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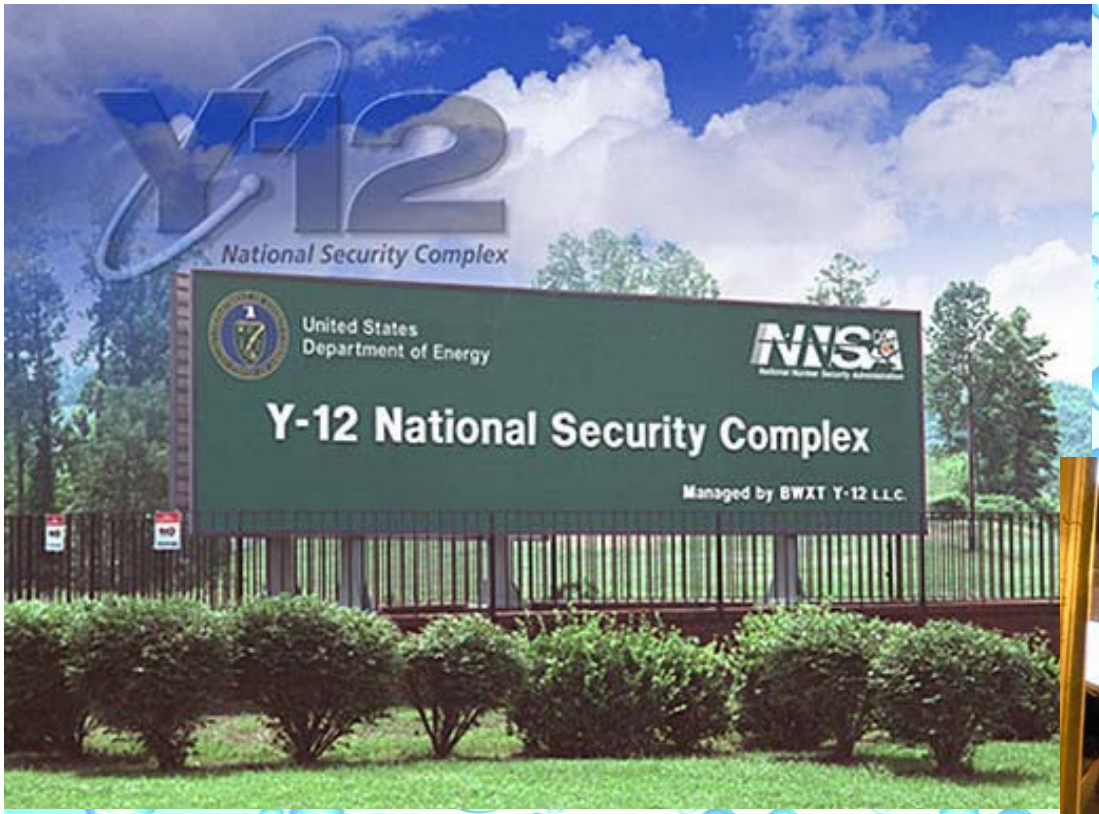
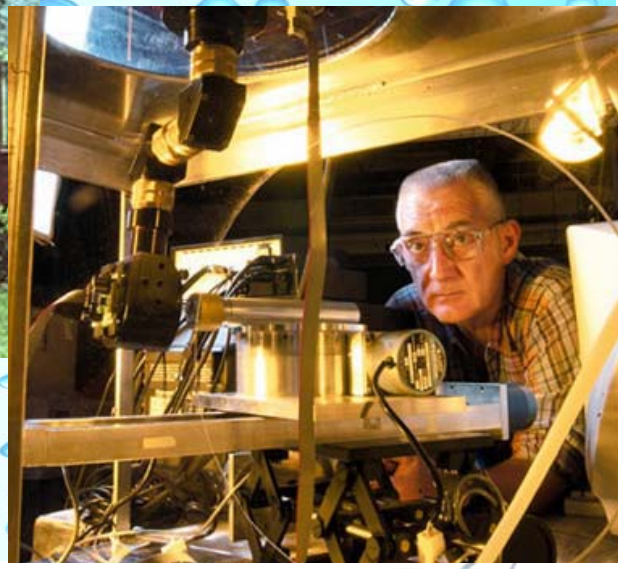
· Dallas Convention Center ·

Water Savings in Industrial Settings

Rosanne Smith, Y-12 National Security Complex

Y-12 National Security Complex





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Water Track, Session 7

NNSA
National Nuclear Security Administration

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Y-12
National Security Complex

Protecting America's Future

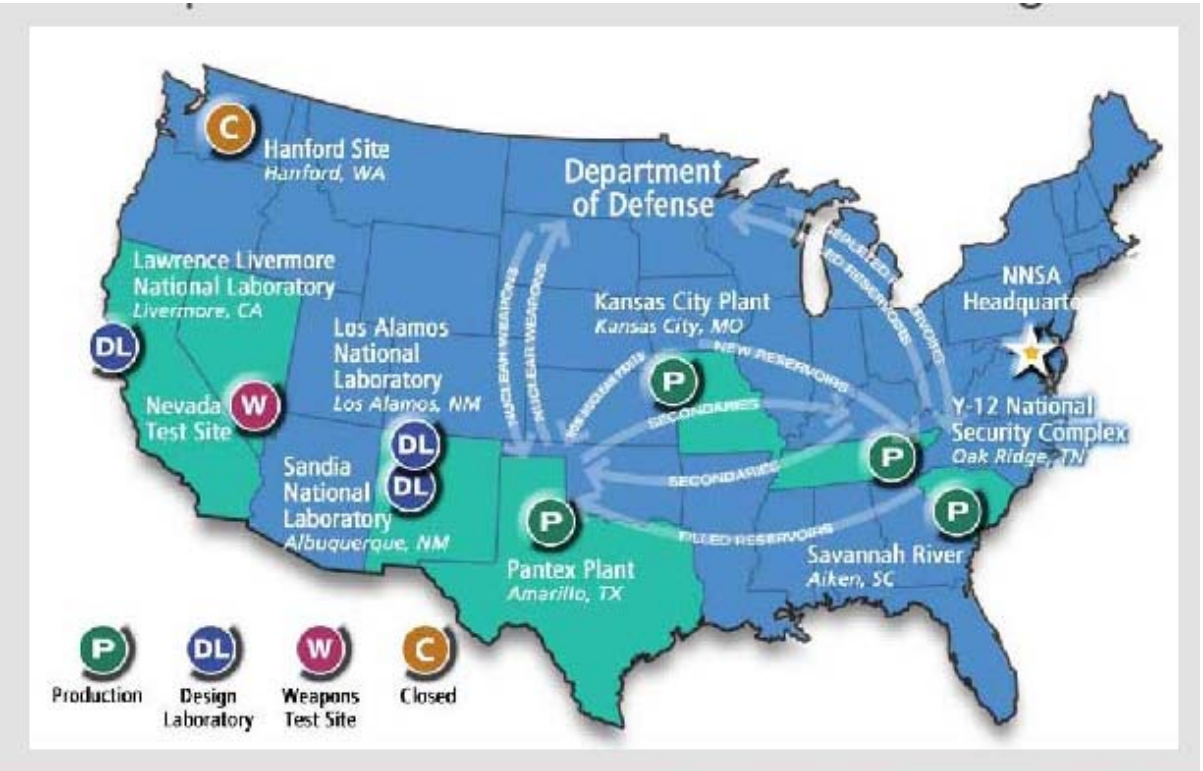
Y-12 National Security Complex

Primary missions

- Producing, refurbishing, and dismantling nuclear weapons components
- Safeguarding and securely storing special nuclear materials
- Preventing proliferation of weapons of mass destruction by removing, securing, and dispositioning special nuclear material.
- Supplying the U. S. Navy with safe, militarily effective nuclear propulsion systems
- Supplying special nuclear material for use in naval and research reactors.
- Providing support of other national security needs and customers

National Nuclear Security Administration

- Semi-autonomous unit of the Department of Energy (DOE) created in 1999
- Oversees the operations of the Nuclear Weapons Complex
- Four production plants
- Three design labs



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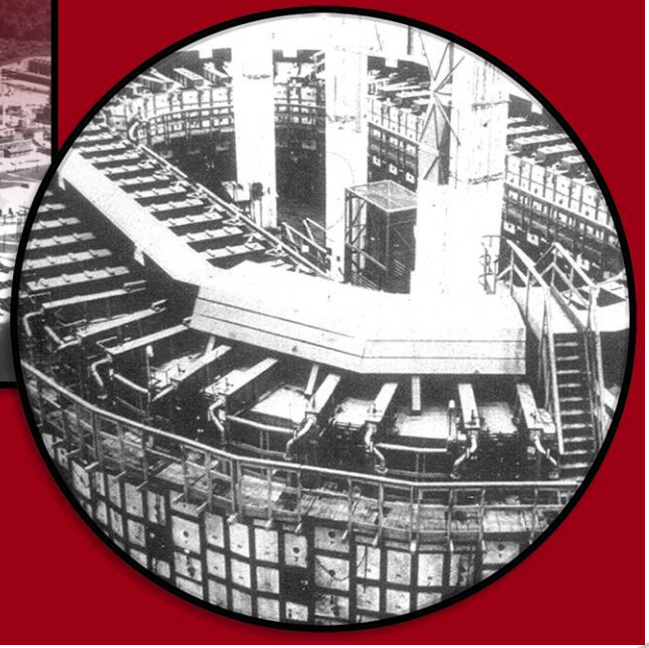
The Manhattan Project

- Y-12 began as part of the Manhattan Project during World War II

Electromagnetic Process



Y-12 was built as a facility to separate U-235 for the first atomic bomb.

Y-12 Core Competencies Deploy Critical National Security Technologies

- **Core Competencies**

- Highly Enriched Uranium Processing
- Related Materials Processing
- Materials Research & Development
- Safeguards and Security
- Nuclear Material Control & Accountability
- Storage and Transportation
- Analytical Chemistry
- Health Physics
- Radiological Protection
- Technical Computing
- Engineering Design & Analysis
- Quality Control

Manufacturing technology

- New 5-Axis Machine Center with tilting rotary table
- New robotic welder for Improved welding capability
- New coordinate measuring machines

Model-based manufacturing

- Revolutionary management of design info, drawings, models

New Plant Laboratory chemistry equipment

- Ability to measure material impurities to lower levels/tighter specifications

Electronic data capture

- Dimensional inspection
- Mechanical property and chemistry

Digital radiography

- Expedited certification, reduced material costs, electronic images

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Y-12 Demographics

- About 7,000 people work at Y-12 each day:
  - 4,600 B&W Y-12 employees
  - 86 National Nuclear Security Administration (NNSA) employees
  - 530 Wackenhut Services
  - 2,500 subcontractors
- 470 facilities (5.5 million ft^2) - 2 1/2 miles long, 1/2 mile wide
- FY 2010 annual budget of ~$700 million
- Number of employees with degrees
  - 1,240 (BS), 541 (MS), 73 (PhD)
- Top 4 TN manufacturing employer
- Received numerous awards for pollution prevention since FY 2000
- Environmental compliance record exceeds 99%
- Recognized by DOE, NNSA, Environmental Protection Agency and Tennessee regulators for award-winning environmental programs

Y-12 today…large campus undergoing a transformation: downsize, consolidate, and rebuild mission-critical facilities with a special emphasis on health, safety, environmental, and security solutions

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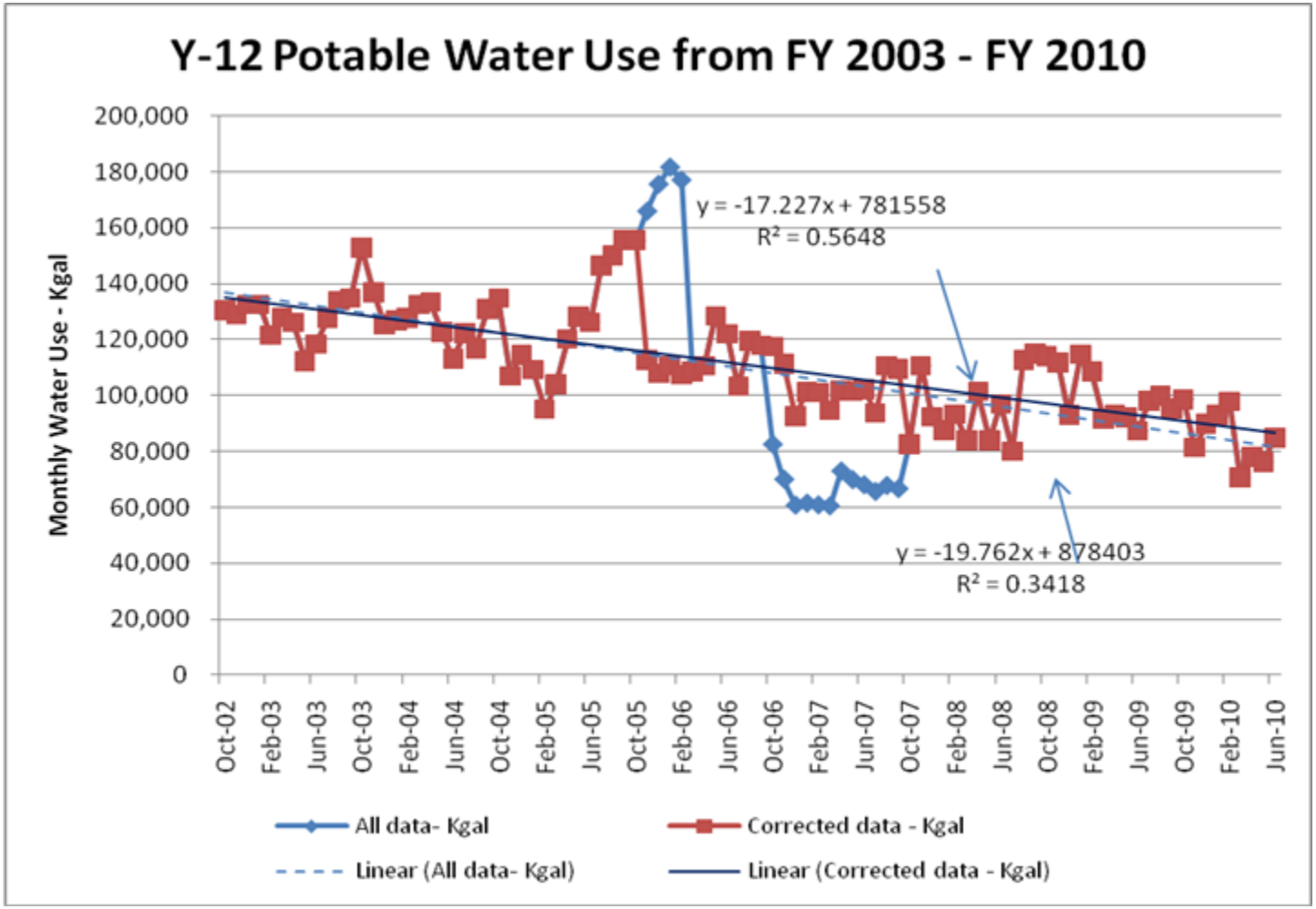
Seven Year Potable Water Consumption Reduction of 40%



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Potable Water Consumption

Source: City of Oak Ridge Utilities

Unit Cost: $1.32 per kgal

Sanitary Sewage: $9.25 per kgal

FY 2009 Consumption: 1,178,800 kgal ($1,556K)

- Domestic Uses: sanitary water systems, including emergency showers and eyewash stations, personnel decontamination facilities, drinking fountains, rest rooms, change houses, and the cafeteria;
- Once-Through Cooling and Process water systems: feed water for the steam plant, makeup water for cooling towers, process cooling, cleaning and decontamination systems, chemical makeup systems, and other miscellaneous needs;
- Fire protection systems, including sprinkler systems and fire hydrants;
- Laboratory Processes

FY 2009 Total Water Intensity: 319 gal/GSF

Est. FY 2007 Water Intensity: 423 gal/GSF

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Process Water Types at Y-12

- **Demineralized water** is produced in a central plant and then distributed to 9 facilities through a distribution piping system. A new system will be installed in an active ESPC conservation measure. Typical applications for demineralized water include:
  - coolant systems for machining weapons components,
  - plating systems for component manufacturing,
  - cleaning processes for components,
  - X-ray film developing processes,
  - chemical analysis of samples, and
  - makeup water to dehumidification systems.

- **Steam condensate** was collected across the site for boiler feedwater, saving thermal energy, reduces potable water use, reduces chemical treatment for feedwater, and reduces the potential elevation of the temperature in EFPC.
- **Cooling towers** dissipate heat from production processes, refrigeration systems, air compressors, and other water-cooled equipment such as induction furnaces, pumps, presses, forming, vacuum pumps, arc melt furnaces, and power supplies. The Y-12 Complex has fourteen systems with a combined capacity of 37,600 tons and a connected load of 19,860 tons actively supporting ongoing operations; one tower system with a combined capacity of 1,200 tons is in standby.

Potable Water System Upgrade $56 M Project Completed

- New elevated potable water storage tanks and main line cross-connection protection for the City of Oak Ridge.
- Tanks have a 4 million gallon capacity
  - increase the potable water distribution system pressure
  - provide reserve fire water capacity.
- Project replaced aged sections and installed new piping for ~6,000 feet of the underground distribution system
- Provides backflow prevention for unprotected fire protection systems.

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East Fork Poplar Creek

A Natural Resource Inside the Plant

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Non-Potable Water Consumption is 100% Creek Augmentation

Source: City of Oak Ridge Utilities

Unit Cost: $0.33 per kgal

FY 2009 Consumption: 1,098,100 kgal ($362K)

- Creek augmentation per state of Tennessee NPDES requirement
- Piped from Clinch River with H_2O_2 added
- 5 million gal daily creek flow
- 2.3 million gal augmentation (as of July 2010)
- Once-through potable water is dechlorinated at several building locations and outfalls for entry to the creek
- Underground springs under 4 buildings are sump-pumped to creek
- Most of the Y-12 facility's 811 acres lie within the 1,170 acre Upper East Fork Poplar Creek watershed

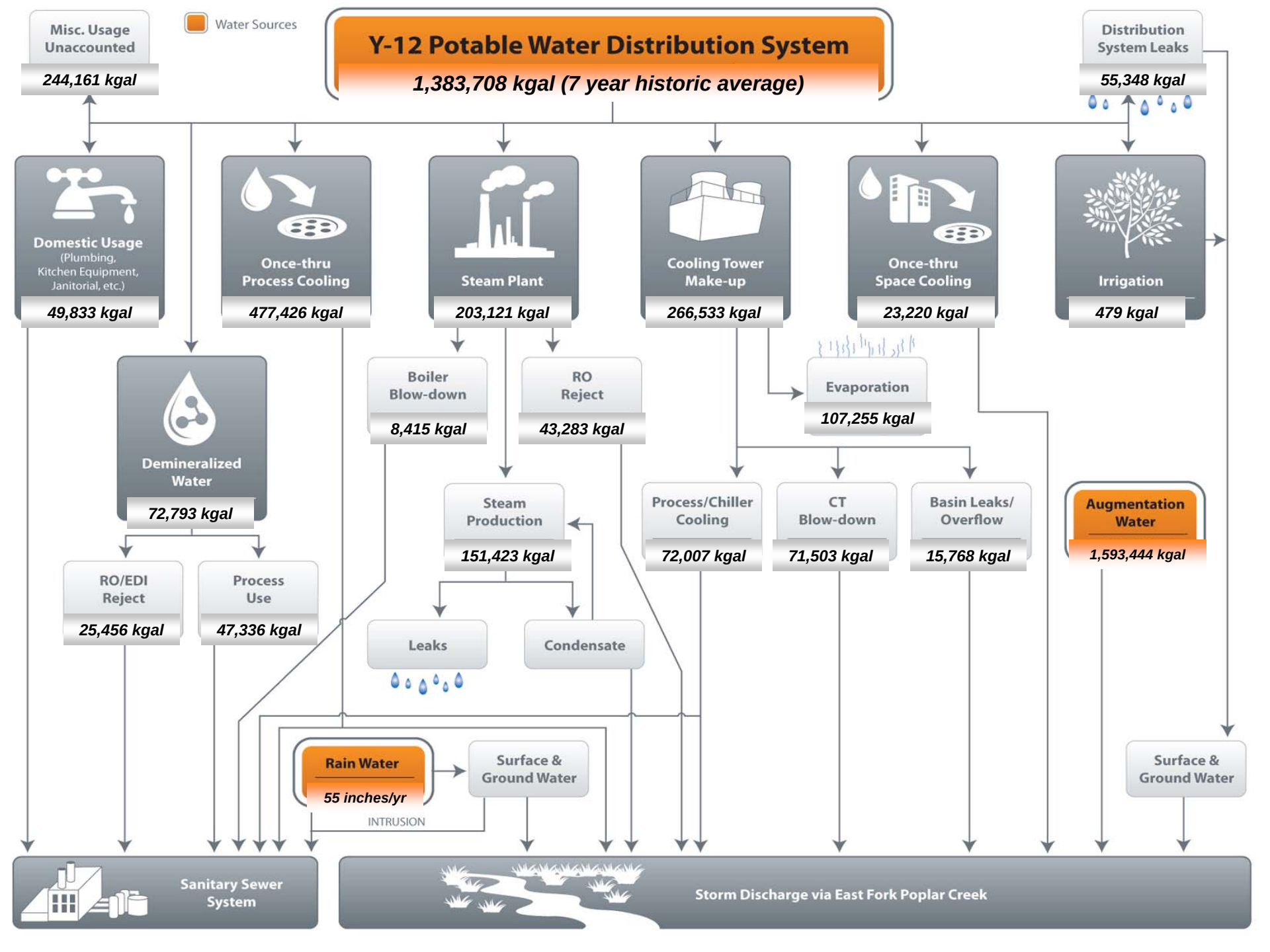
ESPC Contract with Johnson Controls, Inc to Upgrade Y-12 Utility Systems

ECM No.	ECM Description	Electricity Energy Savings ($/yr)	Electricity Demand Savings ($/yr)	Natural Gas Savings ($/yr)	Water / Sewer Savings ($/yr)	Total Utility Cost Savings ($/yr)	Other Energy-Related and O&M Cost Savings ($/yr)	Total Annual Cost Savings ($/yr)
2.1	Chiller Plant Improvement	$306,891	$146,144			$453,035		$453,035
7.1	Condensate Return System Modification			$253,065	$162,562	$415,627	$2,107	$417,734
7.2	Steam Trap Improvement			$401,835		$401,835		$401,835
16.1	Demineralized Water Production Facility Replacement	$5,691	($1,362)	$115,882	($31,072)	$89,138	$729,884	$819,022
	Total	$312,582	$144,782	$770,782	$131,489	$1,359,636	$731,991	$2,091,626

Install condensate piping and pumps necessary to return condensate to the new steam plant.
Insulate portions of the piping system to improve thermal value of the condensate.
The baseline quantity of condensate returned to the new steam plant is zero.
condensate return levels of 25% for June through October and 35% the remainder of the year.

4 Energy Conservation Measures (ECMs)

- Total Project Cost = $22.1M
- Total annual cost savings = $2.0M
- Guaranteed annual cost savings = $1.9M
- 11.03 Year Simple Payback Period
- Reduces energy intensity by 111,060 MBtus/year
- **Reduces water usage by 55.0 M gallons/year**
- Aligns with Master Site Plan and Transformation
- Significant environmental benefits and energy savings


Water Sources
Y-12 Potable Water Distribution System
1,383,708 kgal (7 year historic average)
Misc. Usage Unaccounted
244,161 kgal
Distribution System Leaks
55,348 kgal
Domestic Usage (Plumbing, Kitchen Equipment, Janitorial, etc.)
49,833 kgal
Once-thru Process Cooling
477,426 kgal
Steam Plant
203,121 kgal
Cooling Tower Make-up
266,533 kgal
Once-thru Space Cooling
23,220 kgal
Irrigation
479 kgal
Demineralized Water
72,793 kgal
Boiler Blow-down
8,415 kgal
RO Reject
43,283 kgal
Evaporation
107,255 kgal
RO/EDI Reject
25,456 kgal
Process Use
47,336 kgal
Steam Production
151,423 kgal
Process/Chiller Cooling
72,007 kgal
CT Blow-down
71,503 kgal
Basin Leaks/ Overflow
15,768 kgal
Augmentation Water
1,593,444 kgal
Leaks
Condensate
Rain Water
55 inches/yr
INTRUSION
Surface & Ground Water
Surface & Ground Water
Sanitary Sewer System
Storm Discharge via East Fork Poplar Creek

2010 Water Assessment Conducted by DOE Water Management Program

- Program Manager Will Lintner, DOE Federal Energy Management Program
- Project Leader Kate McMordie of Pacific Northwest National Laboratory (PNNL)
- Water Savers, Inc. subcontract conducted study
- Data Collection
  - Potable and non-potable water billing and metering records
  - Cooling tower round sheets
  - Ground water sampling data
  - Rain water measurement data
  - Portable flow meter data from four locations
  - Occupancy, equipment types, fixture flow measurements, personnel interviews, and consumption activities for buildings on Y-12 site were focus for building tours
  - 18 completed Water Checklists for secure facilities, each comprising domestic use, process water, and specific water-using equipment

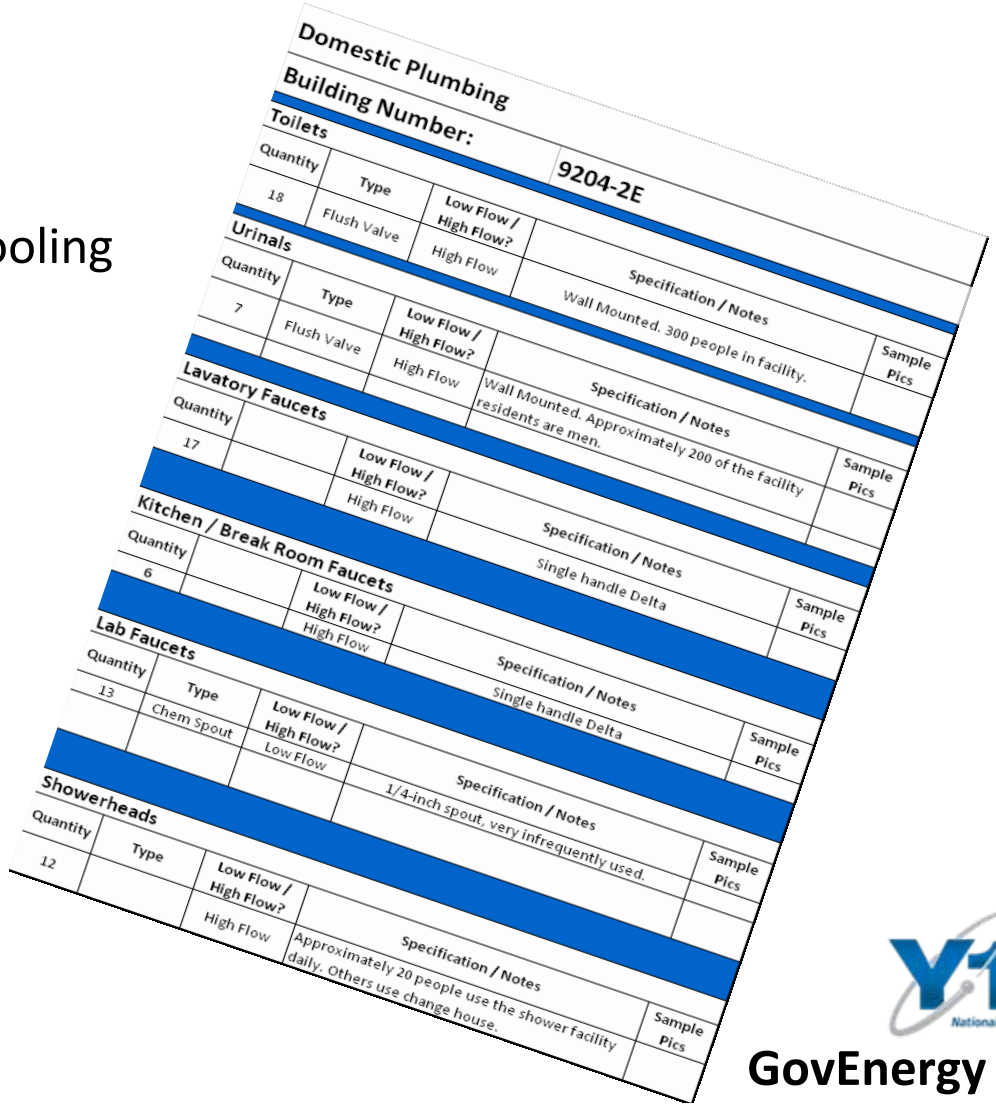
Assessment Process Required Interaction with Water Users

- Plant walkthroughs provide opportunity to focus on areas of concern and known issues by occupants and stakeholders
- Information collection related to utilities systems – historical, current, and planned projects for site transformation
- Systems studied included potable, EFPC, underground springs, building air-handling units, domestic plumbing, fire, cooling towers, sanitary sewer, process supply and return, rain water measurement, and outfalls
- Feedback on checklists required occupants to perform the walkdown
- Stakeholder meetings included a kick-off and subsequent meetings with major stakeholder groups:
  - Utilities Management
  - Utilities Engineering
  - Environmental Compliance
  - Building and Facility Managers
  - Craftspersons and Apprentices

Water Assessment Checklists Addressed Consumption in Secure Facilities

Targeted Checklists for:

- Domestic
- Once-Through Space Cooling
- Process
- Other
  - Ice Machines
  - Reverse Osmosis
  - Sterilizers, etc.



Domestic Plumbing

Building Number: 9204-2E

Toilets

Quantity	Type	Low Flow / High Flow?	Specification / Notes	Sample Pics
18	Flush Valve	High Flow	Wall Mounted. 300 people in facility.	

Urinals

Quantity	Type	Low Flow / High Flow?	Specification / Notes	Sample Pics
7	Flush Valve	High Flow	Wall Mounted. Approximately 200 of the facility residents are men.	

Lavatory Faucets

Quantity		Low Flow / High Flow?	Specification / Notes	Sample Pics
17		High Flow	Single handle Delta	

Kitchen / Break Room Faucets

Quantity		Low Flow / High Flow?	Specification / Notes	Sample Pics
6		High Flow	Single handle Delta	

Lab Faucets

Quantity	Type	Low Flow / High Flow?	Specification / Notes	Sample Pics
13	Chem Spout	Low Flow	1/4-inch spout, very infrequently used.	

Showerheads

Quantity	Type	Low Flow / High Flow?	Specification / Notes	Sample Pics
12		High Flow	Approximately 20 people use the shower facility daily. Others use change house.	

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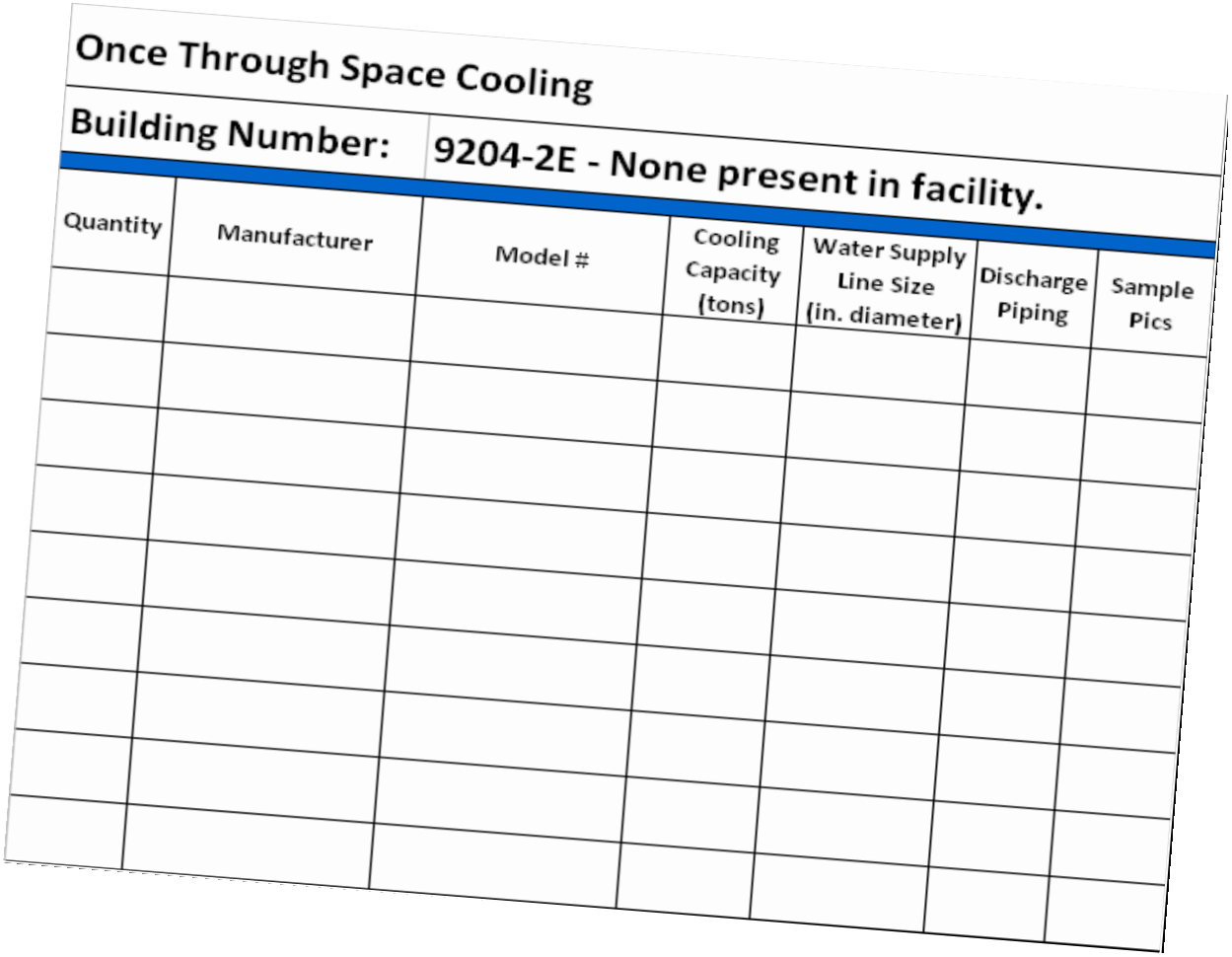
Sample Checklist for HVAC Applications



Once Through Space Cooling						
Building Number:	9204-2E - None present in facility.					
Quantity	Manufacturer	Model #	Cooling Capacity (tons)	Water Supply Line Size (in. diameter)	Discharge Piping	Sample Pics

Sample Process Cooling Checklists – size of lines, flow discharge, and operating times

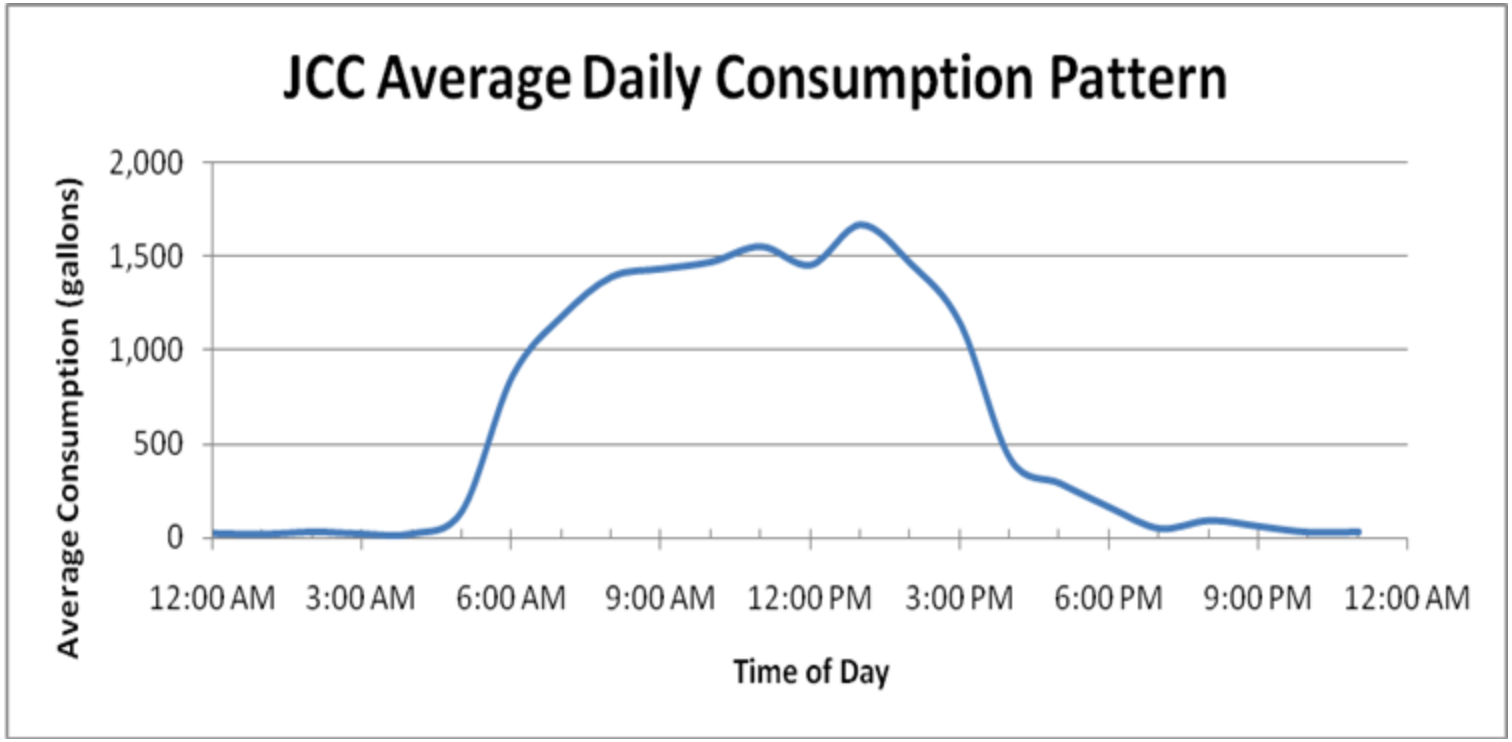
Process Cooling

Building Number: 9204-2E

Process #	Runtime Average (hrs /day)	Operation Time (days / year)	Water Supply Line Size (in. diameter)	Water Supply Type	Discharge Piping	Flow Rate	Comments
1 (SEBW)	24	365		Once Through Potable	Storm	1.7 gpm in standby 2 gpm in use	The equipment is rarely used but is maintaining in an immediate standby state for operational flexibility. The equipment could be brought on line in approximately four-hours. There is a big potential for conservation.
2 (NEBW)	24	365		Once Through Potable	Storm	10 gpm in standby 14 gpm in use	Same as Process #1 above
3 (HVP1)	24	365	1/2 inch	Once Through Potable	Storm	5 gpm	The specification is for 2 gpm, but there is no flow indicator. The supply pressure is 15 psi. The 5 gpm figure is a rough guess of the worst case flow. This equipment will be relocated in approximately two months and the discharge will be to the sanitry sewer at the new location.
4 (New HVP2)	24	20	1/2 inch	Once Through Potable	Sanitary	5 gpm	This equipment will be brought on line in approximately two months. It will be a standby unit for Process #3 above and will only operate as needed based on system load. Cooling water flow is controlled by a solenoid operated valve tied to the equipment start circuit. Run time (days per year) is a best guess.

Jack Case Center Metering Results

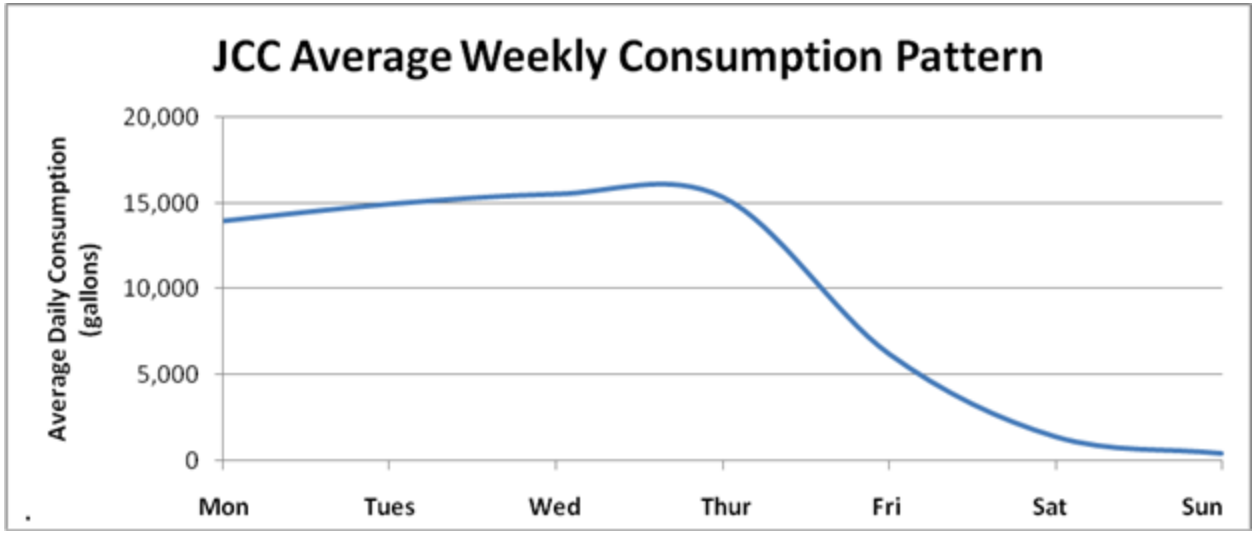
Purpose: To identify general usage patterns and average daily building consumption



Typical office building usage pattern was identified with maximum water consumption during business hours; drop off to little or no consumption during non-business hours.

Jack Case Center Metering Results - continued

Purpose: To identify general usage patterns and average daily building consumption

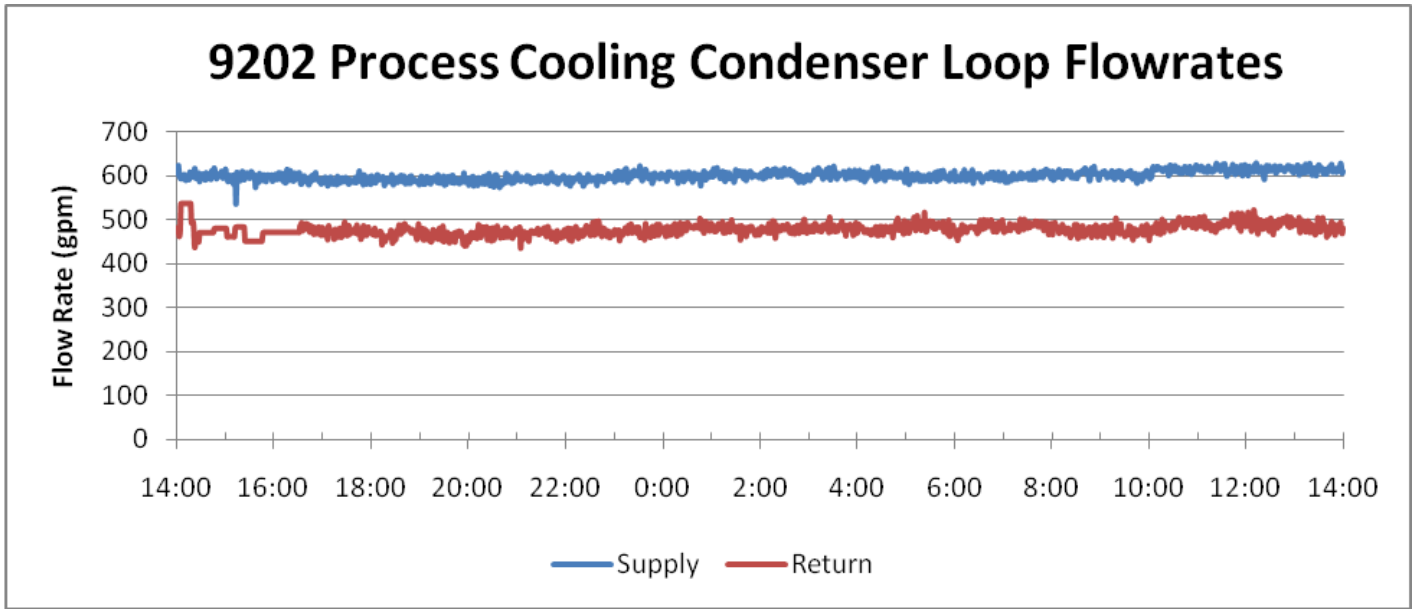


- Verified weekly trend of occupancy.
- Monday through Thursday data exhibits peak consumption, while Friday thru Sunday data exhibits minimal consumption. This is a direct correlation to Y-12 hours/days of operation.
- Note that consumption drops significantly on Friday as it is not an operation day for most salaried Y-12 employees; the JCC kitchen operation is open Monday through Friday.

9202 Condenser Loop Supply and Return

Purpose: To identify discrepancy between condenser loop supply and return flow rates

Target issues: Identified an average discrepancy of 117 gpm between condenser water supplied to the building and returned to the 9409-18/31 cooling towers. Indication of an open condenser loop that is discharging to drain, rather than returning to the tower. Under normal circumstances, you would expect these flow rates to be virtually identical.



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Water Conservation Measures Recommended for Energy, Water, and O&M Savings

Water Conservation Project Summary

Water & Energy Conservation Measures (WECMs)	Water Savings (gal / yr)	Water Savings ($$ / yr)	Energy Savings ($$ / yr)	O&M Savings ($$/yr)	Savings (SS/yr)	Labor & Material ($$)	Simple Payback (yrs)
Domestic Plumbing Retrofits	25,383,800	$271,607	$30,996	$5,096	$307,699	$907,593	2.95
Kitchen Equipment Upgrades	1,363,149	$14,586	$16,112	$2,000	$32,698	$158,388	4.84
Process System Upgrades	57,738,123	$76,214	$0	$0	$76,214	$336,000	4.41
Cooling Tower Upgrades	71,964,002	$94,992	$0	$0	$94,992	$2,212,953	23.30
Space Cooling Upgrades	23,220,432	$30,651	-$286,913	$0	-$256,262	$2,892,857	-11.29
Steam Plant Upgrades	48,484,848	$64,000	$256,000	$0	$320,000	$4,544,898	14.20
Building Sub-metering Systems	0	$0	$0	$0	$0	$882,307	-
O&M Improvements	11,363,636	$15,000	$10,000	$0	$25,000	$0	0.00
Subtotal	239,517,991	$567,050	$26,195	$7,096	$600,342	$11,934,996	
Design Fees						$417,725	
Bonding						$184,992	
Permits						$0	
Taxes						$835,450	
TOTAL PROJECT VALUES	**239,517,991**	**$567,050**	**$26,195**	**$7,096**	**$600,342**	**$13,373,163**	**22.28**

Water Assessment Recommendations

Domestic: high efficiency plumbing fixtures and equipment

Savings Summary (Domestic Plumbing Retrofits)

WCM #	WCM Description	Est. Count	Est. Total Water / Sewer Savings (gal/yr)	Est. Total Water / Sewer Savings ($$/yr)	Est. Total DHW Energy Savings ($$/yr)	Est. Total Annual Savings ($$/yr)	Est. Total Installed Cost ($$)	Overall Simple Payback (yrs)
1	Upgrade toilets to HET units (1.28 gpf flush valve, 1.0 gpf tank)	1,077	10,539,100	$112,768	$0	**$112,768**	**$656,523**	**5.82**
2	Upgrade urinals to HEU 0.5 gpf piston units	400	3,919,500	$41,939	$0	**$41,939**	**$153,720**	**3.67**
3	Install faucet restrictors (0.5 gpm lavatory, 1.0 gpm kitchen/lab)	1,454	1,602,640	$17,148	$1,966	**$19,115**	**$87,284**	**4.57**
4	Install 1.5 gpm low-flow pressure compensating showerheads	503	9,322,560	$99,751	$29,030	**$128,781**	**$10,066**	**0.08**
Domestic Plumbing Retrofits TOTAL			25,383,800	$271,607	$30,996	**$302,603**	**$907,593**	**3.00**

Simple Payback: 3.0 Years

Kitchen: High efficiency machine replacements, flow restrictions, timer controls, and air-cooled replacement for water-cooled equipment

Savings Summary (Kitchen Equipment Upgrades)

WCM #	WCM Description	Est. Count	Est. Total Water / Sewer Savings (gal/yr)	Est. Total Water / Sewer Savings ($$/yr)	Est. Total Energy Savings ($$/yr)	Est. Total Annual Savings ($$/yr)	Est. Total Installed Cost ($$)	Overall Simple Payback (yrs)
5	Install high efficiency dish machine with Opti-Rinse technology	1	124,800	$1,335	$11,606	**$12,941**	**$71,066**	**5.49**
6	Install in-line flow restrictors on garbage disposal nozzle supply lines	1	149,760	$1,602	$0	**$1,602**	**$2,036**	**1.27**
7	Install in-line flow restrictors on tray conveyor trough nozzle supply lines & install timer-based solenoid controls	1	524,160	$5,609	$0	**$5,609**	**$4,668**	**0.83**
8	Install 1.28 gpm pre-rinse sprayers	3	83,741	$896	$261	**$1,157**	**$702**	**0.61**
9	Replace existing steamers with high efficiency connectionless steamer units	4	93,808	$1,004	$2,384	**$3,388**	**$37,485**	**11.06**
10	Install counter-flow heat exchangers on all existing and proposed ice machines	23	0	$0	$1,976	**$1,976**	**$16,431**	**8.32**
11	Replace existing water-cooled ice machines with air-cooled equivalents	2	386,880	$4,140	($114)	**$4,025**	**$26,000**	**6.46**
Kitchen Equipment Upgrades TOTAL			1,363,149	$14,586	$16,112	**$30,698**	**$158,388**	**5.16**

Simple Payback: 5.2 Years

Process Systems: Verification of all process cooling condenser loop supply and return connections; repair any connections that are discharging condenser water to drain. Replace process heat exchangers with new equipment. This measure requires end use equipment modification, and will require coordination between Utilities and Operations. Increasing cooling tower & chiller operating efficiency reduces both water and energy consumption.

Savings Summary (Process Systems Upgrades)

WCM #	WCM Description	Est. Count	Est. Total Water / Sewer Savings (gal/yr)	Est. Total Water / Sewer Savings ($$/yr)	Est. Total Energy Savings ($$/yr)	Est. Total Annual Savings ($$/yr)	Est. Total Installed Cost ($$)	Overall Simple Payback (yrs)
12	Repair condenser loop connections so that all condenser water is returned to the cooling towers	12	57,738,123	$76,214	$0	**$76,214**	**$336,000**	**4.41**
13	Replace process equipment heat exchangers	-	0	$0	$0	**$0**	**$0**	-
Process Systems Upgrades TOTAL		-	57,738,123	$76,214	$0	**$76,214**	**$336,000**	**4.41**

A comprehensive internal audit of process equipment and systems must be completed.

Simple Payback: 4.4 Years

Cooling Towers: Install advanced sub-metering to accurately track cooling tower consumption in real time to better manage and maintain equipment;
Conductivity controller installation to automatically regulate blow-down, thereby maximizing cycles of concentration;
Install side-stream filtration or hydrodynamic cavitation system to pre-filter water and maximize operational cycles of concentration which also reduces chemical treatment requirements

Savings Summary (Cooling Tower Upgrades)

WCM #	WCM Description	Est. Count	Est. Total Water / Sewer Savings (gal/yr)	Est. Total Water / Sewer Savings ($$/yr)	Est. Total Energy Savings ($$/yr)	Est. Total Annual Savings ($$/yr)	Est. Total Installed Cost ($$)	Overall Simple Payback (yrs)
14	Install advanced sub-metering systems	9	0	$0	$0	**$0**	**$99,722**	-
15	Install conductivity controllers	9	29,318,668	$38,701	$0	**$38,701**	**$108,731**	**2.81**
16	Install side-stream filtration or hydrodynamic cavitation systems	9	42,645,335	$56,292	$0	**$56,292**	**$2,004,500**	**35.61**
Cooling Tower Upgrades TOTAL			71,964,002	$94,992	$0	**$94,992**	**$2,212,953**	**23.30**

Simple Payback: 23.2 Years

Space Cooling: Replacement of all water-cooled air conditioning units with air-cooled equivalents. However, due to the low cost of water supplied to these units (there is no sanitary sewer charge associated with the existing units since water is discharge to the storm drainage system), operation of the new units will actually cost more than the existing equipment. These measures are recommended only to reduce total facility water consumption.

Savings Summary (Space Cooling Upgrades)

WCM #	WCM Description	Est. Count	Est. Total Water / Sewer Savings (gal/yr)	Est. Total Water / Sewer Savings ($$/yr)	Est. Total Energy Savings ($$/yr)	Est. Total Annual Savings ($$/yr)	Est. Total Installed Cost ($$)	Overall Simple Payback (yrs)
17	Replace existing water-cooled air conditioning system with air-cooled equivalents	45	23,220,432	$30,651	($286,913)	**($256,262)**	**$2,892,857**	**negative payback**
	Space Cooling Upgrades TOTAL		23,220,432	$30,651	($286,913)	**($256,262)**	**$2,892,857**	**negative payback**

Simple Payback: negative

Steam Plant: Advanced sub-metering installation to accurately track steam plant consumption in real time to better manage and maintain equipment
Extend condensate recovery project to include additional sources of capture thereby saving water and energy

Savings Summary (Steam Plant Upgrades)

WCM #	WCM Description	Est. Count	Est. Total Water / Sewer Savings (gal/yr)	Est. Total Water / Sewer Savings ($$/yr)	Est. Total Energy Savings ($$/yr)	Est. Total Annual Savings ($$/yr)	Est. Total Installed Cost ($$)	Overall Simple Payback (yrs)
18	Install advanced sub-metering systems	1	0	$0	$0	**$0**	**$44,898**	-
19	Extend condensate recovery project to include additional end use capture sites for condensate return	-	48,484,848	$64,000	$256,000	**$320,000**	**$4,500,000**	**14.06**
Steam Plant Upgrades TOTAL			48,484,848	$64,000	$256,000	**$320,000**	**$4,544,898**	**14.20**

Simple Payback: 14.2 Years

Buildings: Advanced building sub-metering system that can be integrated into existing energy management systems

Savings Summary (Building Sub-Metering Upgrades)

WCM #	WCM Description	Est. Count	Est. Total Water / Sewer Savings (gal/yr)	Est. Total Water / Sewer Savings ($$/yr)	Est. Total Energy Savings ($$/yr)	Est. Total Annual Savings ($$/yr)	Est. Total Installed Cost ($$)	Overall Simple Payback (yrs)
20	Install advanced sub-metering systems on primary buildings (excludes storage, utilities equipment facilties, etc.)	31	0	$0	$0	**$0**	**$882,307**	-
	Sub-metering Upgrades TOTAL		0	$0	$0	**$0**	**$882,307**	-

Simple Payback: TBD

Conclusions and Future Direction

- Adopt final Water Assessment Report and recommendations to guide plant programs and project planning;
- Ensure that water programs are incorporated in the site Master Plan and Ten-Year Site Plan;
- Evaluation of cooling and chiller systems with on-going ESPC projects;
- Initiate domestic plumbing upgrades as buildings are renovated annually;
- Prioritize water upgrades for High Performance Sustainability (HPSB) targeted buildings;
- Continue chiller facility maintenance and meter installation to monitor equipment performance;
- Work to finalize water balance and identify all consumption;
- Use water assessment checklist tool for EISA 2007 building audit process;
- Incorporate water system recommendation into on-going Utility Migration Plan underway to support plant transformation;
- Consult with DOE Water Program contacts for further information exchange;
- Continue to monitor and assess raw water needs against creek health.

Energy Efficient and Sustainable Y-12 Footprint

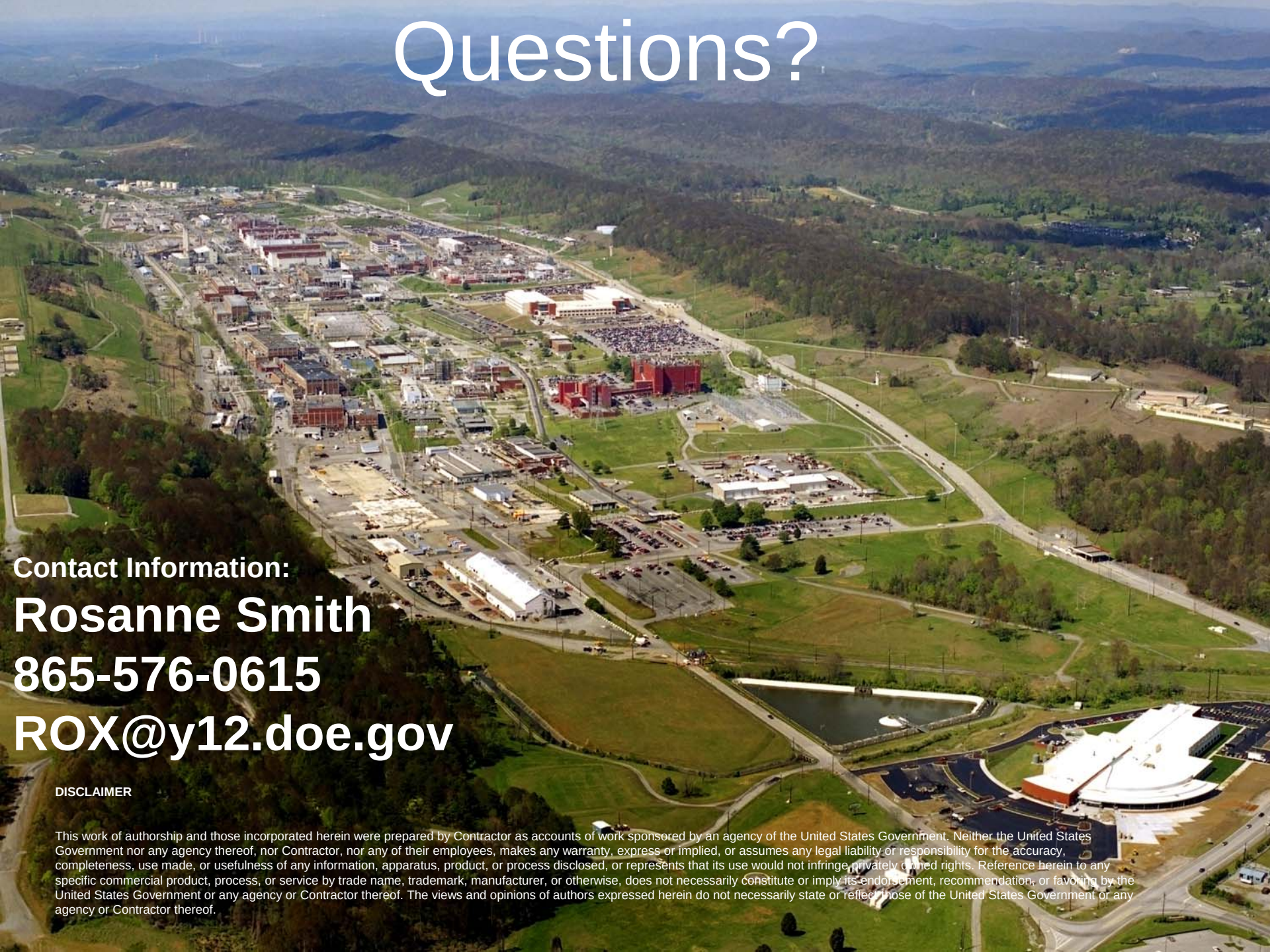
National Nuclear Security Administration

GovEnergy

Y-12 National Security Complex

GovEnergy 2010

Questions?



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