



Report No. 12149
Date: 02/04/06

Fuel Reduction Pilot Program

CONDUCTED AT

BRONX SUPREME COURTHOUSE - 198 EAST 161ST STREET, BRONX NY

JAMAICA CIVIL COURTHOUSE – 89-17 SUTPHIN BOULEVARD, JAMAICA NY

MANHATTAN CO-OP HIGH SCHOOL – 321 EAST 96TH STREET, NEW YORK, NY

FOR

City of New York
Department of Citywide Administrative
Services

TEST RESULTS
FOR
HOT-WATER HEATING SYSTEMS
STEAM HEATING SYSTEMS
DOMESTIC HOT-WATER HEATER

A Confidential Report
Prepared by
Intellidyne LLC

EXECUTIVE SUMMARY

City of New York Department of Citywide Administrative Services Heating System Fuel Reduction Pilot Program

The attached technical report summarizes the Energy Saving Performance of the *IntelliCon*[®] energy saving controls which were installed at the following locations:

- **Bronx Supreme Courthouse – 198 East 161st Street, Bronx NY:**

IntelliCon[®]-CHW controls were installed on two (2) 6,280,000 BTU gas fired Cleaver Brooks hot water boilers used for the buildings perimeter heating. The controls were installed on December 15th, 2005 and data was collected until January 7, 2006. It was determined from logged data that Boiler #1 did not run during the pilot period. During the pilot period the *IntelliCon*[®] controls reduced fuel consumption by 17.85%. This reduction in burner run time was achieved without significant degradation of the space temperature and no noticeable impact to the building's occupants. Average space temperatures during the pilot period were 71.5° on the days when the *IntelliCon*[®] control was out of the circuit and 71.1° when in the circuit. Also notable is the fact that the *IntelliCon*[®] control reduced the on/off cycling of the Boiler by 33.1%.

- **Jamaica Civil Courthouse – 89-17 Sutphin Boulevard, Jamaica NY:**

IntelliCon[®]-CHW controls were installed on two (2) 8,368,000 BTU gas or #2 fuel-oil fired Cleaver Brooks hot water boilers used for the building's heating. The controls were installed on December 14th, 2005 and data was collected until January 10, 2006. During the pilot period the *IntelliCon*[®] controls reduced fuel consumption by 62.06%. This reduction was achieved with no significant degradation of the space temperature and no noticeable impact to the building's occupants. Average space temperatures during the pilot period were 70.3° on the days when the *IntelliCon*[®] control was out of the circuit and 70.1° when in the circuit. Also notable is the fact that the *IntelliCon*[®] controls reduced the on/off cycling of the Boilers by 49.0%.

- **Manhattan Co-OP High School – 321 East 96th Street. New York NY:**

IntelliCon[®]-CHS controls were installed on two (2) 250 HP / 10 PSI gas fired A.L. Eastmond steam boilers used for the building's perimeter heating. One *IntelliCon*[®]-LCH control was installed on one (1) 800,000 BTU gas fired PVI Hot Water Heater used for the buildings domestic hot-water supply. The controls were installed on December 9th, 2005 and data was collected until January 11, 2006. During the pilot period the *IntelliCon*[®] controls reduced fuel consumption of the Steam Boilers by 16.51% and the fuel consumption of the Domestic Hot-Water Heater by 31.07%. This reduction was

achieved with no significant degradation of the space temperature and no noticeable impact to the building's occupants. Average space temperatures during the pilot period were 73.7° on the days when the *IntelliCon*® control was out of the circuit and 73.5° when in the circuit. Also notable is the fact that the *IntelliCon*® controllers **reduced the on/off cycling of the Steam Boilers by 30.1% and the Domestic Hot-Water Heater by 32.3%.**

All of these systems operate on a 24 hours per day, 7 days per week basis. The pilot program data was collected using “alternating day” methodology which is further described later in this report. Detailed data on solar load, outdoor temperature and indoor temperature was also collected and is part of this final report. The Report contains the documentation that supports the summary results and further details the specific length of the pilot program, overall temperature performance during the pilot, and the predictability of the system performance after the *IntelliCon*® effect. This improvement in operational efficiency and reduced energy usage was achieved while providing consistent temperatures. The considerable reduction in on/off cycling can be expected to reduce wear and tear on these systems, maintenance requirements, and pollution.

Special Note:

The Park West High School (ECF) located at 525 West 50th Street, Manhattan NY was selected as a fourth pilot site but not included in this report due to skewed data. Intellidyne technical personnel were instructed by the facility staff that Boilers #1 and #2 were used for normal operation, that Boiler #3 was used for back-up, and that Boiler #4 was not serviceable. Based on this information it was decided to install the *IntelliCon*® controls and data collection equipment on Boilers #1 and #2. During a required on-site visit to download data, it was discovered that Boiler #3 was being used to heat the building. Due to this occurrence during the pilot period, the data collected from boilers #1 and #2 could not be properly analyzed since it was impossible to determine the influence that Boiler #3 had on the results.



90 Pratt Oval
 Glen Cove, NY 11542
 Phone: 516-676-0777
 Fax: 516-676-2640

Test Report

Report No. 12149-1

Date: 02/04/06

Customer:

NYCDCAS

Test Site Location:

Bronx Supreme Court
 198 East 161st Street, Bronx, NY

 Contact: Ted Batista

Test Type: HEATING AIR CONDITIONING REFRIGERATION OTHER: _____
 Product Tested: HW LCH LCS CHW CHS AC CAC RU OTHER: _____

Type of Equipment:

Manufacturer: Cleaver Brooks
 Model: CB 700-150
 Capacity / SetPt: 6,280,000 BTU Input / 190 degs F
 Fuel Type: Nat. Gas
 Application: Perimeter Heating only
 Area Served:
 Misc. 90 Sec. Prepurge, 15 Sec. Postpurge

Test Start Date: 12/15/05
 Test End Date: 01/07/06
 No. of Days in Test: 24

BURNER RUN-TIME: in HRS. in MIN.
 IntelliCon ON-DAYS: 54:00:45
 IntelliCon OFF-DAYS: 61:33:51 RUN-TIME was reduced by: 12.27%

BURNER USAGE FACTOR:
 IntelliCon On-Days: 19%
 IntelliCon Off-Days: 21%

HEATING DEGREE-DAYS (FOR TEST PERIOD)
 IntelliCon ON-DAYS: 320 It was 6.8% Colder on the On-Days.
 IntelliCon OFF-DAYS: 300
 Total Degree-Days: 620

USAGE PER DEGREE-DAY
 ON-DAYS: 0:10:07
 OFF-DAYS: 0:12:19

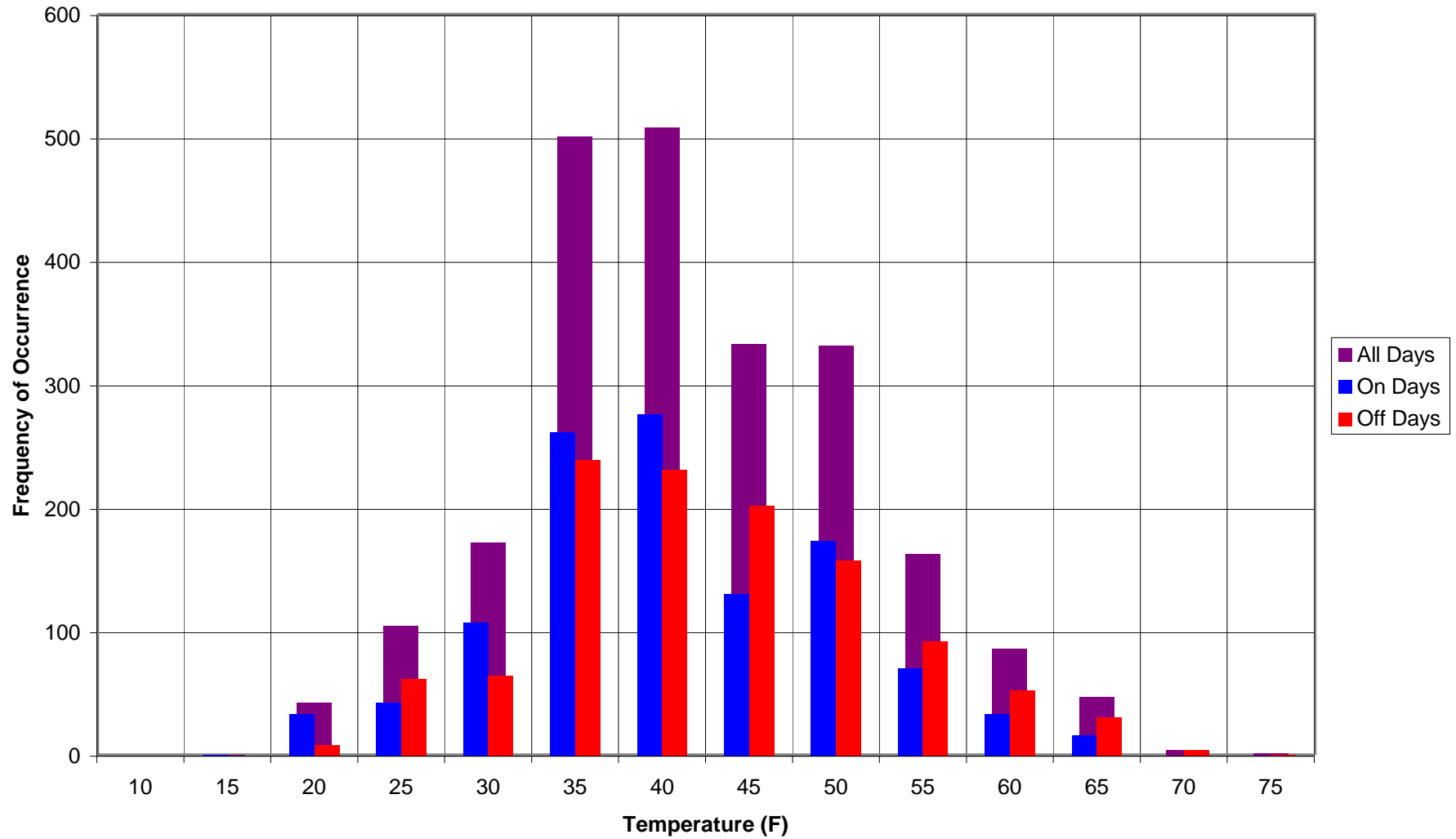
SOLAR LOAD COMPENSATION: (Lumens/Sq. Ft.)
 IntelliCon ON-DAYS: 10042
 IntelliCon OFF-DAYS: 11280 It was 10.98% Sunnier on the OFF-Days.

BURNER CYCLING REDUCTION:
 IntelliCon ON-DAYS: 556
 IntelliCon OFF-DAYS: 831 Cycling was reduced by: 33.1%

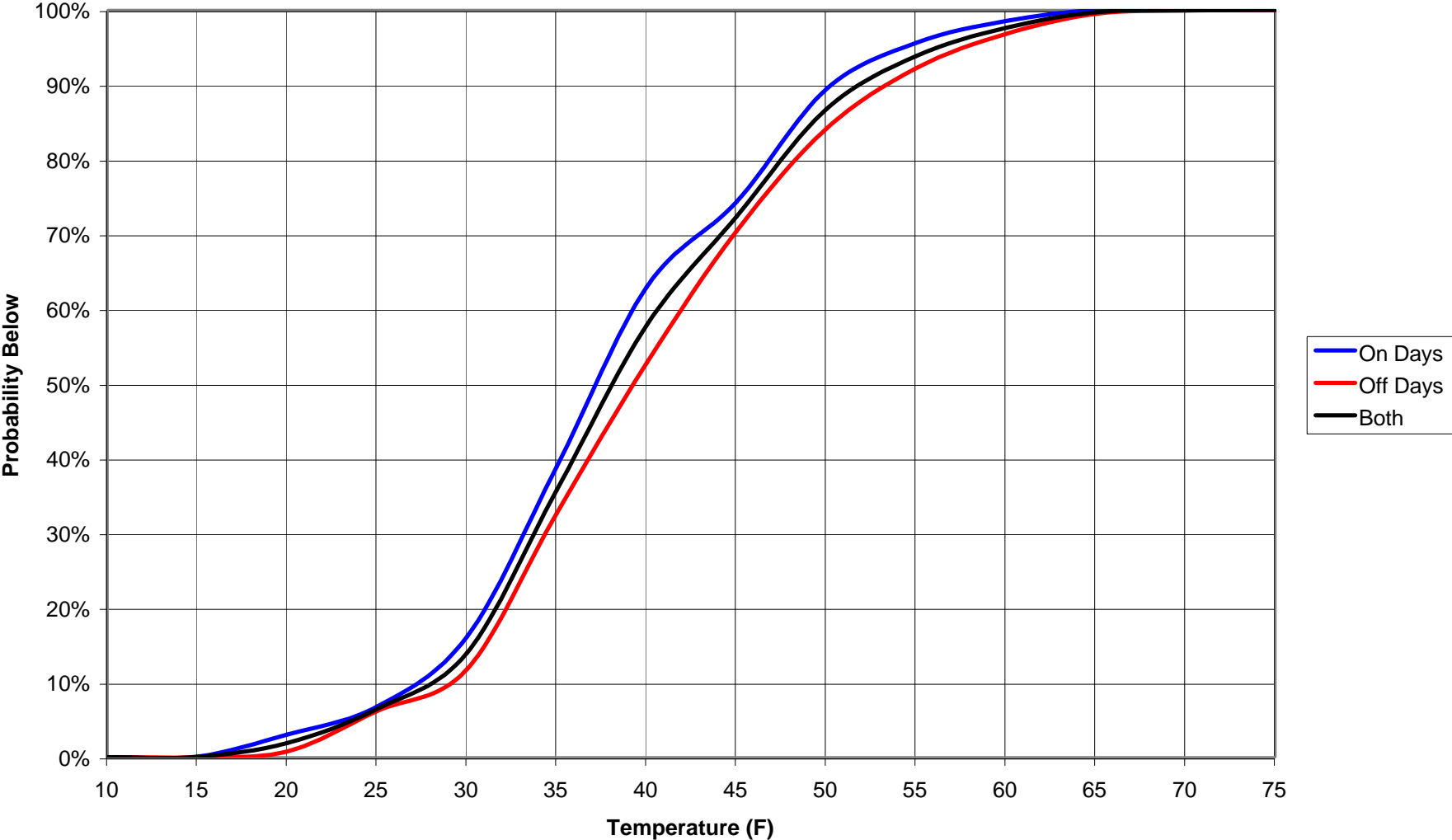
Adj. Savings = 17.85%

COMMENTS: Note: Boiler # 1 did not run for the duration of the test period. Runtimes have been reduced by 105 seconds (prepurge time + Postpurge time) times the number of cycles for each case.

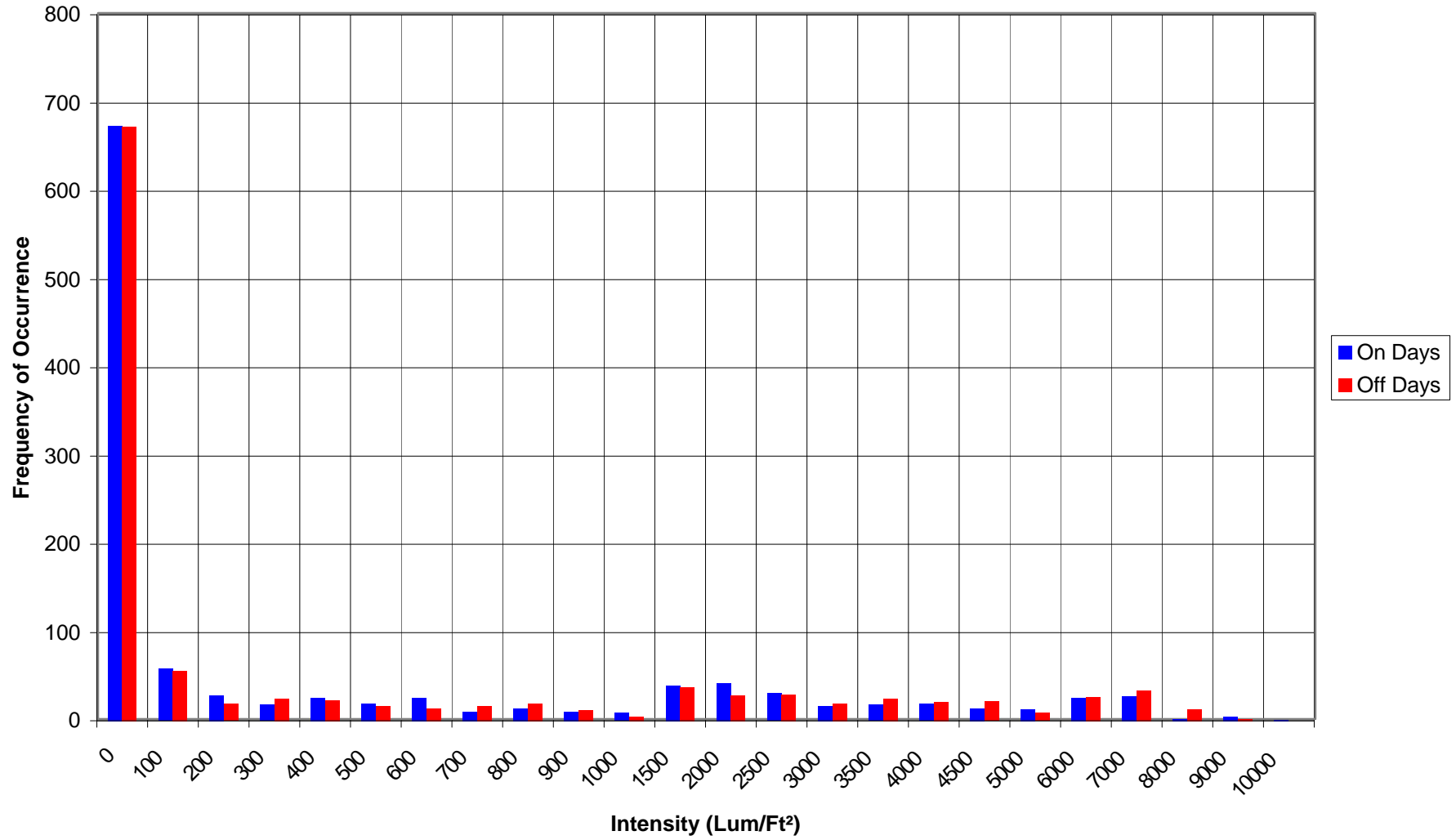
**Bronx Supreme Court
Outside Air Temp Histogram (12/15/05 --1/07/06)**



**Bronx Supreme Court
Outside Air Temperature Probabilities (12/15/05 --1/07/06)**

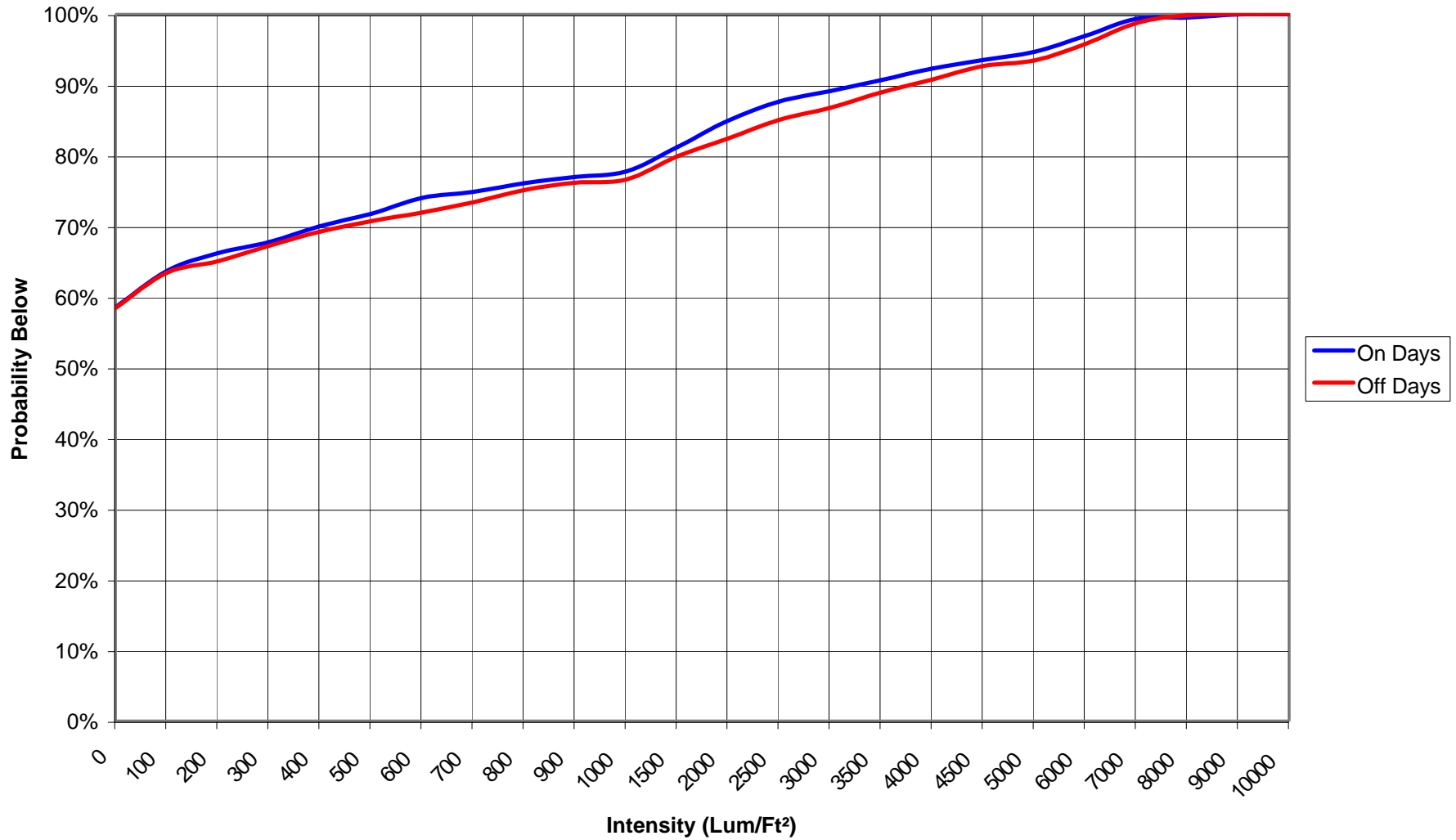


Bronx Supreme Court Solar Load Histogram (12/15/05 --1/07/06)

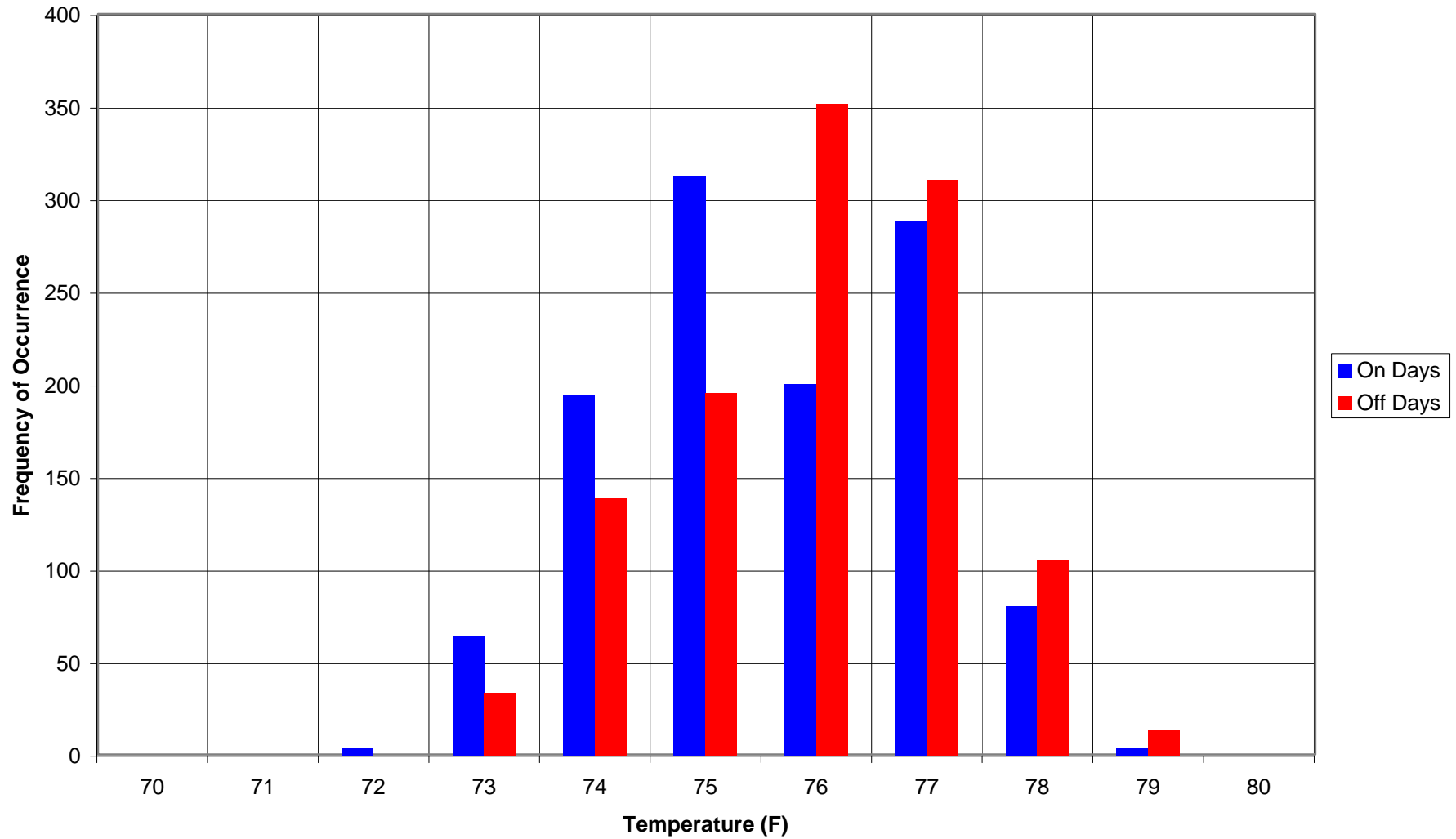


Intensity
(Lum/Ft²)

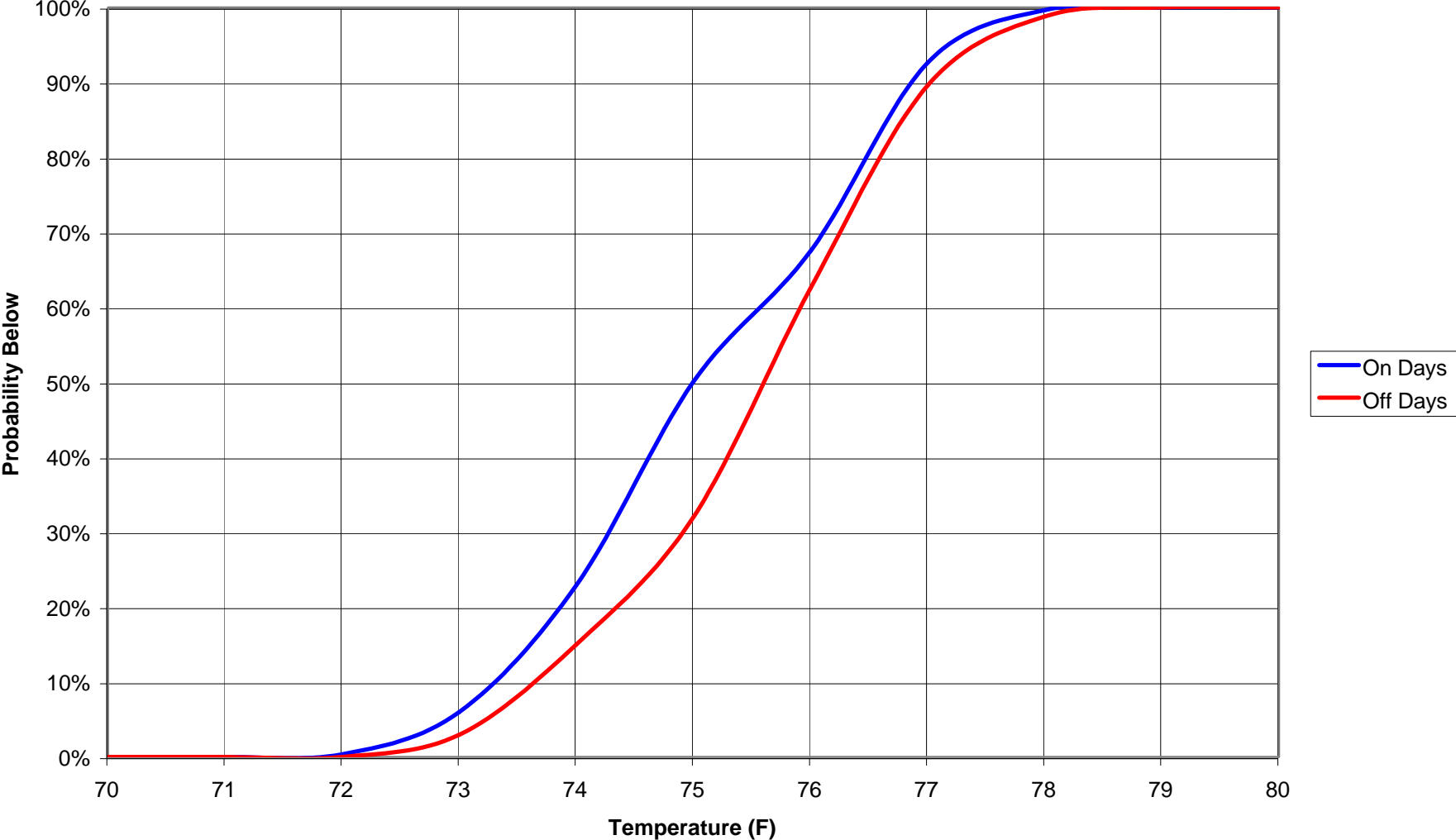
Bronx Supreme Court Solar Load Probabilities (12/15/05 --1/07/06)



**Bronx Supreme Court
Space Temp Histogram (12/15/05 --1/07/06)**



**Bronx Supreme Court
SpaceTemperature Probabilities (12/15/05 --1/07/06)**





90 Pratt Oval
 Glen Cove, NY 11542
 Phone:516-676-0777
 Fax: 516-676-2640

Test Report

Report No. 12149-2

Date: 02/04/06

Customer:

NYCDCAS

Test Site Location:

Civil Court
 89-17 Sutphin Blvd., Jamaica, NY
 Contact: Tom

Test Type: HEATING AIR CONDITIONING REFRIGERATION OTHER: _____
 Product Tested: HW LCH LCS CHW CHS AC CAC RU OTHER: _____

Type of Equipment:

Manufacturer: Cleaver Brooks
 Model: CB 200.200
 Capacity / SetPt: 8,368,000 BTU Input / 180 degs F
 Fuel Type: Nat.Gas or # 2 fuel oil
 Application: Heating only
 Area Served:
 Misc. 90 Sec. Prepurge, 15 Sec. Postpurge

Test Start Date: 12/14/05
 Test End Date: 01/10/06
 No. of Days in Test: 28

BURNER RUN-TIME:

in HRS. in MIN.

IntelliCon ON-DAYS: 103:39:37

IntelliCon OFF-DAYS: 267:10:14

RUN-TIME was reduced by: 61.20%

BURNER USAGE FACTOR:

IntelliCon On-Days: 31%

IntelliCon Off-Days: 80%

HEATING DEGREE-DAYS (FOR TEST PERIOD)

IntelliCon ON-DAYS: 339

It was 2.3% Colder on the On-Days.

IntelliCon OFF-DAYS: 332

Total Degree-Days: 671

USAGE PER DEGREE-DAY

ON-DAYS: 0:18:21

OFF-DAYS: 0:48:21

SOLAR LOAD COMPENSATION: (Lumens/Sq. Ft.)

IntelliCon ON-DAYS: 18710

IntelliCon OFF-DAYS: 22973

It was 18.56% Sunnier on the OFF-Days.

Individual Runtimes

ON-Day Runtime Cycles	Boiler #1	Boiler #2
	55:51:17	47:48:20
	106	251

OFF-Day Runtime Cycles	Boiler #1	Boiler #2
	150:58:16	116:11:58
	336	364

BURNER CYCLING REDUCTION:

IntelliCon ON-DAYS: 357

IntelliCon OFF-DAYS: 700

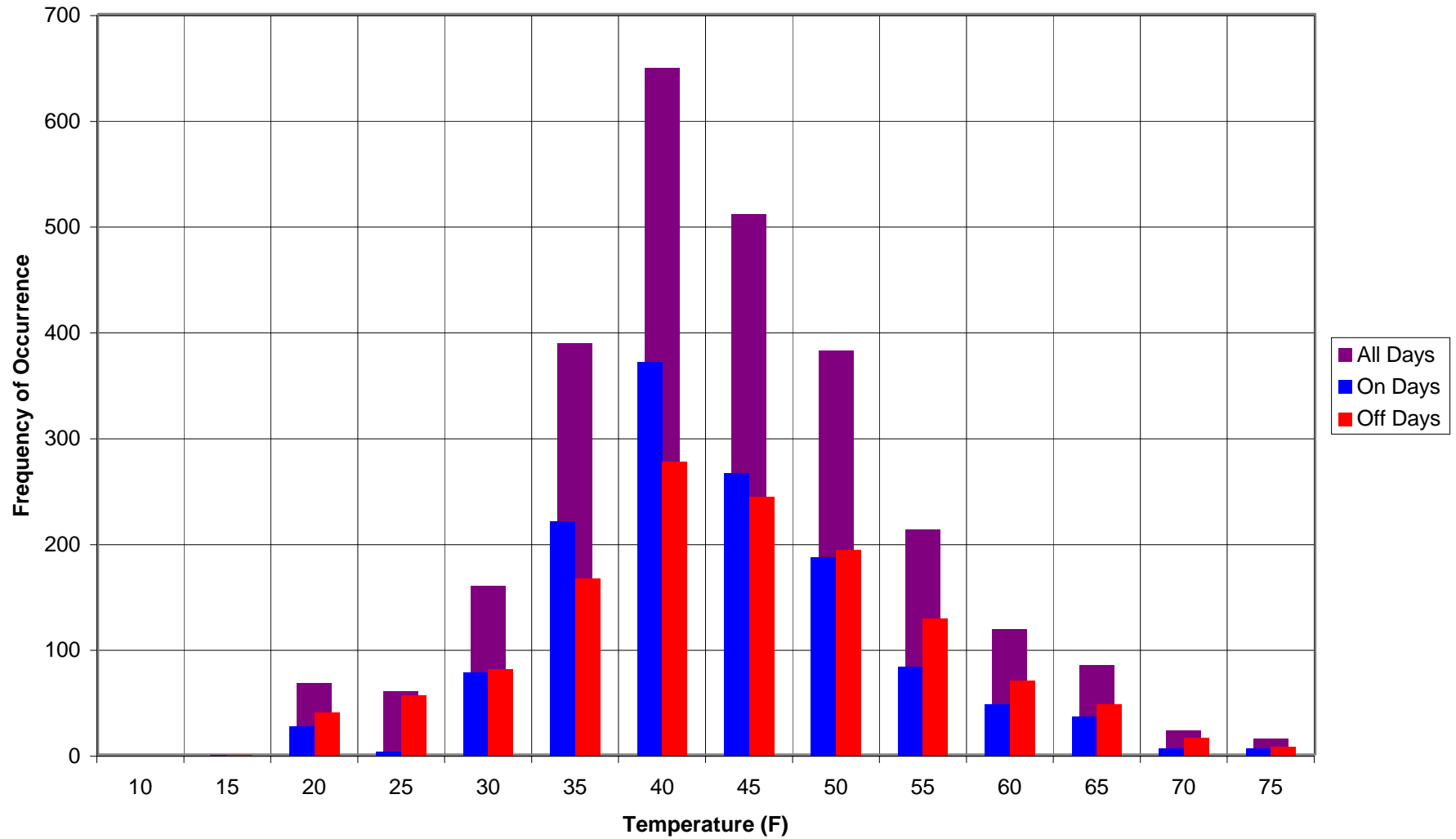
Cycling was reduced by: 49.0%

Adj. Savings = 62.06%

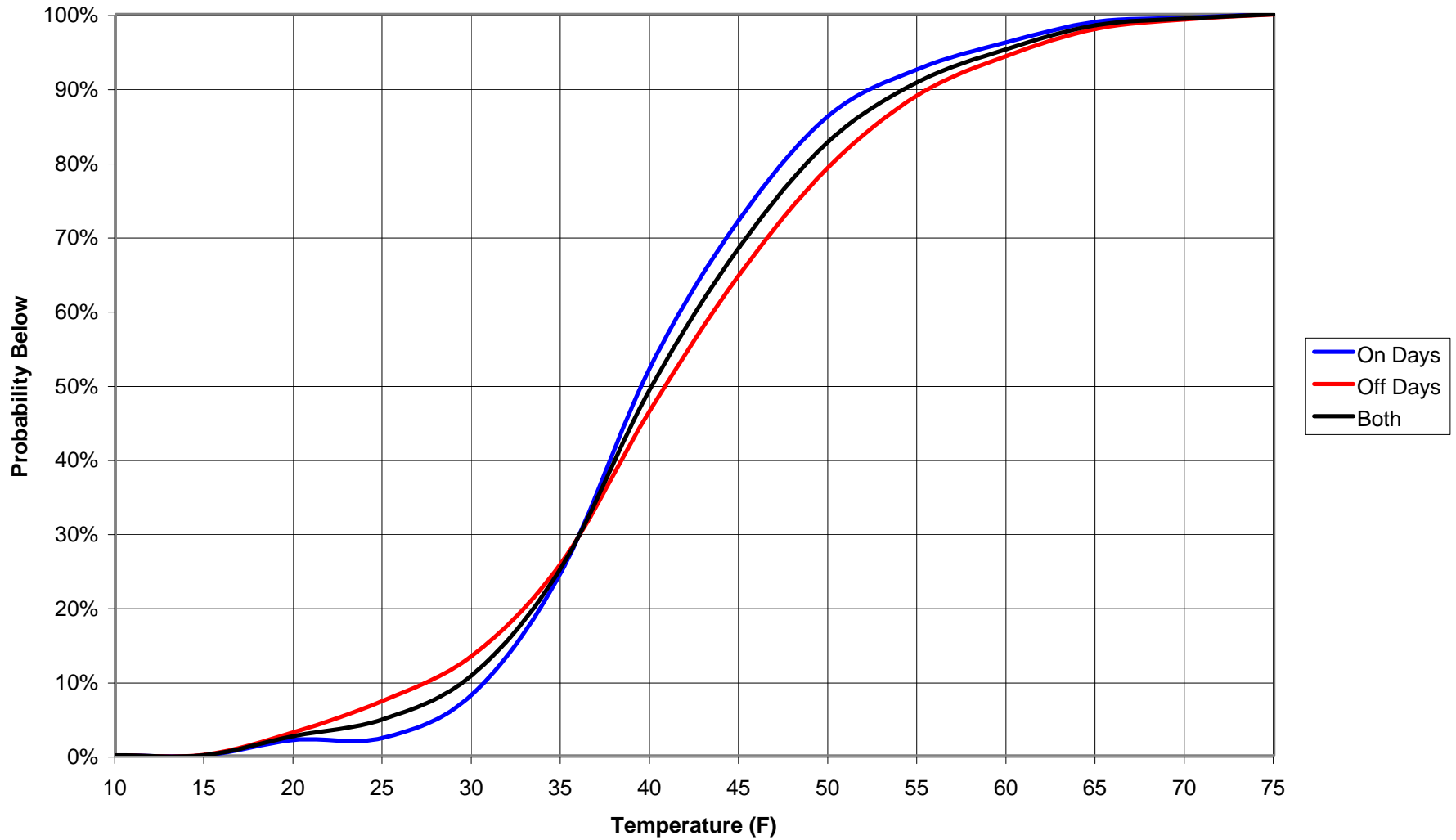
COMMENTS:

Note: Boiler Runtimes are an aggregate of Boilers #1 and #2. Runtimes have been reduced by 105 seconds (Prepurge time + Postpurge time) times the number of cycles for each case. Equipment for Boilers #1 and #2 were the same.

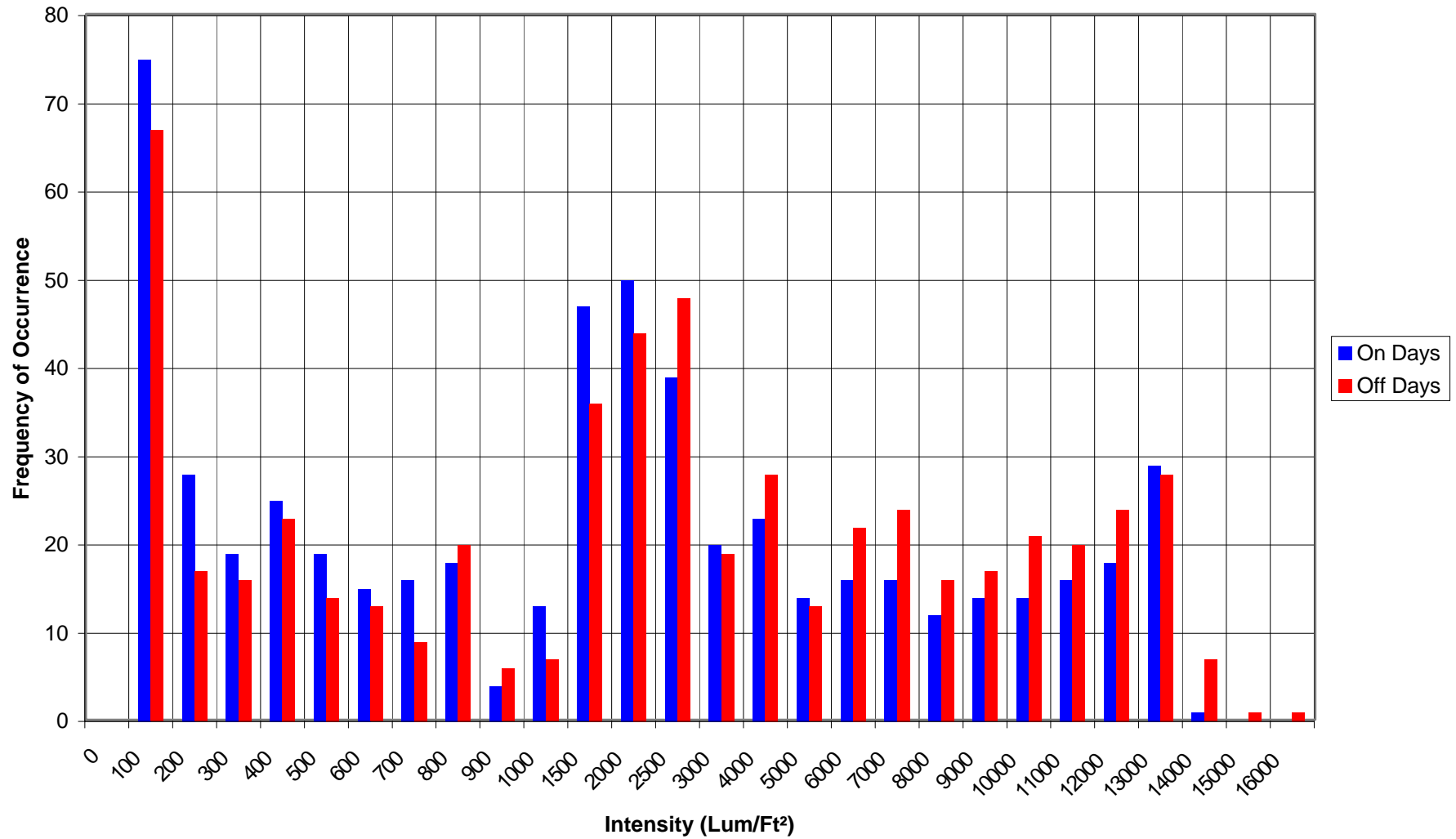
Civil Court
Outside Air Temp Histogram (12/14/05 --1/10/06)



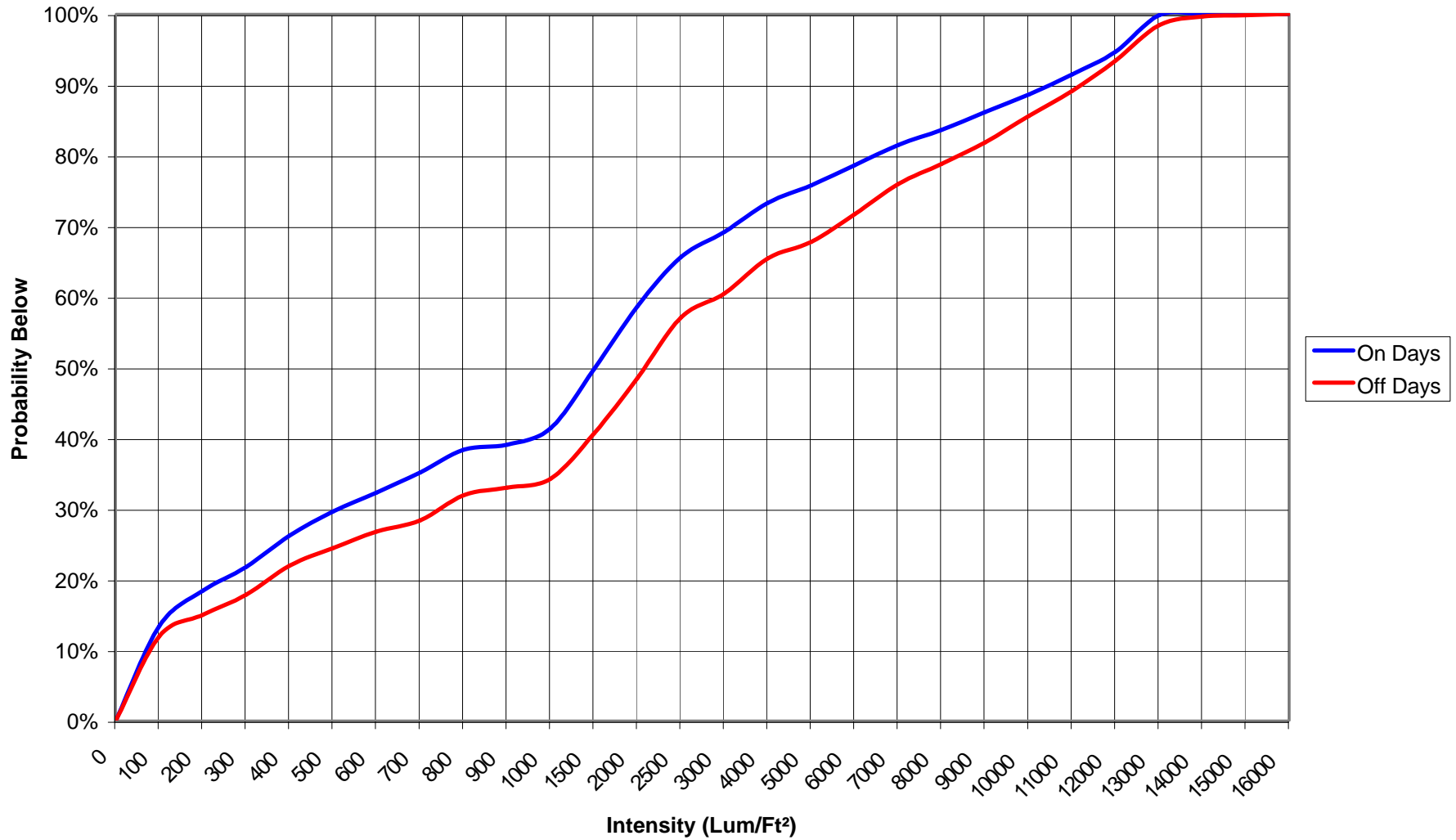
Civil Court
Outside Air Temperature Probabilities (12/14/05 --1/10/06)



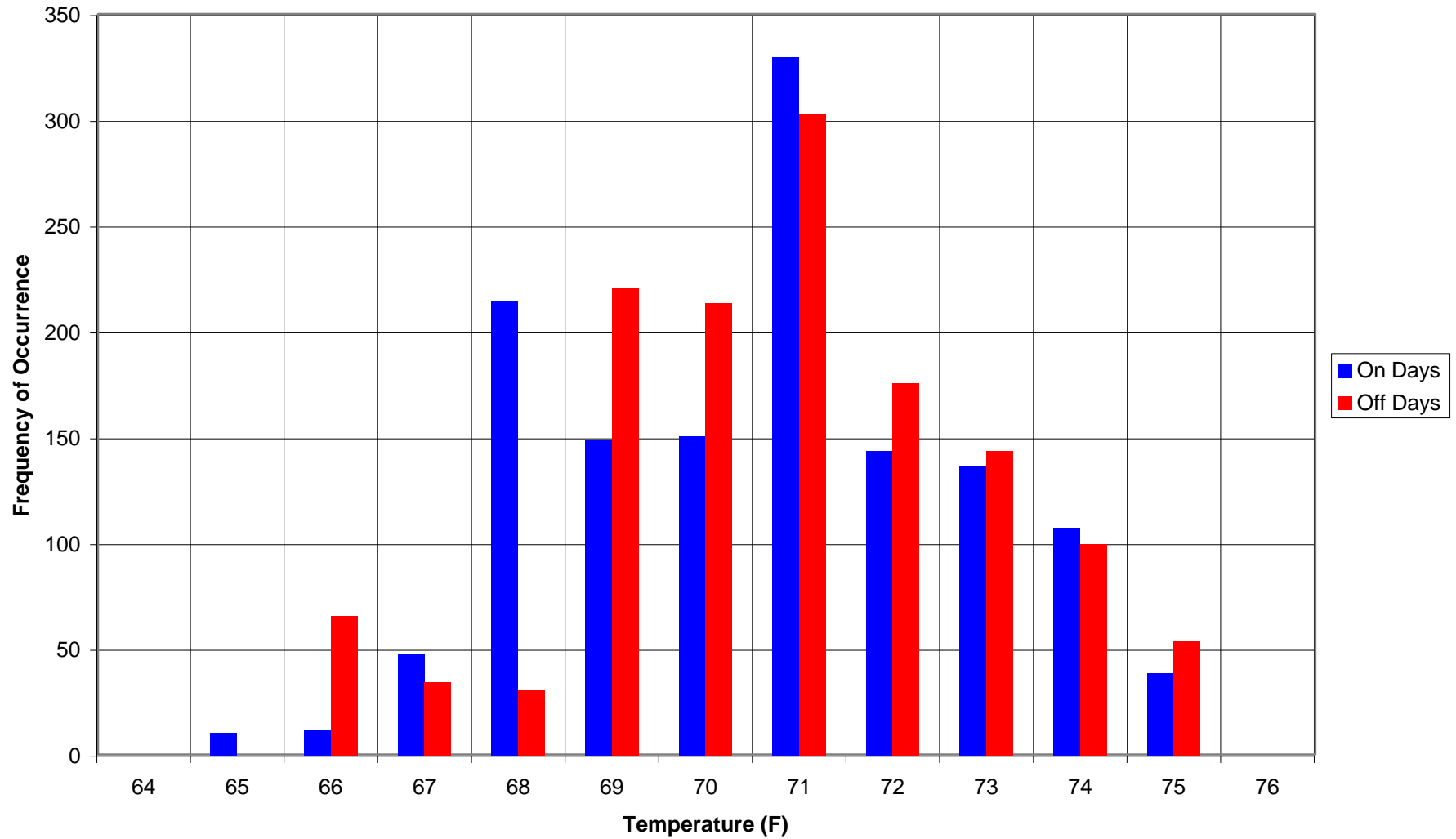
Civil Court
Solar Load Histogram (12/14/05 --1/10/06)



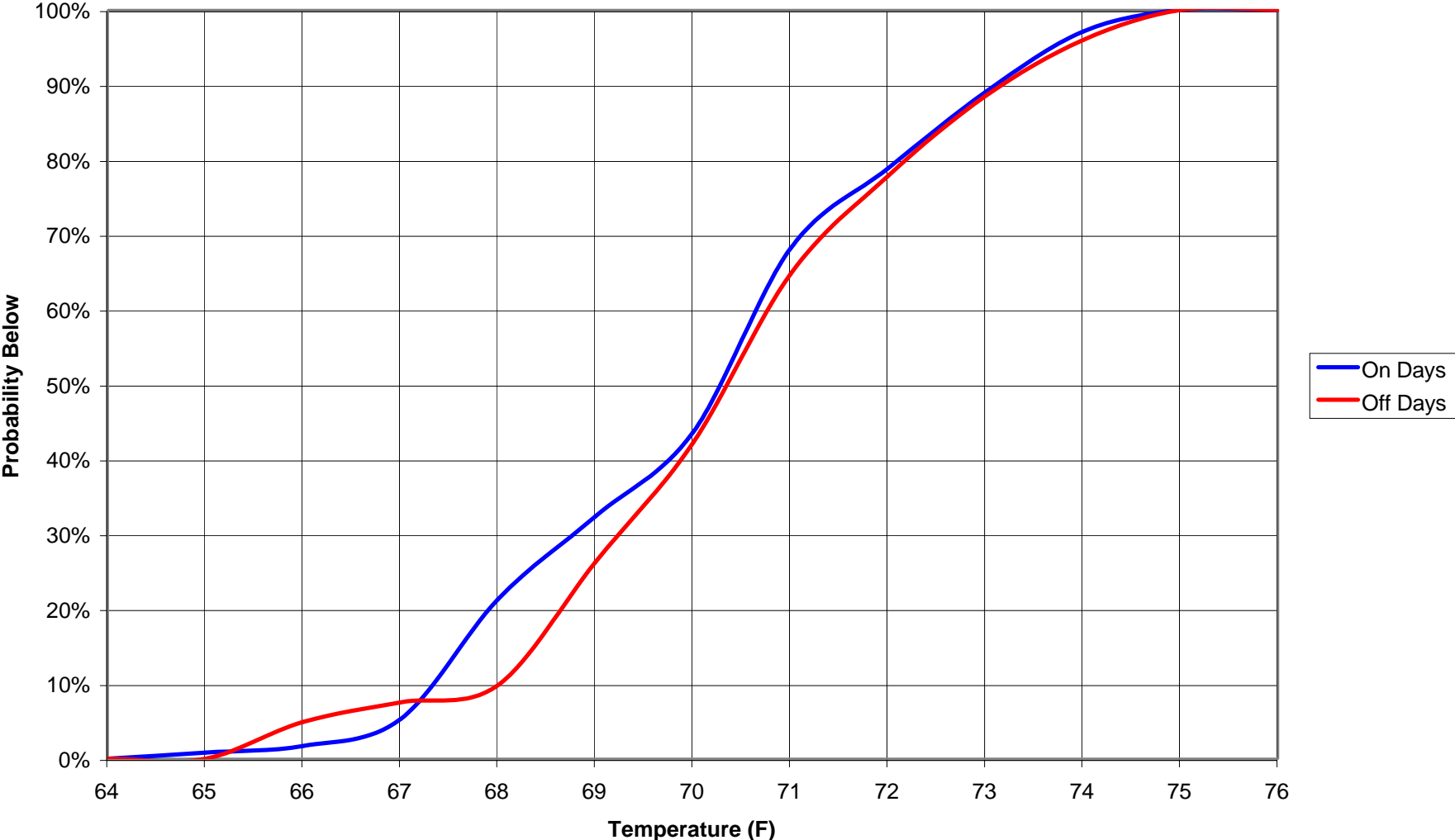
Civil Court
Solar Load Probabilities (12/14/05 --1/10/06)



Civil Court
Space Temp Histogram (12/14/05 --1/10/06)



**Civil Court
SpaceTemperature Probabilities (12/14/05 --1/10/06)**





90 Pratt Oval
 Glen Cove, NY 11542
 Phone: 516-676-0777
 Fax: 516-676-2640

Test Report

Report No. 12149-3

Date: 02/04/06

Customer:

NYCDCAS

Test Site Location:

Manhattan Co-Op High School
 321 East 96th Street, NY, NY
 Contact: Mike Reilly

Test Type: HEATING AIR CONDITIONING REFRIGERATION OTHER: _____
 Product Tested: HW LCH LCS CHW CHS AC CAC RU OTHER: _____

Type of Equipment:

Manufacturer: A.L. Eastmond (Steam Heat)
 Model: FST 250
 Capacity / SetPt: 250 HP / 10 PSI
 Fuel Type: Oil (75 GPH)
 Application: Heating
 Area Served:
 Misc. 150 Sec. Prepurge, 15 Sec. Postpurge

Test Start Date: 12/09/05
 Test End Date: 01/11/06
 No. of Days in Test: 34

BURNER RUN-TIME:

in HRS. in MIN.

IntelliCon ON-DAYS: 114:38:15

IntelliCon OFF-DAYS: 127:54:50

RUN-TIME was reduced by: 10.38%

BURNER USAGE FACTOR:

IntelliCon On-Days: 28%

IntelliCon Off-Days: 31%

HEATING DEGREE-DAYS (FOR TEST PERIOD)

IntelliCon ON-DAYS: 450

It was 7.3% Colder on the On-Days.

IntelliCon OFF-DAYS: 419

Total Degree-Days: 869

USAGE PER DEGREE-DAY

ON-DAYS: 0:15:18

OFF-DAYS: 0:18:19

SOLAR LOAD COMPENSATION: (Lumens/Sq. Ft.)

IntelliCon ON-DAYS: 3904

IntelliCon OFF-DAYS: 4025

It was 3.01% Sunnier on the OFF-Days.

Individual Runtimes

ON-Day Runtime Cycles	Boiler #1	Boiler #2
	39:55:36	74:42:39
	66	124

OFF-Day Runtime Cycles	Boiler #1	Boiler #2
	47:24:04	80:30:46
	162	202

BURNER CYCLING REDUCTION:

IntelliCon ON-DAYS: 228

IntelliCon OFF-DAYS: 326

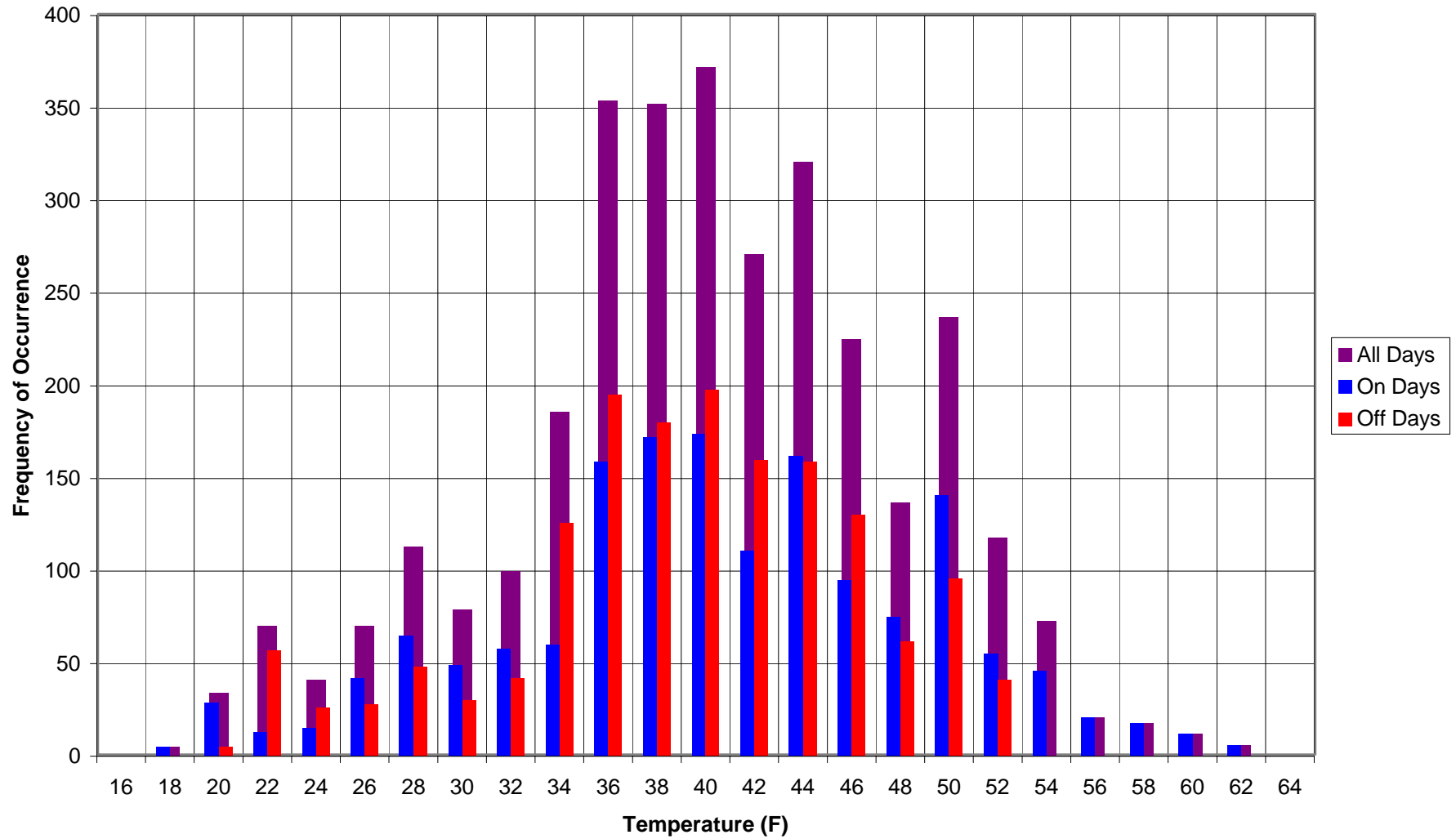
Cycling was reduced by: 30.1%

Adj. Savings = 16.51%

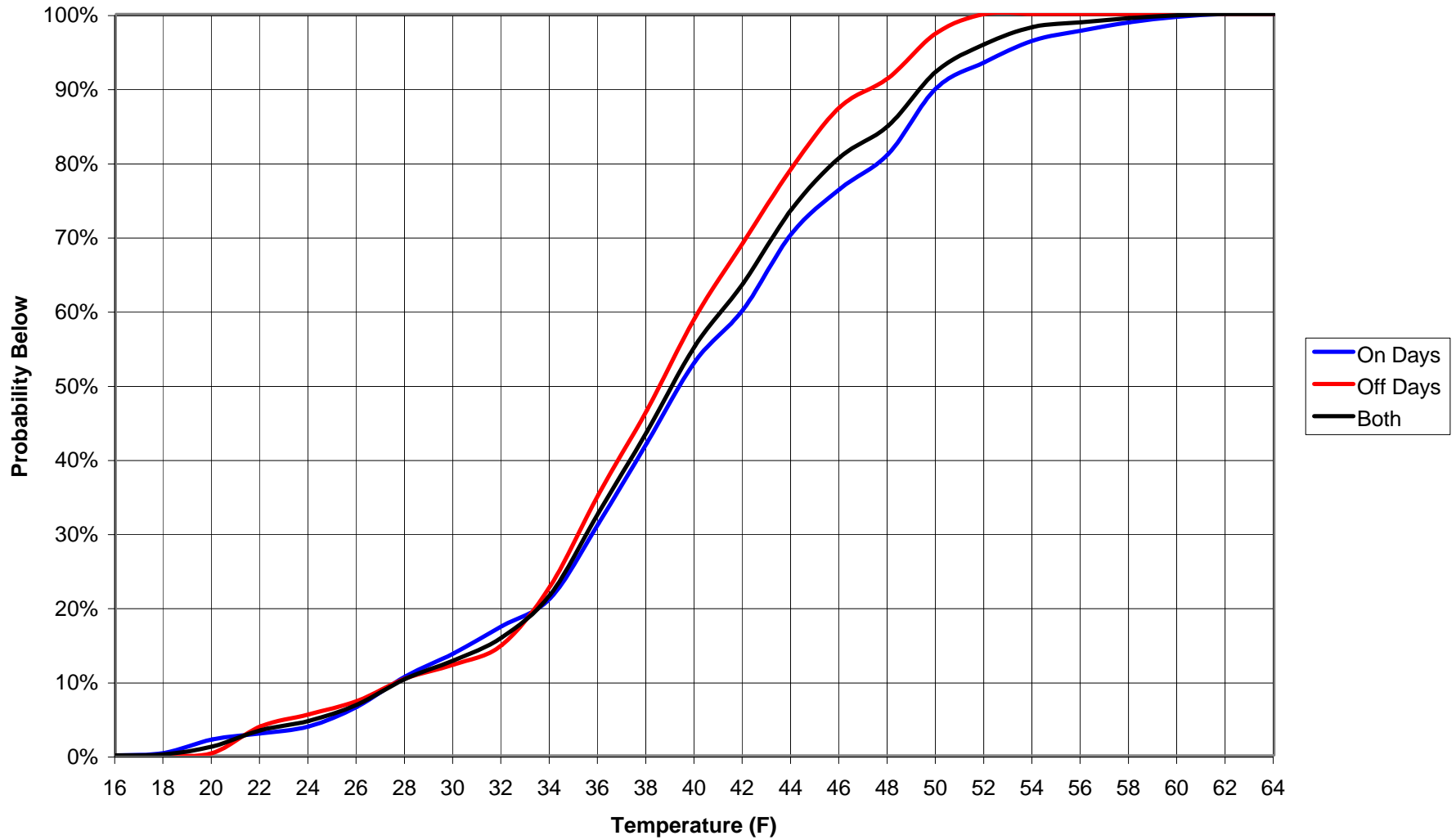
COMMENTS:

Note: Boiler Runtimes are an aggregate of Boilers #1 and #2. Runtimes have been reduced by 165 seconds (prepurge time + Postpurge time) times the number of cycles for each case. Equipment for Boilers #1 and #2 were the same.

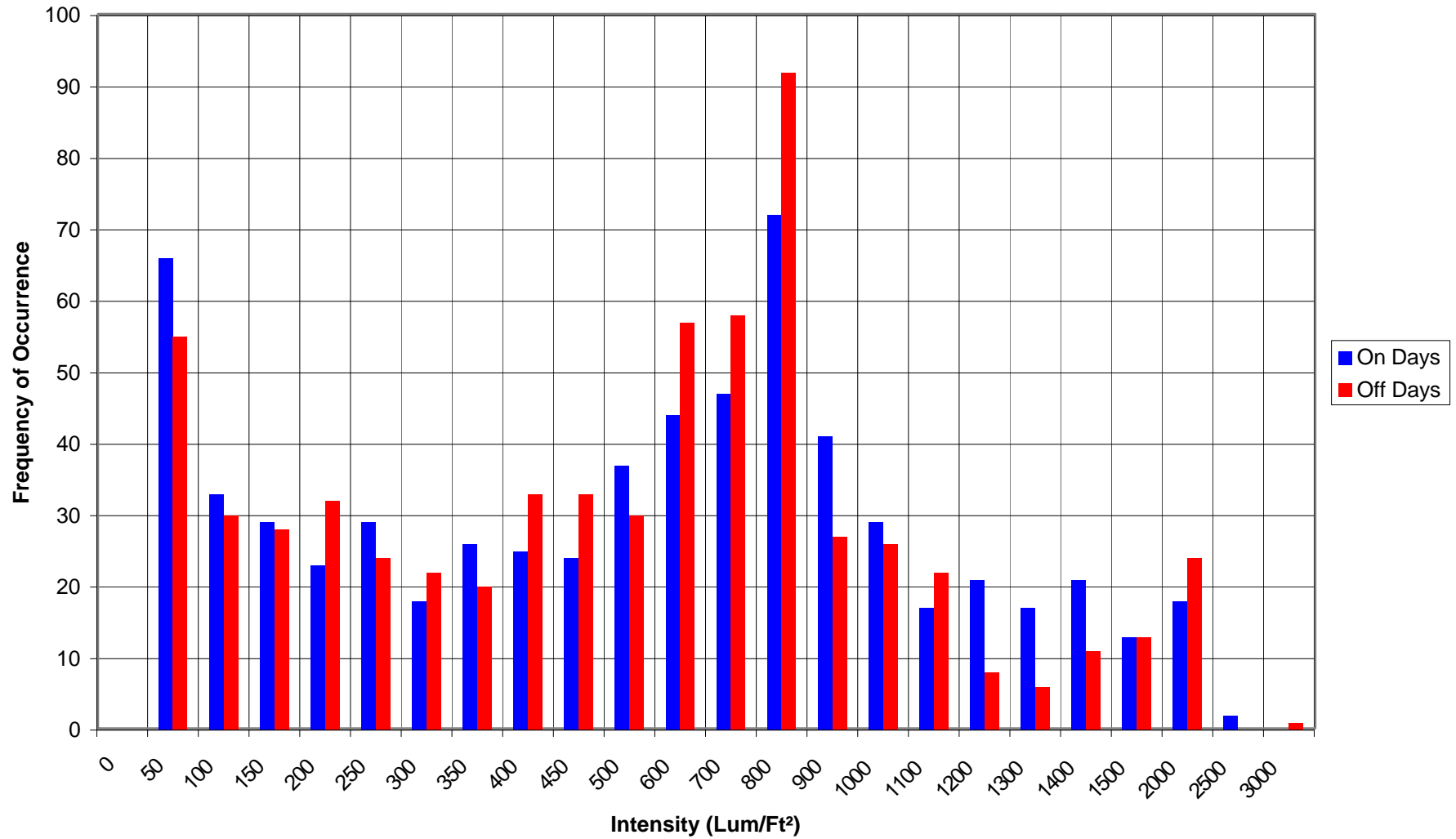
Manhattan Co-Op High School Outside Air Temp Histogram (12/09/05 --1/11/06)



**Manhattan Co-Op High School
Outside Air Temperature Probabilities (12/09/05 --1/11/06)**

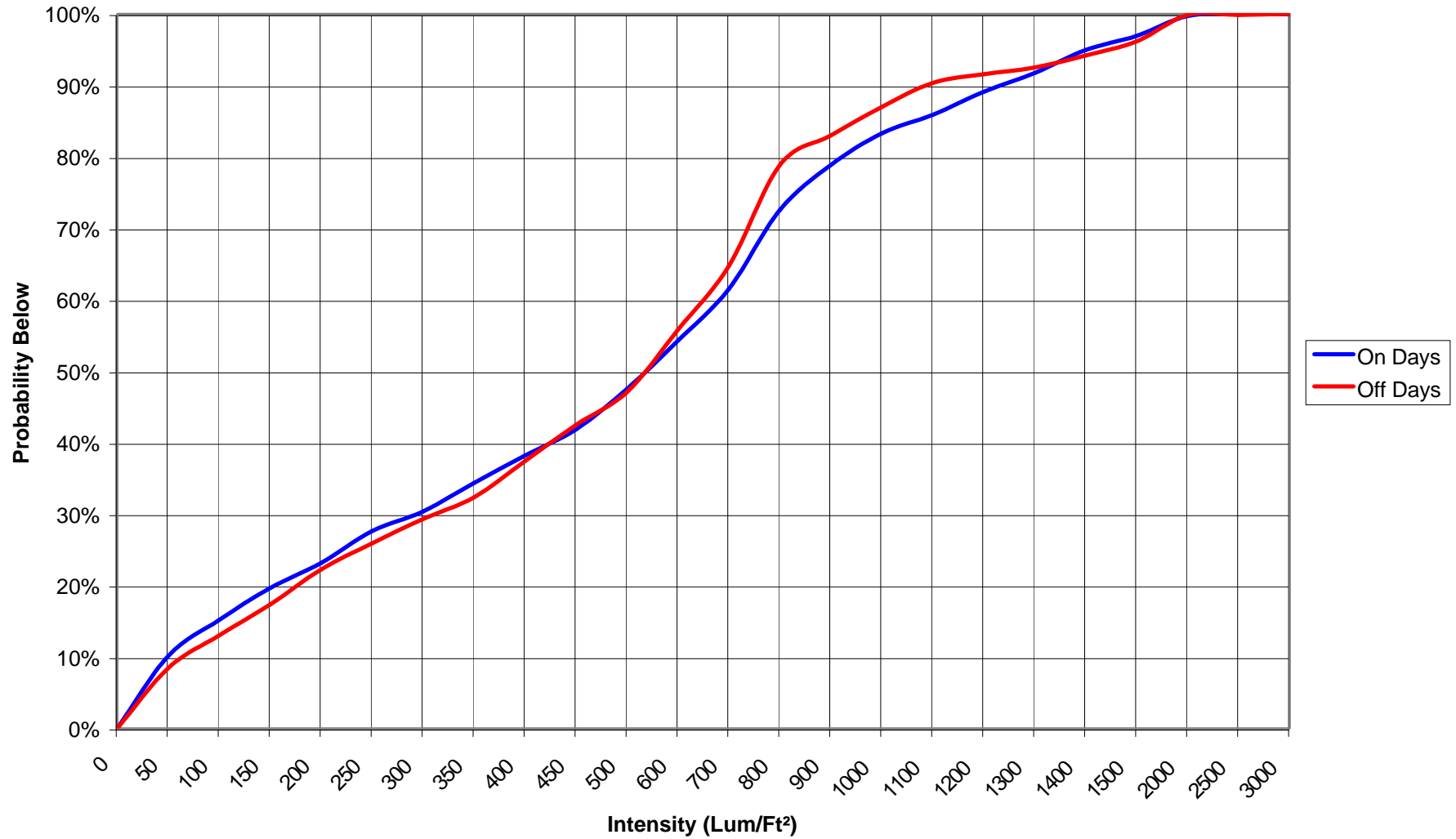


Manhattan Co-Op High School Solar Load Histogram (12/09/05 --1/11/06)

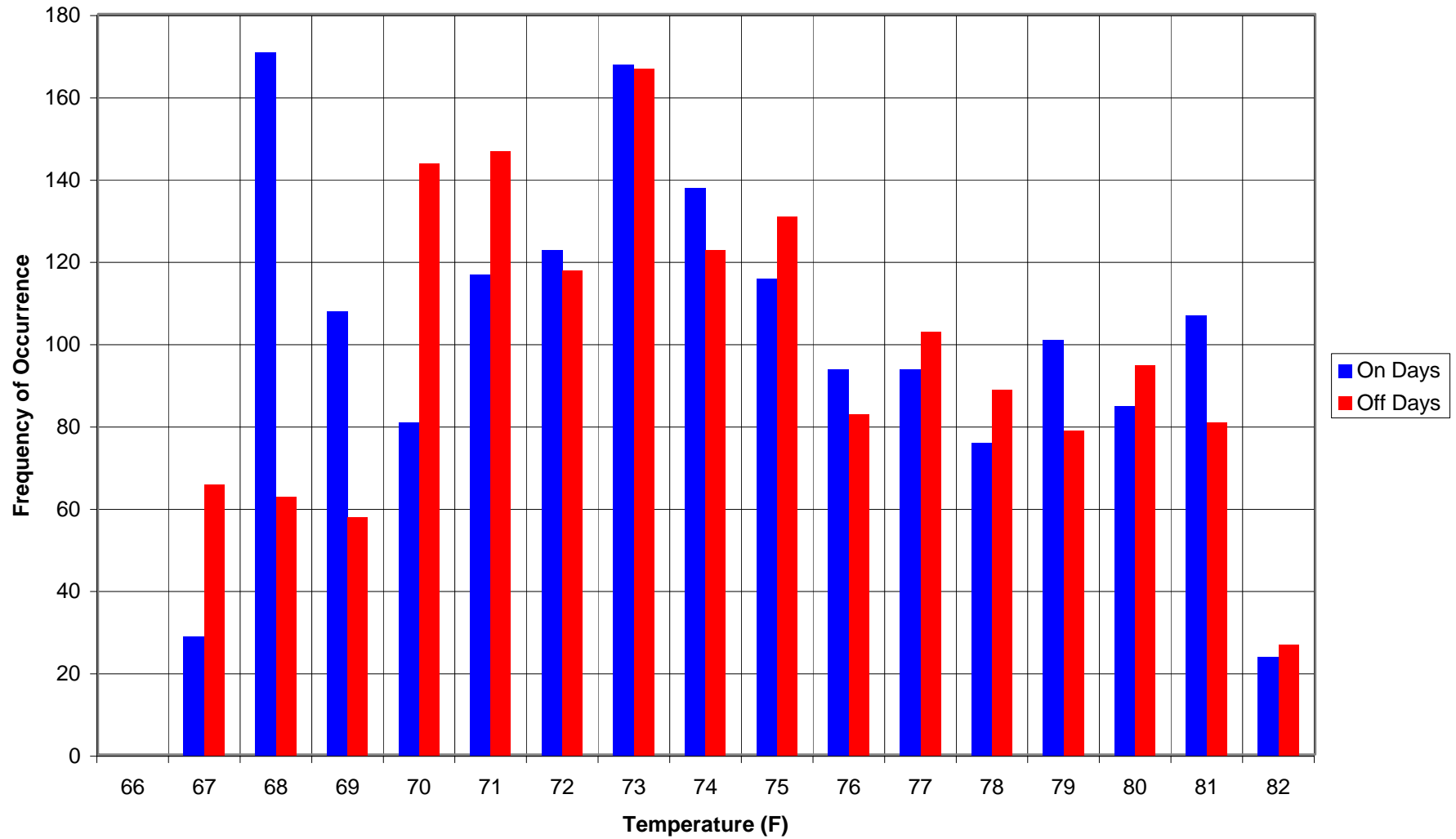


Intensity
(Lum/Ft²)

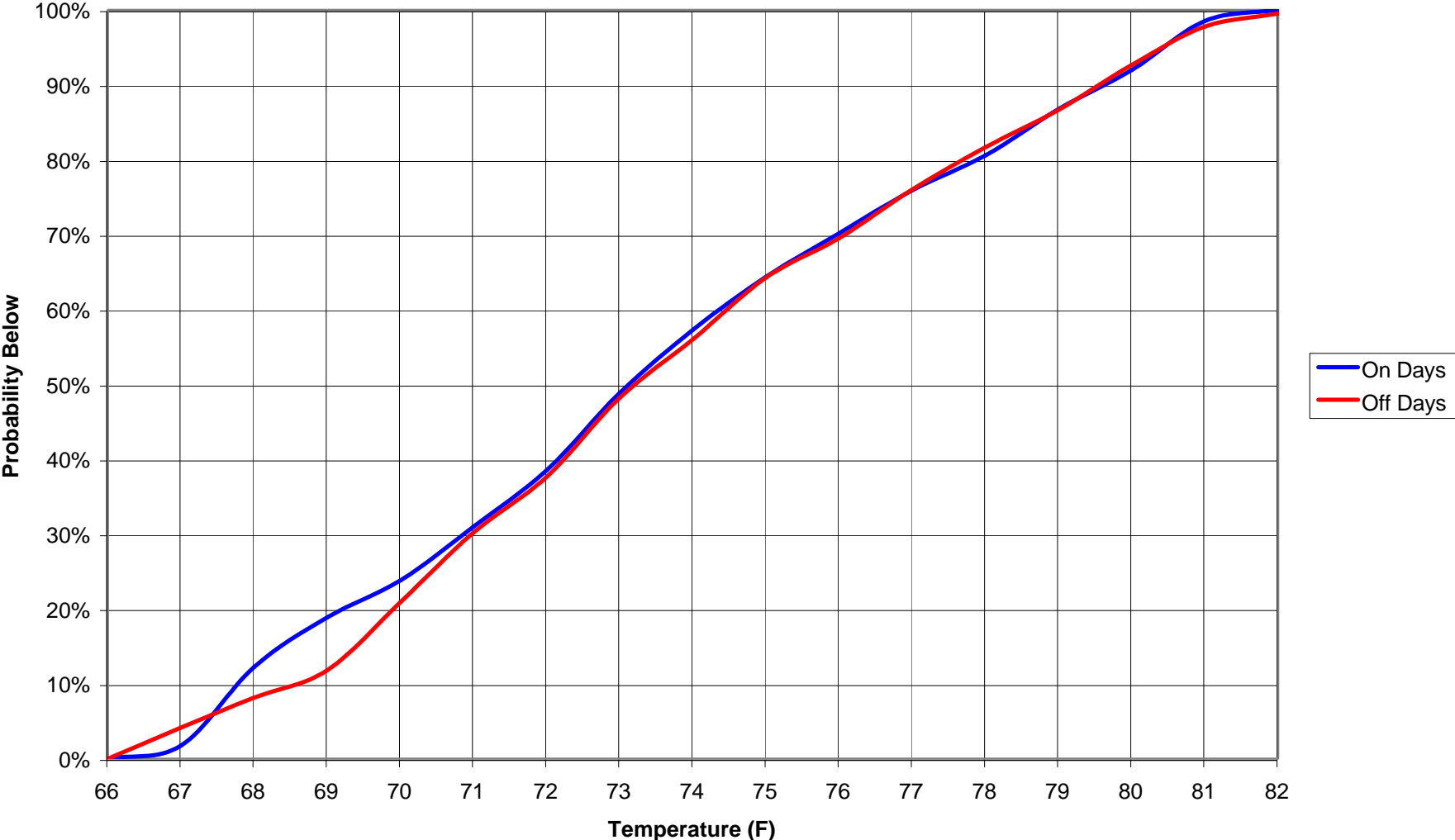
Manhattan Co-Op High School Solar Load Probabilities (12/09/05 --1/11/06)



**Manhattan Co-Op High School
Space Temp Histogram (12/09/05 --1/11/06)**



**Manhattan Co-Op High School
SpaceTemperature Probabilities (12/09/05 --1/11/06)**





90 Pratt Oval
 Glen Cove, NY 11542
 Phone: 516-676-0777
 Fax: 516-676-2640

Test Report

Report No. 12149-4

Date: 02/04/06

Customer:

NYCDCAS

Test Site Location:

Manhattan Co-Op High School
 321 East 96th Street, NY, NY

 Contact: Mike Reilly

Test Type: HEATING AIR CONDITIONING REFRIGERATION OTHER: _____
 Product Tested: HW LCH LCS CHW CHS AC CAC RU OTHER: _____

Type of Equipment:

Manufacturer: PVI Hot Water Heater
 Model: 1000N600A
 Capacity / SetPt: 800,000 BTU Input
 Fuel Type: Natural Gas
 Application: Domestic Hot Water
 Area Served:
 Misc. Pre-Purge: 60 Seconds, Post Purge: 15 Seconds

Test Start Date: 12/09/05
 Test End Date: 01/11/06
 No. of Days in Test: 34

BURNER RUN-TIME:

in HRS. in MIN.

IntelliCon ON-DAYS: 11:08:04

IntelliCon OFF-DAYS: 16:09:08

RUN-TIME was reduced by: 31.07%

BURNER USAGE FACTOR:

IntelliCon On-Days: 3%

IntelliCon Off-Days: 4%

BURNER CYCLING REDUCTION:

IntelliCon ON-DAYS: 113

IntelliCon OFF-DAYS: 167

Cycling was reduced by: 32.3%

Savings = 31.07%

COMMENTS: Runtimes have been reduced by 75 seconds (prepurge time + Postpurge time) times the number of cycles for each case.



90 Pratt Oval
Glen Cove, NY 11542
Phone: 516-676-0777
Fax: 516-676-2640

Testing Methodology

EQUIPMENT USED FOR TESTING PURPOSES

Specific timing and data logging devices are used to gather detailed information about the unit(s) being evaluated. Each device has been carefully selected for its reliability, capability and function. The individual devices INTELLIDYNE uses are explained below.

1. TIME CLOCK:

Manufacturer: Tork Model: 8007V-0

Is used to switch the IntelliCon® product in and out of the circuit. This is done on a 24 hour basis. The result is that the IntelliCon® product is in control ("in" the circuit) one day and not in control ("out" of circuit) the next day. A 14 day time clock was selected so that a complete alternation of days that IntelliCon® is in control would result.

2. CURRENT SWITCH:

Manufacturer: Veris Industries Model: Hawkeye 608/908

The current switch is used to monitor when current is being drawn by the cooling/refrigeration compressor or heating burner. When current is sensed it is "On" when no-current is sensed it is off "OFF". The current switch is used in conjunction with the "Change-of-State" data logger.

3. "CHANGE-OF-STATE" DATA LOGGER:

Manufacturer: Onset Computer Corp. Model: H06-001-02

This device monitors and logs the "change-of-states" (the on / off status) of the unit being tested. It is used in conjunction with the CURRENT SWITCH, above, and time and date-stamps (logs) each change of status. By processing the logged data, the durations for each cycle can be determined.

4. "LIGHT INTENSITY" DATA LOGGER

Manufacturer: Onset Computer Corp. Model: HLI

This data logger is used to monitor and log Light Intensity and is used to determine the solar-load influence on the facility.

5. "T/Rh" DATA LOGGER

Manufacturer: Onset Computer Corp. Model: H08-004-02

This data logger is used to monitor and log the temperature and relative humidity in the conditioned space.

6. "TEMPERATURE" DATA LOGGER

Manufacturer: Onset Computer Corp. Model: H08-001-02

This data logger is used to monitor and log the outdoor air temperature, and is used to determine the degree-day influence on the facility

WHAT DATA IS COLLECTED

Linking all of the above together with the IntelliCon® product being “in” and “out” of the circuit, on alternating days, yields the following data:

- ? How many on/off cycles per day (if applicable).
- ? Total “on time” per cycle, per day.
- ? Total “off time” per cycle, per day.
- ? What the solar load of the facility was during the test period (if applicable).
- ? What the relative humidity in the conditioned space was during the test period (if applicable).
- ? What the temperature of the conditioned space was during the test period (if applicable).
- ? What the outdoor air temperature was during the test period (if applicable).

How The Data Is Analyzed

Upon completion of the test, all the data is evaluated to calculate the reduction of consumption (savings).

Short-term testing analysis can only be performed properly by the elimination and reduction of as many variables as possible and through the analysis of the data on a statistical basis. The alternating “in” circuit / “out” of circuit testing has the advantage of minimizing the variations due to time-sensitivity, day-of-week sensitivity, degree-day effects, etc.

In order to properly evaluate the data, the following must be determined:

1. A baseline must be established. Baseline consumption data is the “use” or consumption information that is unaffected by the IntelliCon economizer (“out” of circuit). This may be derived during the test (which is what is done here) or from historical records. The advantage of deriving the base-line during the test is that site specific degree-day and solar data may be determined as opposed to weather-service data that may or may not be indicative of the test site.
2. It is necessary to determine what effects or influences are caused by solar- load and degree-day variations. This is done by performing a statistical analysis on the solar and degree-day data collected during the base-line phase.
3. In order to properly compare the two consumption cases (IntelliCon “in” and “out” of circuit), and determine the savings, it is necessary to adjust (or “normalize”) the data collected during the “in-circuit” phase. The consumption data collected when the IntelliCon economizer was “in-circuit”, is “normalized” by compensating for the effects of the solar and degree-day influences that occurred during the same phase of the test. This is accomplished by applying the statistical analysis results of the solar and degree-day influences (collected during the base-line phase) as a means to compensate for the solar and degree-day variations that occurred during the “in” circuit phase of the test.
4. The normalized consumption data acquired during the “in” circuit phase is compared to the base-line data and the savings determined.