile of INMETCO.

**17. Geology of the INMETCO Facility**

The INMETCO facility is situated on a low-relief upland area at an approximate elevation of 915<sup>±</sup> feet. The Connoquenessing Creek, which flows around the site, is situated approximately 900 feet north of the facility at an approximate elevation of 780 feet, and 1,600 feet south of the facility at an elevation of approximately 830 feet. The river has a very narrow floodplain and very steep slopes, which range from 50 to 75 percent. Therefore, INMETCO is not in the 100-year flood plane.

Regional structure consists of a homocline, which dips, in a southerly direction. However, numerous small undulations and other minor structural features are superimposed on the regional trend. Bedrock underlying the INMETCO plant dips approximately one percent to the west-southwest. There are no major faults identified in this area. However, lineaments, fractures, and joints are generally quite prevalent.

Stratigraphic units present in the study area primarily belong to the Pottsville Group of the Pennsylvania System. Overlying Allegheny Group strata (Clarion Formation) comprise adjacent hilltops. The lowest exposed stratigraphic unit is the Upper Connoquenessing Sandstone Member, which is quite massive and laterally extensive. Above this are argillaceous strata, which comprise the Mercer Shale Member. Situated above the Mercer Shale Member is the 30-foot to 50-foot thick Homewood Sandstone.

This unit typically forms topographic flats in upland areas and cliffs along its outcrop. The Homewood Sandstone is light brown to gray in color and is often quite iron stained; it is generally fine grained near the top of the unit and becomes medium grained with depth. Clay streaks are common and it also exhibits extensive cross bedding. Strata of the Clarion Formation (Allegheny Group) above the Homewood Sandstone comprise hilltops situated adjacent to the INMETCO facility. Lithologies include interbedded shale and sandstone and several thin coal seams.

**18. Community Relations**

INMETCO has good community relations with the local citizens. Approximately 75% of Inmetco's work force live within a 15 mile radius of the facility.

**19. Environmental Litigation**

INMETCO has no pending or past environmental litigation involving the facility, its employees or its officers. INMETCO has no compliance issues with any federal, state or local agency.

**20. PCB's & Asbestos**

INMETCO has no PCB-containing materials on site.

INMETCO has conducted Asbestos Abatement of Asbestos found on site from the former US Steel operation. All known asbestos has been removed and properly disposed of.

**21. Boiler and Industrial Furnace Rule (BIF)**

INMETCO's furnace operation is exempted from the BIF regulations as stated in 40 CFR § 260, 261, 265 & 266. See section 266.100 (c) and Appendix XII, as published in Federal Register/Volume 56, No. 166/Tuesday, August 27, 1991/Rules and Regulations. INMETCO filed its notice under the rule with EPA/DEP on August 16, 1991. A supplemental notice pursuant to the rule on August 21, 1991 was filed, as per the regulation.

**22. INMETCO's Co-Product Slag (Aggregate)**

The INMETCO Process produces annually approximately 14,000 to 19,000 tons of a rock aggregate slag. Inmetco's slag is covered by 40 CFR 266.20 Subpart C; Recyclable Materials used in a manner constituting disposal.

The slag is sold locally for use as construction aggregate for roads, parking lots and backfill.



**23. Inmetco Products**

The cadmium from batteries is recovered as a product in the INMETCO Cadmium Recovery Operation.

The cadmium is sold to nickel-cadmium battery manufacturers for reuse in batteries and pigments.

Nickel-Chromium-Iron-Moly Remelt Alloy is sold to the stainless steel mills for the manufacturing of stainless steel products.

The slag is sold for use as a construction aggregate.

**24. Miscellaneous Notes:**

The DEP, Bureau of Solid Waste, conducts RCRA inspections approximately four times per year. The local solid waste inspector at (724) 656-3160.

INMETCO's: EPA I.D. number is PAD087561015  
Dunn and Bradstreet number is 08-756-1015  
Federal Tax number is 13-2858892  
Incorporated in the state of Delaware  
NAICS 331419

**25. Miscellaneous Notes cont.**

INMETCO is a wholly owned subsidiary of:  
Horsehead Holding Corporation  
4955 Steubenville Pike, Suite 405  
Pittsburgh, PA 15205  
724-773-2212  
Dun & Bradstreet (DB) #609074703

List of Surrounding Land Uses

North Residential  
South Industrial/Woodlot  
East Residential  
West Industrial

Population within 1 mile of the facility: 11,000  
4 miles of the facility: 17,000  
Ellwood Boro: 8,890

Latitude is 40:51:25, Longitude is 80:16:37

Inmetco is less than a half-mile away from the nearest school, hospital and fire department.

Total number of non-union employees: 98

69 Hourly

56 are in Production

13 are in Maintenance

29 Salaried

2 are in the Environment, Health & Safety Department personnel\*

\*Both individuals have been employee at in Inmetco in excess of

15 years

Facility-wide turnover rate over the past 3 years was less than 6%

Average annual precipitation (rainfall) in Ellwood City, PA is: 36 - 39"

Rain events - 10 year: 3.9", 25 year: 4.2", 100 year: 5.2"

Prevailing wind direction - from West & South - Speed: 5-15 knots

Mean annual lake evaporation is 20 - 30" per year

Altitude above sea level 917.7'

Average Barometric Pressure 1017.5 Millibars

Average Relative humidity 58%

Seismic Coefficient Factor #1

Average Temperatures: Minimum 20°F, Mean 59°F, Maximum 61.9°F

Average Soil Pressure Bearing Load 2,000 PSF

Total Under Roof Facility Square Footage 350,244

Front Page of Business Licence

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF STATE

JUNE 19, 2009

TO ALL WHOM THESE PRESENTS SHALL COME, GREETING:

**THE INTERNATIONAL METALS RECLAMATION COMPANY, INC.**

I, Pedro A. Cortés, Secretary of the Commonwealth of Pennsylvania  
do hereby certify that the foregoing and annexed is a true and correct  
copy of  
CERTIFICATE OF AUTHORITY filed on January 24, 1977  
which appear of record in this department.



IN TESTIMONY WHEREOF, I have  
hereunto set my hand and caused  
the Seal of the Secretary's Office to  
be affixed, the day and year above  
written.

*Pedro A. Cortés*  
Secretary of the Commonwealth

ISO Certifications

787 North Doshon Road, Ann Arbor, Michigan 48106  
(313) 931-9000

*Certificate of Registration*

This certifies that the Environmental Management System of  
**The International Metals Reclamation Company**

One Inmetco Drive  
Ellwood City, Pennsylvania, 16117, United States

has been assessed by NSF-ISR, and found to be in conformance to the following standard(s):

**ISO 14001:2004**

**Scope of Registration:**

High Temperature Metals Recovery Facility with Part B Hazardous Waste Storage

**Exclusions:** None

**Industrial Classification:**

NAACE D127.4  
IAF - EMS 17



Certificate Number: 61321-EM1  
Certificate Issue Date: 14-FEB-2011  
Registration Date: 11-FEB-2011  
Expiration Date: 10-FEB-2014

*William Niodrzwiocki*  
William Niodrzwiocki,  
President & General Manager,  
NSF-ISR, Ltd.

International Register of Certificated Auditors - The certificate is property of NSF-ISR and is not to be reprinted, copied, or used for any other purpose. To verify registration, visit www.nsf-ISR.com or call 313-931-9000. NSF-ISR, Ltd. is not responsible for any errors or omissions.



NSF International Strategic Registrations

300 North Dearborn Road, Ann Arbor, Michigan 48105  
248.761.9000

### Certificate of Registration

This certifies that the Quality Management System of  
**THE INTERNATIONAL METALS RECLAMATION COMPANY**

*Inmetco*  
One Inmetco Drive  
EBwood City, Pennsylvania, 16117, United States  
has been assessed by NSF-ISR and found to be in conformance to the following standard(s)

### ISO 9001:2008

**Scope of Registration:**  
Secondary smelting and refining of ferrous and nonferrous metals. Metals recovery and waste recycling

**Exclusions:** Product Design

**Industrial Classification:**

NAEC: D2274  
SIC: 3341  
IAF - QMS: 17



Certificate Number: 61321-ISR1  
Certificate Issue Date: 11-AUG-2009  
Registration Date: 09-AUG-2009  
Expiration Date: 07-AUG-2012

*Christian B. Lupo*  
Christian B. Lupo, General Manager  
NSF-ISR, Ltd.

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