ADRES Automated Demand Response and Energy Savings
BUILDING AUTOMATION SYSTEM INFORMATION RESPONSE

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1. IT Department Advantages and Considerations

Each ADRES Controller includes an embedded cellular modem with a private IP address which transmits all encrypted data to the cellular carrier then passes the segmented data traffic through an IPSEC VPN tunnel to the ADRESpro servers. All servers, switches and other network devices are included in the ADRES first cost setup. See diagram 1-1 and detailed cyber secure network installation drawing below.

The ADRES Controller system with six HVAC units per store would cost $20k to $40k less than an equivalent BACnet hardwired Ethernet system. The ADRES Controller does not require the conduit or Ethernet cable that would be run to each of the six HVAC BACnet controllers. The ADRES Controller also does not run on the corporate IT network and is not dependent on the local LAN or local ISP.

Corporate IT Network Advantages and Considerations:

➢ ADRES Building Automation System (BAS) does not use Corporate WAN or LAN networks.
➢ ADRES network 100% Isolated from Corporate IT Network.
➢ No corporate IT support required for construction, implementation or operations of ADRES BAS.
➢ No local server or network is required to monitor or control the ADRES system.
➢ ADRES Controller meets the DoD level of cyber security.
    o All controllers have a private IP address that is segmented from other cellular network traffic.
    o All traffic is segmented by carrier and then directly routed through an IPSEC VPN tunnel from the ADRES Servers.
    o Access to the ADRES controllers is provided by a secure HTTPS website through a web browser.
➢ The ADRES Controller has a built-in over-the-air firmware update utility to allow for changes in firmware to be executed without deployment of HVAC personnel on-site.
➢ Corporate management and control over buildings, units, and all system users is through the secure HTTPS ADRESpro website.
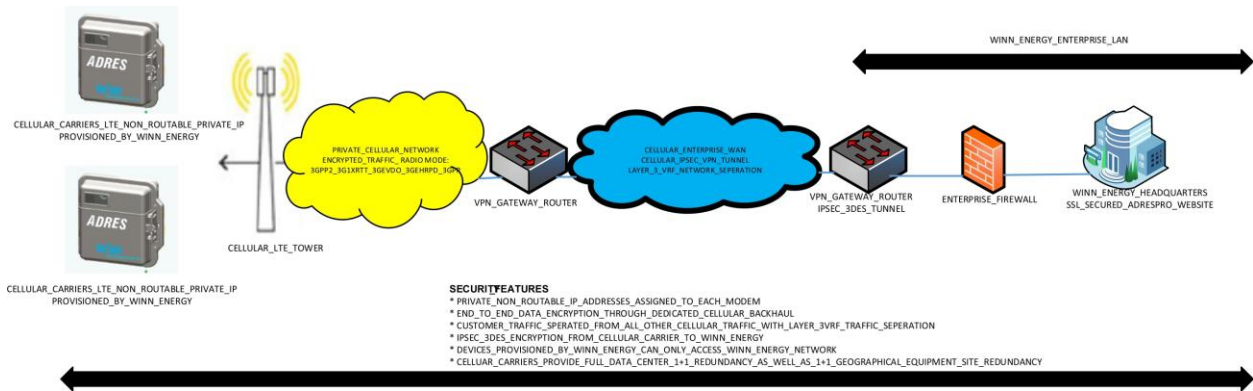

Diagram 1-1   ADRES Cyber Secure Network

ADRES Control Series

Control System Solution   **ADRES Cyber Secure Installation Overview**


Cellular Hardwired Backhaul VPN, IPSec Encryption.

Cellular Digital Wireless VPN, IPSec Encryption between ADRES Micro and ADRESpro Servers.

ADRESpro Servers VPN, IPSec Encryption.

ADRESpro Server VPN, IPSec Encription receiving FTP Files from ADRES Gateway. Connected to ADRESpro Servers through CISCO network IPSEC VPN.

User Workstation providing local secure Web Page Hosted by ADRESpro Server access to End Customer ADRES control data and alarms.

Cell Carrier Data Servers

ADRESpro Servers

Secure Web Server
https:adrespro.com/dashboard
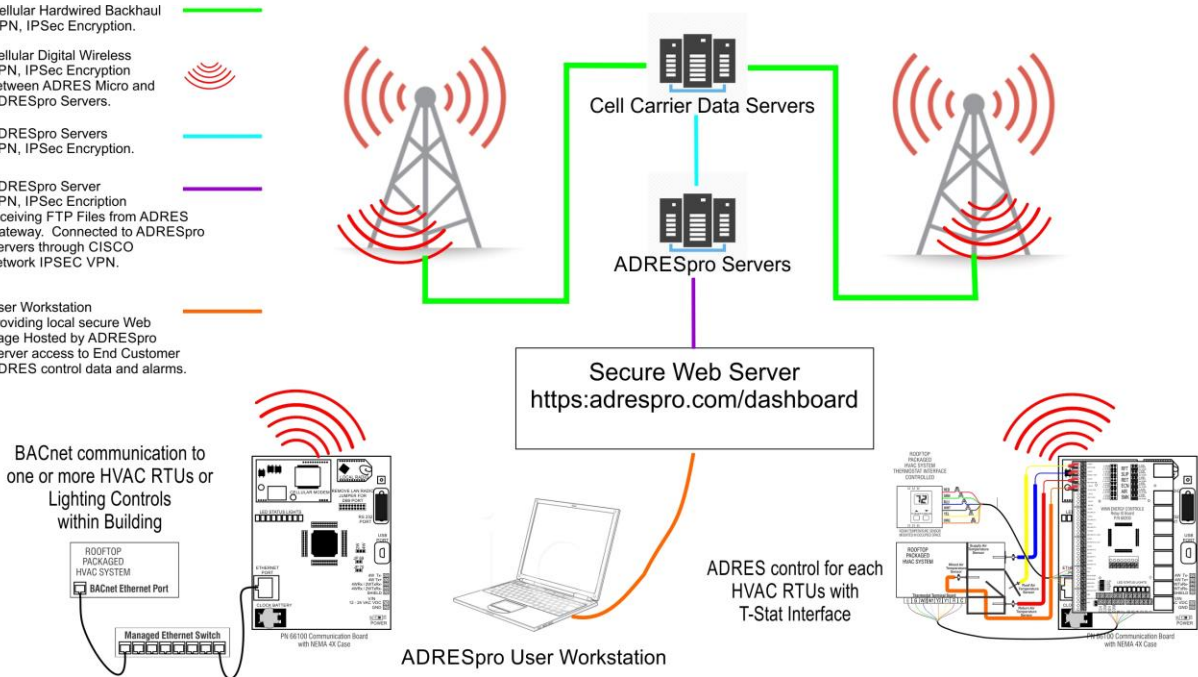
BACnet communication to one or more HVAC RTUs or Lighting Controls within Building

ROOFTOP PACKAGED HVAC SYSTEM
BACnet Ethernet Port
Managed Ethernet Switch

ADRESpro User Workstation

ADRES control for each HVAC RTUs with T-Stat Interface

1   ADRES BACnet Gateway / Ethernet or RS 485 Serial
2. ADRES with Cellular WAN Modem (Private IP and VPN from WEC Server to Carrier to ADRES).
3. ADRES Communication Board with Ethernet or RS 485 connected to Managed Switch. ADRES to Poll each BACnet capable RTU for performance data and Alarms. ADRES will push this data to ADRESpro Server to post as secure web page. ADRES will store data in local memory.
4. ADRES will not allow remote access from Cell Modem to public internet.
5. ADRES has over-the-air firmware update capability.

1   ADRES with Relay IO board installed on each HVAC RTU.
2. ADRES with Cellular WAN Modem (Private IP and VPN from WEC Server to Carrier to ADRES).
3. ADRES Relay IO board connected to T-Stat HVAC interface with room, supply, return, mixed and roof temp and humidity sensors.
4. ADRES controls real-time with advanced energy saving logic. ADRES controls VFD indoor fan directly.
5. ADRES modulates economizer directly with advanced digital economizer logic.
6. Eliminates all ethernet and power wiring.
7. Eliminates single point failure.
8. Removes all communication from end customer network.

2. Engineering Department Considerations

Recommended ADRES deployment is one ADRES controller for each HVAC Unit. ADRES controller to be installed at the factory interfaced to standard thermostat controls with the addition of advanced modulating economizer control and variable frequency drive (VFD) Indoor fan control including all sensors.

Alternatively, the ADRES can be installed in its NEMA 4X enclosure on the exterior of the HVAC unit and wired into the standard Thermostat interface as above. Exterior mounting and installation provides easy access by maintenance personnel to check the operating status of HVAC unit using the status lights on the ADRES controller.

Each ADRES Controller includes an embedded cellular modem with a private IP address which transmits all encrypted data to the cellular carrier then passes the segmented data traffic through an IPSEC VPN tunnel to the ADRESpro servers. All servers, switches and other network devices are included in the ADRES first cost setup.

The ADRES Controller system with six HVAC units per store would cost $20k to $40k less than a BACNET hardwired Ethernet system. The ADRES Controller does not require the conduit or Ethernet cable that would be run to each of the six HVAC BACnet controllers. The ADRES Controller also does not run on the corporate IT network and is not dependent on the local LAN or local ISP. Additional ADRES controls are available and preconfigured to interface and control renewable technologies and systems that might be added in the future including lighting control, solar PV, battery storage, wind turbines, backup generators, etc.

Each ADRES Controller includes an on-board measurement and verification reporting capability that that can be used for approved Utility rebate and incentives programs.

ADRES system hardware and software features:

> ADRES Controller hardware and point list capability (see page x).
> ADRES Controller can be installed in HVAC unit at the factory.
> ADRES Controller can eliminate BACnet or hardwired server (s), controller (s), conduit, and Ethernet runs to the HVAC units, lighting controls, etc.
> ADRES Controller can be retrofit to existing HVAC equipment in an externally mounted NEMA enclosure and either Thermostat Interface or even BACnet controlled HVAC unit.
> ADRES Controller provides all advanced capabilities and functionality of a hardwired BACnet controller with the addition of on-board memory of performance data.
> Each ADRES Controller is setup to automatically forward performance, sub meter, control settings, set points, etc. every 15 minutes to the ADRES Servers. The elimination of having to "poll" each BACnet unit results in improved network efficiency and eliminates a single point of failure within each building.
> The ADRES Controller has a built-in over-the-air firmware update utility to allow for changes in firmware to be executed without deployment of HVAC personnel on-site.
> The ADRES Controller will record and store performance data in 15 minute increments in its on board memory for more than 1 year.

➢ The ADRES Controller has the ability to be hardwired via Ethernet or RS485 connection to local equipment if the Cellular option is not chosen or if the ADRES Controller is needed to interface with other technologies.

ADRES Control Series

| Control System Solution | Summary of Features and Options |

• Feature   ▫ Option

HVAC Systems
• **Single to four-stage gas/electric**
• **Single to four-stage heat pumps**
• **O or B type reversing valves**
• **Emergency heat control**
• **Electric strip heaters**
• **Modulating economizer control**
• **Single or two-stage heat**
• **Ventilation control**
▫ **Humidifier control**
▫ **De-humidifier control**

Sensors
• **Room or space temperature**
• **Supply air temperature**
• **Outdoor air temperature**
▫ **Indoor humidity**
▫ **Outdoor or supply air humidity**
▫ **Supply air pressure**
▫ **Air quality**

Auxiliary Inputs
• **Warmer and cooler keys**
▫ **Electric meter kWh**
▫ **DSM command control**

Heating and Cooling Selections
• **Heating only**
• **Cooling only**
• **Automatic heat/cool changeover**
• **Heat and cool off**
• **Emergency heat (heat pump)**

Heating and Cooling Modes
• **Manual operation**
• **Program operation**
• **Override operation**
• **Vacation economy mode**

Indoor Fan Operation
• **Automatic**
• **Continuous**
• **Timed continuous**
• **Duty cycle operation**
• **Fresh air mode**
▫ **VFD indoor fan control**

Comfort Enhancements
• **Programmable time/temperatures**
• **Programmable On to Off heating temperature range**
• **Programmable On to Off cooling temperature range**
• **Alarm when temperatures exceed preset limits**
• **Warmer and cooler keys at each space sensor for occupant limited override**

System Communication and Control
• **Modbus communication interface to one or more devices and systems for monitoring, control and alarming.**
• **BACnet communication interface to one or more devices and systems for monitoring, control and alarming.**
• **OpenADR demand response capable**
• **Web Browser monitoring and control using PC Computer, smart phone, etc.**
• **Local control using Web Browser.**

Energy Savings
• **Programmed time/temperature**
• **Vacation mode**
• **Timed fan operation**
• **Advanced Digital Economizer control**
• **Intelligent fresh air mode**
• **Limit 2-stage heating in moderate weather**
• **Execute supply air reset during moderate demands**
• **Alarm feature detects poor equipment performance**
• **Limit unauthorized changes to setpoint**
• **Limit setpoint change using Warmer and Cooler keys**
• **Built in Measurement & Verification.**
▫ **Adjust setpoint temperature during high KW demand**
▫ **Monitor energy usage and detect heavy or unusual usage.**
▫ **Monitor nightime or overtime HVAC usage**

3. Construction and Construction Management Considerations and Advantages

The corporate construction and construction management department working with the building contractor and subcontractors will have a greatly reduced first cost of implementing the ADRES Controller system compared to a BACnet controlled hardwired system. The ADRES will eliminate all conduit and Ethernet hardwired cable to each individually controlled HVAC unit. There is no configuration of a BACnet Server, network switches, firewalls, or ISP installation costs for the ADRES Controlled system. The elimination of conduit, wiring, network equipment along with the configuration and testing of the system is expected to save $20k to $40k in first cost implementation per building.

Specific Construction Advantages:

➢ No Conduit and Cabling for Ethernet "hardwired" communication.
➢ No WAN or LAN required.
➢ No setup and configuration of network or network switches.
➢ No configuration of BACnet Server.
➢ No GC testing of wiring and network.
➢ All programming done remotely.
➢ All firmware upgrades done over-the-air.
➢ No single point failure to building.

Typical Cellular WAN Cyber Secure Installation
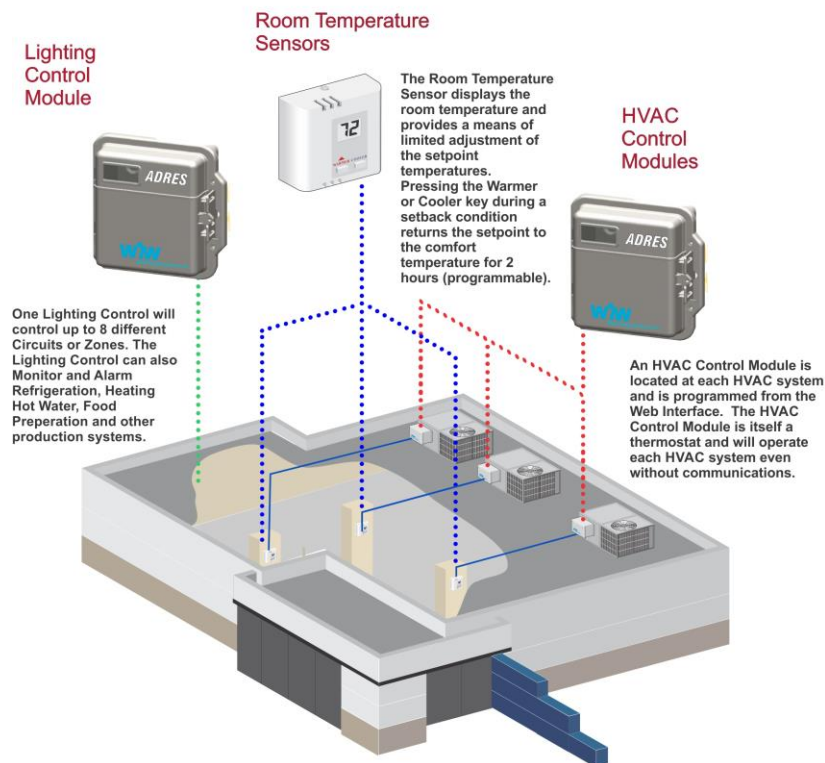
4. Operations and Maintenance Management Considerations

During the initial commissioning and acceptance to the transition of the ADRES Controller system the facility operations center will have a seamless integration into the new system. Contractor notes, comments and pictures of ADRES Controller units can be uploaded and cataloged into the ADRESpro website for historical review and pertinent information for every individual unit.

During the commissioning of the ADRES Controllers a new clean baseline for each HVAC unit system performance will be recorded by the ADRESpro website software for a baseline of current utilization of the system. This baseline of data will be used for future evaluation to determine any system deterioration in efficiency and performance as well serve as a baseline for savings once the ADRES Controller system is turned on and implemented.

The ADRES Controller has built-in measurement and verification reporting which establishes a baseline of energy consumption versus ambient temperature conditions for trending and then maintaining optimum unit efficiency once the ADRES Controller is implemented.

Detailed ADRES Administrator User Guides are available on line along with video tutorials on how to setup, configure and manage buildings, units, and users.

The ADRESpro website allows authorized users the ability to monitor, configure, and record service notes directly from the website. The authorized user may view real time system performance and settings along with configuring and controlling the unit directly from the website. The authorized user can see the historical alarm logs and historical services logs for every ADRES Controller unit they are authorized to view.

The ADRESpro website integrates the Google Map API with alarm color coding of the ADRES Controllers which allows a user a quick overview of units that are in alarm, have a warning, or are in a normal working condition. All alarms remain active on the map and the alarm log until the user has acknowledged the alarm.

Many alarms and alerts can be resolved through the interface without dispatching personnel saving money by not having to have a technician come on-site. The Alarms also facilitate timely coordination and scheduling of maintenance activities by contractors and service technicians.

The ADRESpro website provides a service and maintenance log for contractors and maintenance techs to facilitate quality control and optimal time management for maintenance service requests. The maintenance log has the added feature of uploading photographs and descriptions of the maintenance performed for quality control by corporate personnel.

Service and Maintenance Advantages:

> The ADRESpro website has the ability to give granular permissions to specific HVAC, Lighting, and other ADRES Controller units to corporate users, regional users, store personal, third party personal and contractors
> Authorized users have full control over alarms, monitoring and historical trending through the web interface.

- Corporate Administrators or assigned Administrators can receive alarms and alerts by SMS or by Email. Different contractors and users can receive alarms specific to the equipment that they provide service.
- The Alarm Log and Service Log provide clear communication between end customers and contractors on alarm condition and current action being taken to resolve the alarm or alert.
- All HVAC, Lighting, Generator, Solar PV, Wind Turbine, and other ADRES Controller types automatically provide 15-minute historical performance trending.
- The ADRES Controller has built in Measurement and Verification reports that are available for Utility Rebate and Incentive Programs.
- The ADRES Controller can be setup and configured on a unit-by-unit to participate in Demand Response programs.
- The ADRESpro website allows the customer and corporate office to track preventative and unscheduled service maintenance by the contractor. The website allows you to enter in maintenance notes with data, time, description, and before and after pictures of unit being serviced.

ADRES Control Series

Control System Solution	ADRES Control Unit Types Available

Lighting Control

Monitor
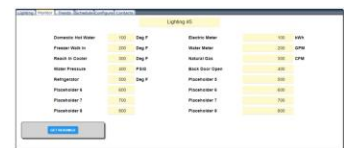
Backup Generator

Wind Turbine
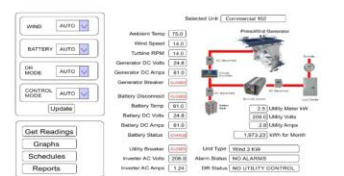
Solar Thermal
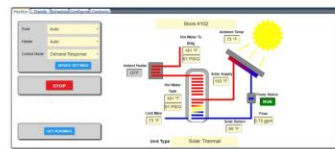
Solar PV with Battery

HVAC Package
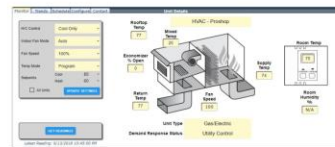
5. Energy Management Department

The Energy Management Department that is responsible for electric, gas, and water utilities can utilize that ADRES Controller to provide procurement strategies. With the ADRES Controller tracking energy consumption, trending data, and weather data the Energy Management Department can optimize wholesale energy procurement strategies or select an optimized utility rate structure for a region or buildings.

The ADRES Controller can provide real-time or scheduled demand response to reduce energy costs while maintaining the store environment.

Future addition of Solar PV and battery systems, small commercial wind turbine systems, backup emergency generator systems, advanced lighting systems can all be controlled, monitored, alarmed, programmed and configured by the corresponding ADRES unit type controller.

Some of the Energy Management and Utility Highlights:

➢ The ADRES Controller provides energy consumption, trend data, with weather data to project energy consumption requirements for different times of the year.
➢ Automated Utility accepted and approved Measurement and Verification system.
➢ The ADRES Controller can trend, graph, and report energy consumption associated with individual building systems (e.g. HVAC, Lighting, etc.…)
➢ The ADRES Controller unit can be programmed to participate in Demand Response Programs.
➢ The ADRES Controller uses Utility verified Measurement and Verification reports to participate in Utility Rebate and Incentive Programs.

ADRESpro HVAC Trend Report Example
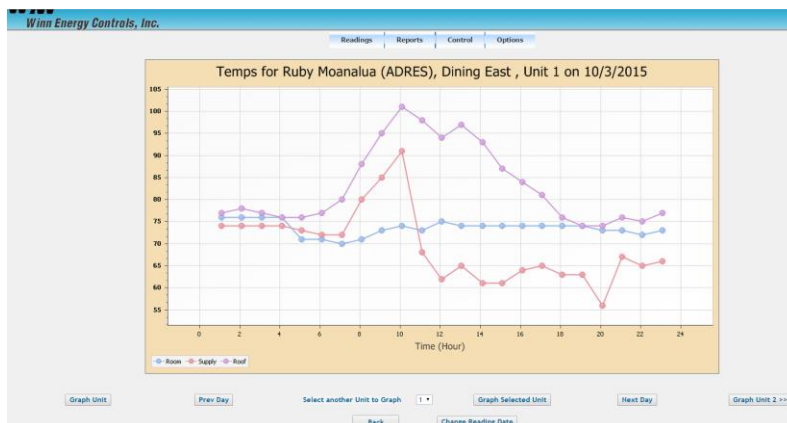
ADRESpro electric meter detailed report sample. Graphical trending of the data is also available.

Tabular HVAC summary M&V performance data is shown within the following report sample:

HVAC summary M&V performance report sample:

Energy Savings Report (HVAC)

M&V for Ruby Mililani

Filtering Criteria
Building Status: All		Baseline Range: All
Select Days: All		Post Range: 7/1/2015 to 8/1/2015
Select Time: All		

Ambient Temp (Bin)	Baseline Performance Data						Post Retrofit Performance Data						Resulting Energy Saved			
	Total Bin Hours	Energy Consumption (kWh Avg)	Room Temperature (Deg F Avg)	Supply Temperature (Deg F Avg)	Return Temperature (Deg F Avg)	Delta Temp (Supply - Return) (Deg F Avg)	Total Bin Hours	Energy Consumption (kWh Avg)	Room Temperature (Deg F Avg)	Supply Temperature (Deg F Avg)	Return Temperature (Deg F Avg)	Delta Temp (Supply - Return) (Deg F Avg)	Efficiency Improvement	Energy Saved (kWh Avg)	Total Post Retrofit Hours	Total kWh Saved
0 - 4																
5 - 9																
10 - 14																
15 - 19																
20 - 24																
25 - 29																
30 - 34																
35 - 39																
40 - 44																
45 - 49																
50 - 54																
55 - 59																
60 - 64	9.00	6.3	70.6	67.0	70.6	-3.56	7.00	0.1	72.6	68.0	72.6	-4.57	4,769 %	6.2	7.00	43
65 - 69	62.00	6.9	71.5	68.0	71.5	-3.47	66.00	1.2	74.2	113.3	74.4	38.82	490 %	5.7	66.00	378
70 - 74	33.00	16.1	72.3	60.0	72.3	-12.33	169.50	6.8	74.9	166.5	75.0	91.44	138 %	9.4	169.50	1,585
75 - 79	15.00	20.4	71.9	62.0	71.9	-9.87	88.00	14.1	75.1	180.1	75.1	105.09	45 %	6.4	88.00	559
80 - 84	26.00	20.3	72.0	67.0	72.0	-4.96	65.75	16.9	75.3	179.1	75.3	103.76	20 %	3.5	65.75	227
85 - 89	34.00	23.0	72.1	70.0	72.1	-2.09	64.00	16.8	74.8	156.8	74.9	81.82	37 %	6.3	64.00	400
90 - 94	11.00	23.9	71.4	81.0	71.4	9.64	78.00	14.5	74.5	144.9	74.8	70.10	66 %	9.5	78.00	739
95 - 99							30.00	13.8	74.4	182.2	74.4	107.77				
100-104							4.00	11.8	74.8	203.0	74.8	128.25				
105-109																
110-114																
115-119																
Totals	190	117.0					572	95.8							538.25	3,931

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