DEPARTMENT OF THE TREASURY
Bureau of Engraving and Printing (BEP)
Washington, D.C. and Fort Worth, TX Facilities

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SUBJECT: Reducing Environmental Impacts

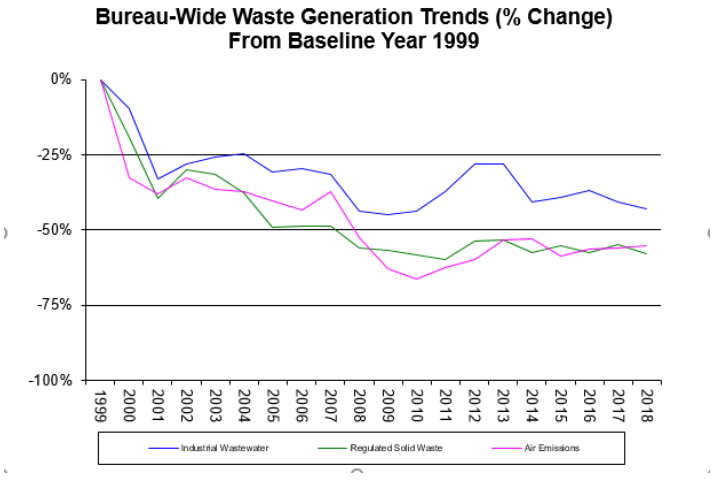
The purpose of this paper is to summarize the Bureau's approach to environmental stewardship, the historical initiatives that contributed to our long term positive trends, and the management systems designed to ensure the sustainability of our proven approach.

General Approach

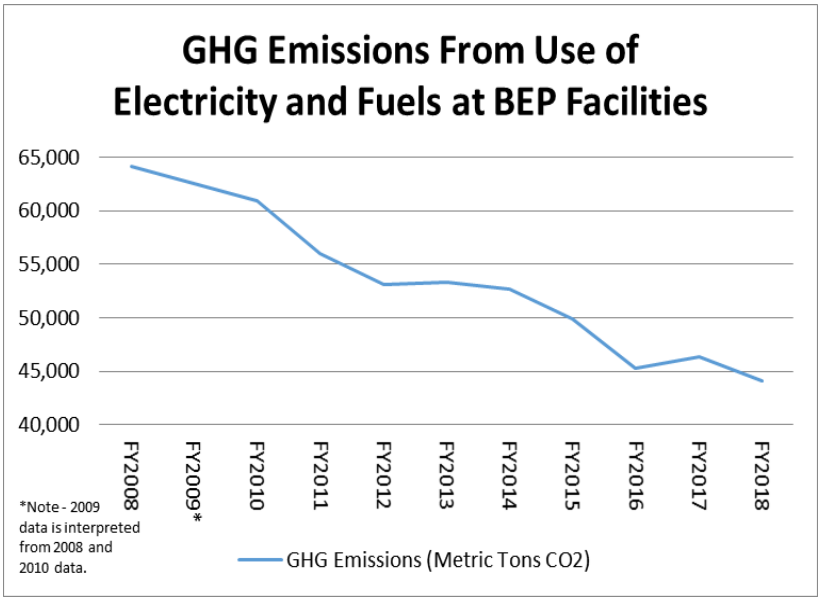
The Bureau of Engraving and Printing's environmental mission is to continually strive to reduce our adverse impact on the environment. Our primary objectives are to reduce the use and disposal of materials that threaten the environment and/or human health, reduce energy we consume, and generate less landfill waste by increasing recycling. We maintain ISO 14001 registered environmental management systems (EMS) at both our Washington, DC (DCF) and Fort Worth, TX (WCF) facilities that incorporate employee health and safety, thereby increasing the benefits to the Bureau. To summarize our EMS, we have completed a process that identified our significant environmental, health, and safety aspects (SEAs), which led to continuous improvement objectives and targets, management plans, and operational controls. At the Fort Worth Facility (WCF), EMS improved the facility's Compliance History Rating with the Texas Commission on Environmental Quality.

Long Term Results

The long term benefits of this approach are a marked decline in all three of our major waste streams: regulated air emissions, solid waste, and wastewater. The graph shows percent reductions from baseline year 1999 to the present. In that span air emissions and regulated solid wastes have been reduced by more than 55% and industrial waste water has been reduced by more than 40%. The progress attained is attributable to the variety of projects completed at both currency production facilities, and the concerted efforts of many groups within the Bureau. Many of the projects that



have been completed are listed in the following tables. To achieve further reductions in industrial waste water discharges, BEP has installed a wiping solution recycling plant at DCF that may reduce these discharges from the plant by more than 90% when it is fully operational. In addition to focusing on high volume waste streams, BEP has also focused on substituting hazardous materials with less hazardous materials or processes. For example cyanide hardening and the use of lead-based solder have been replaced with non-hazardous processes, and petroleum-based solvents have been replaced with safer, lower VOC solvents on some currency presses.



Another measure of sustainability is an organization's energy consumption and the resulting greenhouse gas (GHG) emissions. The Bureau has placed a consistent emphasis on improving the efficiency of its operations and facilities, and these efforts have saved energy and reduced BEP's GHG emissions. BEP has completed a variety of energy conservation projects at its facilities, under the guidance of its Office of Facilities Support. To further reduce our environmental impact, BEP increased purchases of electricity from renewable sources to 15% of total consumption in FY18. BEP has begun to conduct comprehensive greenhouse gas emissions surveys, using fiscal year 2008 as a baseline. As shown in the graph above, BEP has reduced GHG emissions from direct use of energy and fuels at BEP facilities by more than 20,000 metric tons/year since the baseline year, a reduction of 30%.

Accomplishments and Initiatives

The following lists are both a compilation of initiatives that contributed to our reductions, as well as a list of ongoing initiatives aimed at ensuring that we continue reducing our impact on the environment. The lists show our current and ongoing initiatives and the completed accomplishments in descending order.

Air Emissions: Includes air emissions that are captured and controlled from intaglio printing sections, and general fugitive emissions that are not captured		
#	Year	Action
Current & Planned		• Evaluation of vapor phase deposition as an alternative to hard chrome plating, in order to eliminate hexavalent chromium emissions. • Installation of a low VOC emission UV banding press for printing moneybands;

		FY2021.
1	2017	Replacement of two older COPE presses at DCF with one newer COPE.
2	2017	Removal of heat-set web press and for printing moneybands and the press' catalytic oxidizer.
3	2016	WCF replaced diesel buses used for its public tour with electric buses.
4	2016	Implementation of low VOC solvent on DCF intaglio currency presses to reduce VOC emissions while enabling use of automatic plate wash systems to reduce chance of print quality problems.
5	2014	Installation of Large Packaging Equipment at WCF and DCF, and eventual removal of multiple COPES.
6	2013	Reduced Scope 1 & 2 GHG emissions by 11,066 metric tons CO2 (>17%) from BEP's 2008 baseline, as a result of BEP facilities' energy conservation initiatives.
7	2012	WCF implementation a 50% VOC cleaning solvent for manual cleaning of intaglio presses, resulting in an estimated VOC emissions reduction of 8 tons/year.
8	2012	Reformulation of COPE Isomet solvent to a 70% VOC blend is estimated to reduce DCF VOC emissions by approximately 1000 lbs./year.
9	2011	Shut down and decommissioning of DCF's old plating lines, eliminated 0.25 tons/year VOC and HAPs emissions, as well as emissions of Cr and Ni.
10	2011	DCF paint shop completes transition to low VOC aqueous paints and coatings, reducing air emissions by approximately 1.3 tons/year, and reducing hazardous waste generation from the paint shop by 95%.
11	2010	Elimination of VOC control system serving I-10 & SOI presses, eliminating > 600 MT of CO2 emissions per year.
12	2010	Installation of new thermal oxidizer with high efficiency burner at WCF reduced natural gas consumption 37% per day of production.
13	2010	Completed comprehensive GHG emissions inventory for all BEP facilities for baseline year (FY2008) and FY2010.
14	2006-2009	Replacement of I-8 presses with SOI presses, significantly reducing air emissions due to lower ink and solvent consumption.
15	2009	Replacement of WCF chillers with new energy-efficient models that use a refrigerant that has non-ozone depleting substances.
16	2005	Replacement of varsol with a water-based cleaner on I-10 presses at DCF.
17	2000	Improved ink usage of I-10 presses, and cut-out rollers. (Lower air emissions.)
18	1999	Replacement of Main Chillers at DCF to reduce use of ozone depleting substances (ODS).
19	1997	Elimination of glycol ethers from inks.
20	1997	Installation of mist eliminator to recycle chrome mist in the plate making.
21	1990	Converted to non-alcohol dampening solution for all offset printing.
22	1989	Installation of scrubbers to control chrome emissions in plate making.

23	1999	Installation of VOC control systems for I-10 presses at DCF.
24	1991	Replacement of type wash (methylene chloride) with Varsol.
25	1987	Reduction in intaglio ink VOCs from 25% to 12%.
26	1984	Converted from solvent-based to water-based gravure inks.
27	1980s	Elimination of formaldehyde from currency paper.

Solid Waste: Includes hazardous and non hazardous waste		
#	Year	Action
Current & Planned		• Replace organotin heat stabilizer in roller PVC formulas with a less hazardous chemical (FY20). • Implement chromium plating using platinized titanium anodes (FY20). • Evaluate options for minimizing wastes and replacing hazardous chemicals with less hazardous substitutes; (ongoing).
1	2018	DCF waste ink management project completed. This is estimated to reduce waste ink shipments by 90 drums/year, saving $7,500 annually.
2	2017	Implementation of single note inspection at DCF and WCF reclaims 400 tons of good notes that otherwise would have been shredded and landfilled between its start in 2017 and 1st half 2019. Additional regulated waste generation avoided calculated to be 4,600 tons.
3	2015	Elimination of aerosol products containing chlorinated solvents that generate RCRA F-listed wastes at DCF.
4	2014	Replacement of varsol on SOI presses with a solvent that does not cause hazardous waste generation. As a result of this action, no hazardous waste is generated from the operation of intaglio currency presses at DCF.
5	2012	DCF waste water pretreatment process improvements reduce hazardous waste generation by 5.1 tons/year.
6	2010	Installation of aerosol can puncturing system, reducing waste volume and increasing recycling of metals.
7	2009	Bucket wash recycling – installation of a pump to recycle wastewater with chemicals from the bucket washing machine, reducing the disposal of hazardous waste from the machine by 15 tons/year.
8	2008	Elimination of ferric chloride in etching, through installation of CTIPS process.
9	2008	WCF Plating line upgrades reduce hazardous waste generation by approximately 35,000 lbs. year.
10	2006-2009	Installation of SOI presses, reducing ink sludge due to lower ink consumption.
11	2005	Complete elimination of the use of lead solder in Engraving.
12	2005	Initiate replacement of aerosol cans with pump dispensers.

13	2004	Replaced $CaCl_2$ in the pretreatment plant with a polymer that resulted in a significant reduction (61%) in waste ink solid sludge.
14	2004	Recycling of solvents, paints, and thinners.
15	2003	Elimination of cyanide hardening process.
16	2000	Improved ink usage of I-10 presses, and cut-out rollers. (Less sludge)
17	2000	Green purchasing rules for all materials, chemicals, and equipment.
18	1999	Chemical review process targeting for elimination or replacement of chemicals with notable human toxicity.
19	1999	Implemented lead-free bullets on target range.
20	1994	Initiated drum recycling program.
21	1994	Modified ink pump to leave less waste ink.
22	1993	Modification of run off to storm sewers from sanitary.
23	1990	Recycling of a broad range of materials from cans to toner cartridges.
24	1990	Replacement of lead driers with cobalt manganese driers.
25	1987	Replace naphtha wipes on A&B presses with water wipes.
26	1980s	Replacement of chrome pigment with a copper based pigment in the green ink.
27	1985	Identification and disposal of old/unused chemicals throughout BEP.
28	1981	Installation I-8s (water wipe) eliminated paper wipe waste.

Wastewater: Includes industrial wastewater from currency production.		
#	Year	Action
Current & Planned		• Recycling of Wiping Solution; the recycling process will conserve approximately 7 - 12 million gallons of water annually at DCF, depending on production. Construction completed FY17; plant performance and reliability enhancements ongoing; FY20.
1	2019	All DCF security gates and bollards replaced with pneumatic or other systems that do not contain oil reservoirs, eliminating the potential for oil spills to stormwater drains to the Tidal Basin and Washington Channel.
2	2018	WSRP operated from Oct.-Mar. of FY18 and reduced DCF's wastewater discharge by 3MM gallons.
3	2012	WCF installed water conserving plumbing fixtures that are estimated to reduce facility water use by 644,000 gallons/year.

4	2012	Irrigation water use reduction plan at WCF saved 552,000 gallons in the third quarter of 2012, versus the same period in the prior year.
5	2011	Full transition of DCF electroplating operations to efficient new lines reduced plating waste water discharge by 510,000 gallons/year.
6	2006-2009	Installation of SOI presses reduced wastewater processing burden due to lower ink and solvent consumption
7	2008	Re-engineered the addition of Bentonite in the Wiping Solution Wastewater Pretreatment Plant process which reduced Bentonite consumption by 58% which equated to a sludge reduction of 26,820 pounds/year.
8	2004	Replaced $CaCl_2$ in the (WWPP) with a polymer that resulted in less water hardness, reduced sludge production, and reduced consumption of sulfuric acid.
9	1994	Installed plating wastewater pretreatment plant to eliminate the discharge of chrome, nickel, and copper into the sewer system.
10	1990	Installation of wastewater pretreatment plant (WWPP) to eliminate the discharge of solids into the sewer system.

Energy: Includes electrical, steam, and control systems.		
#	Year	Action
	Current & Planned	• Re-lamping DCF Main and Annex Bldg. with LED lights to reduce lighting energy consumption by 1,960,000 kWh/yr, with an estimated cost savings of $216,000/yr; FY2019. • WCF lighting control and LED re-lamping is expected to save $68,000/yr; FY2019. • Compressed air plant capital improvement project at DCF will replace two 300-hp compressors with new variable frequency driven compressors; expected cost savings or $50,000/yr; (FY18/FY19). • Wiping solution recycling system will reduce the need to heat water during formulation of new wiping solution savings of 1.8 BBtu/year.
1	2018	WCF chilled water plant optimization equipment installed. Estimated operation cost savings of $70,000 - $140,000/yr.
2	2018	Completed retro-commissioning of ten air handling units at DCF. This project is expected to reduce the AHUs energy consumption by 15-30%.
3	2014	DCF completed Supervisory Control and Data Acquisition system installation and implementation. The project is expected to save 38 BBtu/year.
4	2014	Installation of high efficiency, low NOx boilers at WCF, replacing older units, saving an estimated 3.3 BBtu/year.
5	2014	As a collective result of BEP's various energy conservation initiatives, BEP reduced energy intensity by 28.5% from our FY2003 baseline, exceeding the Executive Order 13423 target of 27% by the end of FY2014.
6	2013	DCF installed variable frequency drives (VFDs) on cooling towers to save 411,000 Kwh/year.
7	2012	WCF lighting system upgrades installed high efficiency lighting and ballasts through the 694,000 square foot facility, saving an estimated 520 Mwh/year.

8	2012	Building automation system upgrades were completed for production area air handlers at WCF, yielding an estimated energy savings of 694 Mwh/year.
9	2011	Replaced six chillers at WCF with high efficiency units as part of a chiller plant rebuild. The estimated savings is 231 Mwh/year.
10	2010	Elimination of natural gas fueled VOC control system (incinerators) serving I-10 & SOI presses. These incinerators were DCF's main use of natural gas.
11	2010	Installation of new thermal oxidizer with high efficiency burner at WCF reduced natural gas consumption 37% per day of production.
12	2010	DCF Annex building steam supply improvements reduced energy consumption by approximately 17.6 billion BBtu or 2,110 tons of GHG annually.
13	2010	Compressed air plant modifications – Digital flow control and increased system storage. Anticipated annual energy saving is 1.5 MMBtu.
14	2009	Lighting replacements and installation of occupancy sensors - An estimated annual energy savings of 7,240 MWh is expected.
15	2009	Replacement of WCF facility roof with a California Title 24 cool standard design that is expected to reduce energy consumption by 10%.
16	2008	VFD installation on chilled water pumps and chiller plant automation - An estimated annual energy saving of 2,383 MWh is expected.
17	2007	Water consumption in FY 2007 is 48 million gallons, 47% reduction from 90 million gallon in FY 2003.
18	2006	Total energy consumption in FY 2006 was 274.3 Bbtu, a 20.4% reduction from the FY 2003 based line 344.5 Bbtu.
19	2006	Replacing urinal and water closet flush valves with lower water consumption flush valves at DCF.
20	2006	Vacuum pump replacement at DCF – 881,200 kWh annual energy savings.
21	2005	Air handler energy management system - strategy is to turn off air handling units during unoccupied hours. Annual energy savings of 43 BBtu.
22	2004	Changed steam operation procedure. Annual energy savings of 3.3 BBtu.
23	2004	Steam Trap Replacement and Monitoring program.
24	2001	Chilled water plant replacement **–** annual energy savings of 4,275,000 kWh.

Recycling: Includes recycling, reuse, and energy recovery.		
Items	Tons	Action/Result
Current & Planned	• Evaluate options for recycling WWPP ink sludge, plating line filters and sludge, and shredded film containing silver. • Currency paper scrap and trim recycling project has the potential to divert 500-600 tons of wastes from DCF from energy recovery to recycling and to save over $100,000/year. • Evaluate recycling methods for non-hazardous waste inks to divert this material from landfills.	
Shredded currency and sheet edges	1,400	500-600 tons/year to energy recovery (DCF) and 800 tons/year to recycling (WCF – sheet edges only).

Black Ink Reconstitution	250	Excess black intaglio ink from printing higher value denominations is reconstituted at WCF and for printing $1 notes. In 2015, approximately 400 tons of waste ink was recycled.
Scrap Metal	190	DCF and WCF divert 170 – 230 tons/year of scrap metal from landfills through recycling programs.
Waste Paper	170	DCF recycles roughly 160 – 180 tons/year of office paper, newspaper, and commingled paper wastes.
Wood	165	BEP diverts 130-190 tons/year of wood pallets and other wood wastes from landfills to recycling or energy recovery.
Cardboard	125	BEP facilities recycle 110 – 140 tons/year of cardboard.
Cooking Oils	30	Cafeterias at DCF and WCF generate roughly 30 tons/year of waste oils that are collected and recycled.
Plastics	29	26 – 31 tons/year of plastics are separated from DCF waste streams and recycled, saving resources and reducing disposal costs.
Spent Forklift Batteries	21	DCF and WCF recycle approximately 21 tons/year of lead acid batteries.
Nickel, Copper, Brass and Aluminum	18	BEP collects 10-13 tons of nickel containing-wastes from machining and electroplating operations each year and sends them to metals reclamation. Another 6-15 tons/year of Al, Cu, and Brass are also segregated and reclaimed.
Carpet Tiles	10	DCF added carpet tiles to its recycling program-2003.
e-Wastes	7	Waste electronics from DCF and WCF are primarily collected and recycled though existing IT equipment vendor contracts, although some is shipped to e-Waste recyclers.
Contract Specification	N/A	Suppliers that use recovered materials in their products supplied to the BEP receive preference.

Outlook

The Bureau is committed to maintaining a vigorous EMS that will help drive our continuous improvement efforts into the future. In the near future, we anticipate completing a significant project that will enable BEP to recycle approximately 15 million gallons of industrial wastewater at our DCF facility. Our longer term challenges include identifying options for recycling or beneficial re-use of waste water pre-treatment plant ink sludge, options to further reduce regulated air emissions and greenhouse gas emissions, as well as options to reduce generation of hazardous waste. Projects like these show we are taking action to ensure our environmental mission, which is to continually strive to reduce our adverse impact on the environment, generates real results.