# Brockton Power

## Public Health
## and
## Environmental Impacts

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# Presented by

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# Alternatives for Community & Environment


ACE builds the power of communities of color and lower income communities in New England to eradicate environmental racism and classism and achieve environmental justice. We believe that everyone has the right to a healthy environment and to be decision-makers in issues affecting our communities.

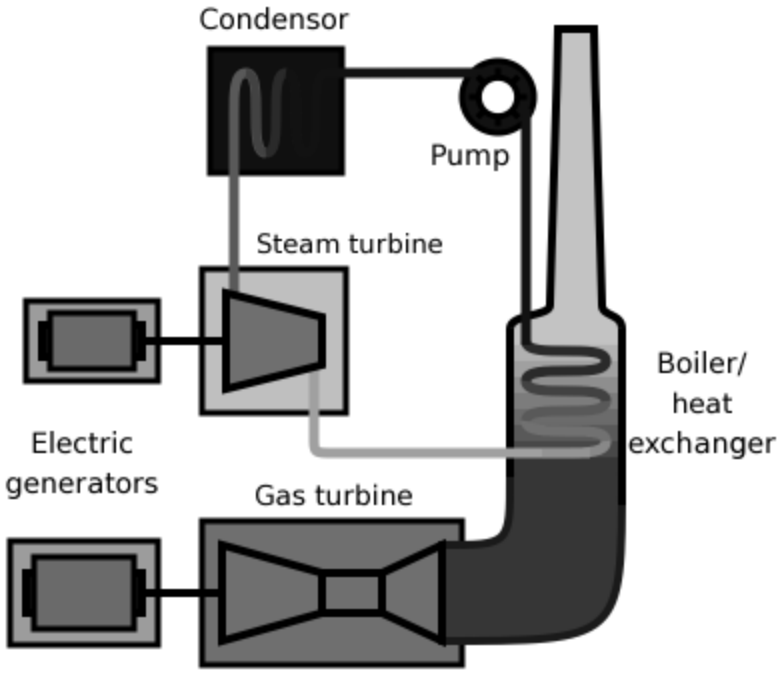
# Brockton Power:
## (3 km (1.86 miles) circumference)

# Brockton Power
## (scale model)

# Brockton Power:
# Plant Size and Type

- Combined cycle
- 350 megawatt
  - 300 megawatt turbine
  - 50 megawatt duct firing
- Dual fuel
  - Natural gas
  - Ultra Low Sulfur Diesel
- Wet mechanical draft cooling tower

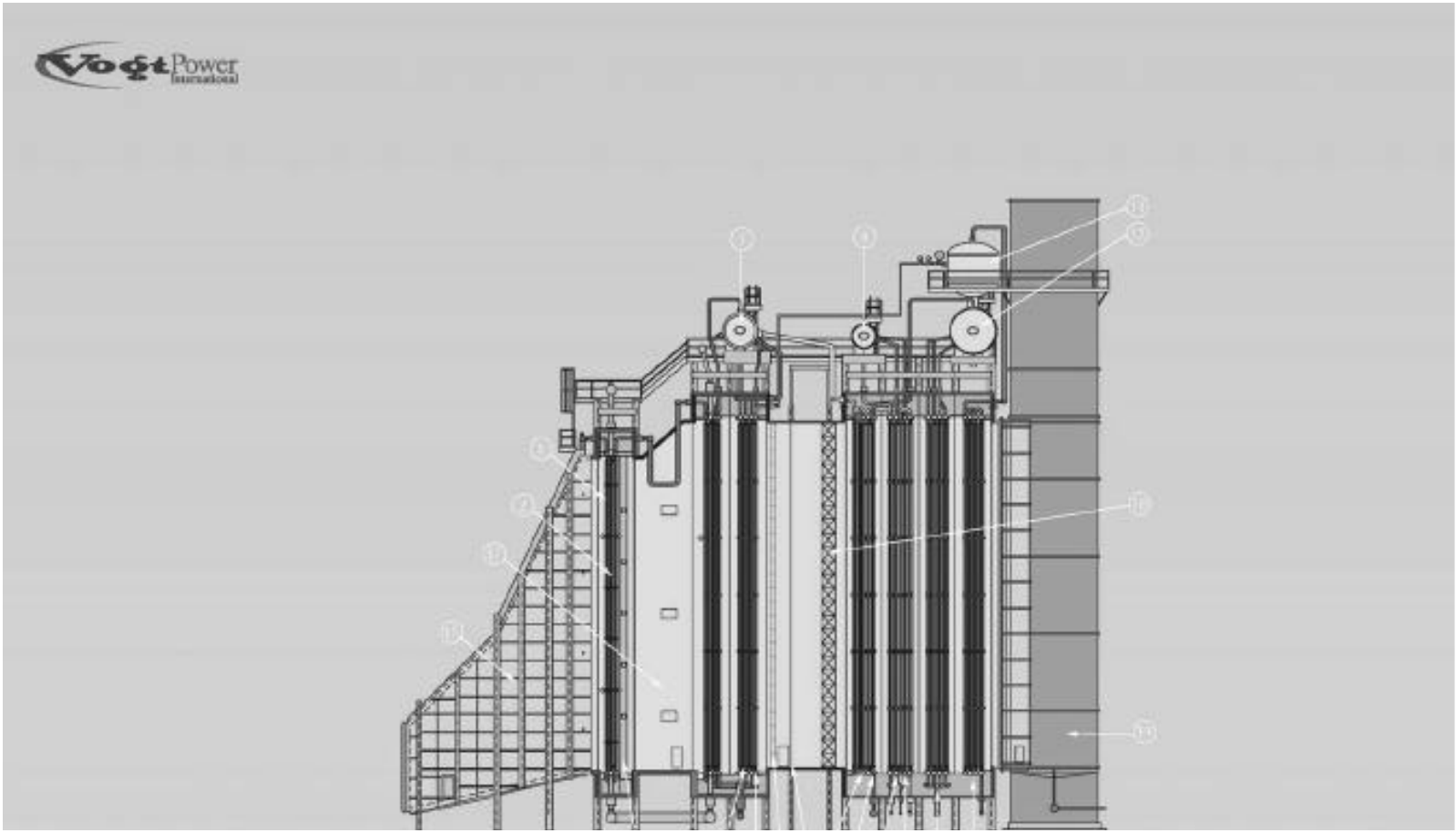
# Combined Cycle Power Plant



# Duct firing

- The heat recovery steam generator (HRSG) will be designed with supplementary firing of fuel after the gas turbine to increase the quantity or temperature of the steam generated. Without supplementary firing, the efficiency of the combined cycle power plant is higher, but supplementary firing lets the plant respond to fluctuations of electrical load. Supplementary burners are also called *duct burners*.
- More fuel is sometimes added to the turbine's exhaust. This is possible because the turbine exhaust gas (flue gas) still contains some oxygen. When so fired, Brockton Power will generate about 153 MW from the steam turbine.

# HRSG



# 350 MW Comparison to recent power plants in Massachusetts

| Facility | Size (MW) | On Line | Fuels |
|---|---|---|---|
| Dighton Power | 170 | 1999 | Nat gas |
| Millennium | 350 | 2000 | Nat gas/ oil |
| Berkshire Power | 270 | 2001 | Nat gas/ oil |
| ANP Blackstone | 580 | 2001 | Nat gas |
| ANP Bellingham | 580 | 2002 | Nat gas |
| Mystic | 1,500 | 2003 | Nat gas |
| Fore River | 750 | 2003 | Nat gas/ oil |
| Mirant Kendall | 280 | 2003 | Nat gas/ oil |

- 1 megawatt = 1,000 kilowatts
- Typical home uses about 800 kilowatt hours per month average; in New England about 650 kilowatt hours per month.
- BP could supply 140,000-316,000 homes if operating at 350 MW continuously (unlikely).

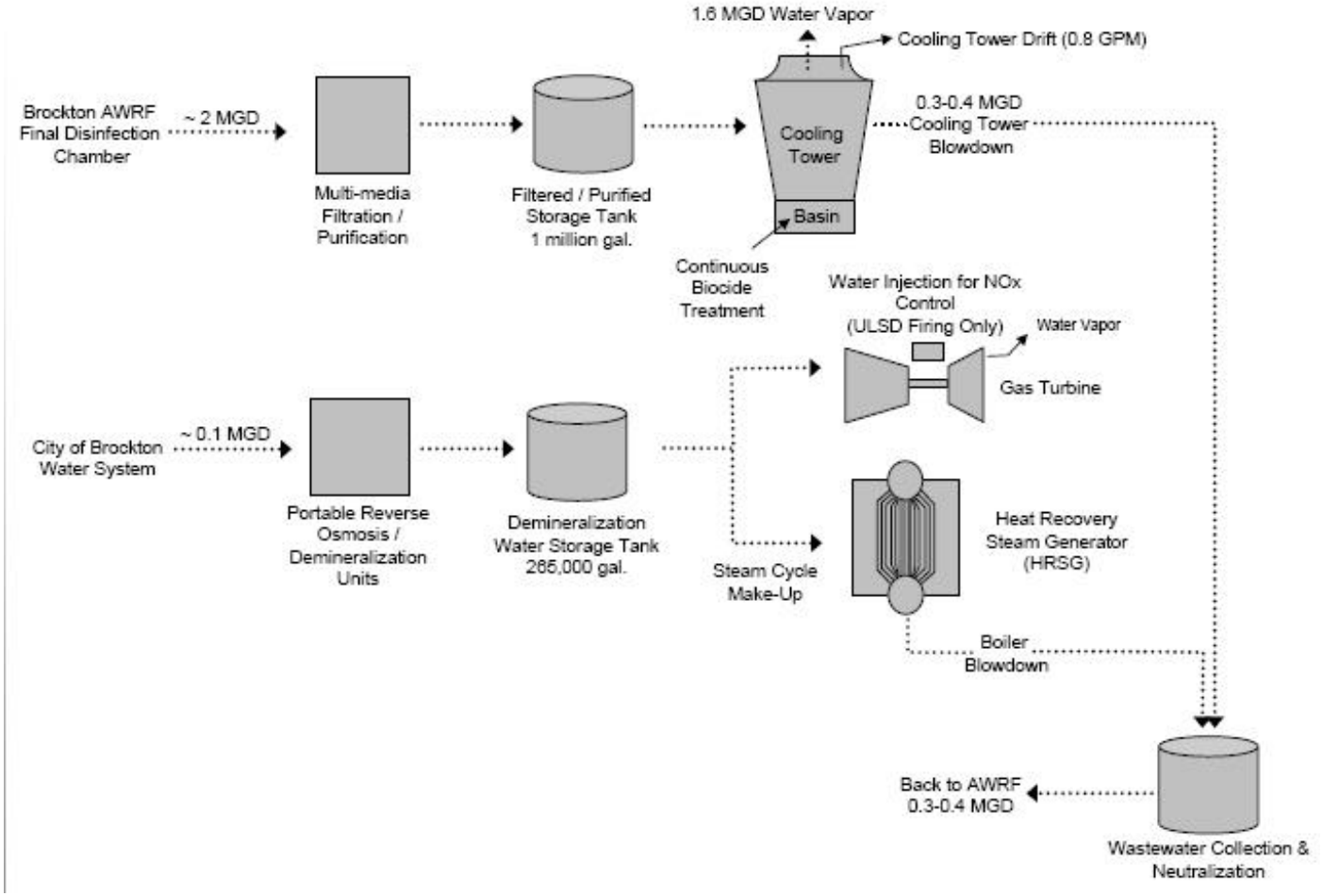
# Dual Fuel

- Natural gas
  - To be supplied by a high pressure gas line that Brockton Power will construct on site to connect to a gas transmission pipeline off site.
  - Least polluting fossil fuel in use for a power plant.
- Ultra Low Sulfur Diesel (ULSD)
  - Supplied by tanker trucks.
  - Stored in a 750,000 gallon above ground tank - enough for 2 days of operation at full power.
  - Wants permit to use for 60 days per year.
  - Much more polluting.

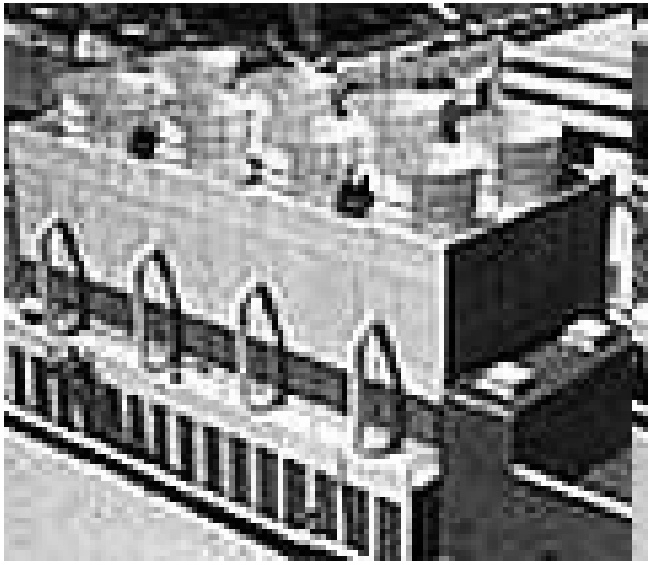
# Dual Fuel

- The power plant would spew much more particulate matter into the air when operating on ULSD as compared to natural gas:
  - 52 tons of PM pollution per year when no ULSD burning
  - 70 tons of PM pollution per year when 30 days of ULSD burning
  - 85 tons of PM pollution per year when 60 days of ULSD burning

# Wet Cooling: Follow the Water



# Wet Mechanical Draft Cooling Tower



- Seven cell cooling tower
- On the southern portion of the site
- Deck height 40 feet
- Top of stacks 50 feet high (above the fans)
- About 1.6 MGD of water emitted as hot steam

# Need for Brockton Power

Is Brockton Power needed?

- Now?
- In the next 6 years?
- In the next 10 years?

# Current ISO-NE Capacity November 2007

**Table 7: Summer & Winter Capability by Generator Category (MW)**

| Generator Category | Summer | Winter |
|---|---|---|
| Combined Cycle | 11,044 | 12,722 |
| Fossil | 9,777 | 10,048 |
| Nuclear | 4,548 | 4,588 |
| Hydro (Includes Pumped Storage) | 3,368 | 3,483 |
| Combustion Turbine | 1,951 | 2,487 |
| Diesel | 212 | 219 |
| Miscellaneous | 65 | 65 |
| **Total System** | **30,965** | **33,612** |

# Capacity Additions 2007-2008

**Table 10: Capacity Additions**

| Project Name | Summer MW | Unit Type | Fuel Type | State | SIS Queue Projected Commercial Operation Date |
|---|---|---|---|---|---|
| GMP Essex Diesel | 8 | IC | Oil | VT | 10/31/2007 |
| Covanta Haverhill | 1.6 | IC | Landfill Gas | MA | 11/1/2007 |
| Indeck Alexandria | 16.6 | ST | Biomass/Wood waste | MA | 2/1/2008 |
| Cos Cob Redevelopment | 36 | GT | Oil | CT | 2/1/2008 |
| L'Energia | 74 | CC | Natural Gas/Oil | MA | 6/15/2008 |
| Total | 136.2 | | | | |

# Brockton Power: Not Needed Now

**Table 17: Monthly Peak Load Forecast and IC Requirements (MW) for the 2008-2009 Capability Year**

| Month | Monthly Peak Load | IC Requirements |
|---|---|---|
| Jun-08 | 24,700 | 32,175 |
| Jul-08 | 27,970 | 32,158 |
| Aug-08 | 27,970 | 32,160 |
| Sep-08 | 22,060 | 32,147 |
| Oct-08 | 19,050 | 35,735 |
| Nov-08 | 20,450 | 35,739 |
| Dec-08 | 22,770 | 34,536 |
| Jan-09 | 22,370 | 34,527 |
| Feb-09 | 21,530 | 34,514 |
| Mar-09 | 20,560 | 35,691 |
| Apr-09 | 17,980 | 35,646 |
| May-09 | 20,250 | 35,679 |
| Annual Resulting Reserves | With HQICCs 15.0% | |
| | Without HQICCs 10.7% | |

# Brockton Power: Not Needed Through 2014

ISO-New England wrote in October 2008:

- "ISO New England's 181-page *2008 Regional System Plan* forecasts that the region will have sufficient capacity to meet electricity demand through 2014…."
- That forecast is based on the February 2008 forward capacity market auction. Those auctions are designed to ensure sufficient capacity for the next three years.

# Brockton Power:
# Not Needed for the Next Ten Years

**1.1 Summer Peak Capabilities and Load Forecast (MW)**

| NEW ENGLAND (1) | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TOTAL LOAD | 27577 | 28088 | 28598 | 29074 | 29524 | 29940 | 30311 | 30631 | 30912 | 31157 | 31373 |
| TOTAL CAPACITY | 33127 | 31291 | 31660 | 31883 | 31883 | 31883 | 31883 | 31883 | 31883 | 31883 | 31883 |

# Brockton Power: Air Pollution

| Fuel | | Duct | Natural Gas | | ULSD | | | |
|---|---|---|---|---|---|---|---|---|
| Pollutant | Load | Firing | ppm[10] | lb/MMBtu | ppm | lb/MMBtu | tpy | Method |
| $NO_x$ | 60-100% | No | 2.0 | 0.0074 | 6.0 | 0.0233 | 107 | SCR and Water injection (during ULSD firing) |
| | 100% | Yes | 2.0 | 0.0074 | 6.0 | 0.0233 | | |
| CO | 100% | All | 2.0 | 0.0045 | 4.0 | 0.0095 | 109 | Combustion Controls and Oxidation Catalyst |
| | 75% | No | 2.0 | 0.0045 | 5.0 | 0.012 | | |
| | 60% | No | 3.0 | 0.0067 | 20.0 | 0.047 | | |
| VOC | 75-100% | No | 1.0 | 0.0013 | 6.0 | 0.0081 | 31 | Combustion Controls and Oxidation Catalyst |
| | 100% | Yes | 2.5 | 0.0032 | 6.0 | 0.0081 | | |
| | 60% | No | 1.0 | 0.0013 | 9.0 | 0.012 | | |
| $PM_{10}/PM_{2.5}$ | 100% | Yes | NA | 0.007 | NA | 0.023 | 85 | Use of natural gas and ULSD |
| | 100% | No | NA | 0.005 | NA | 0.026 | | |
| | 75% | No | NA | 0.006 | NA | 0.035 | | |
| | 60% | No | NA | 0.007 | NA | 0.050 | | |
| $SO_2$ | All | All | NA | 0.0006[11] | NA | 0.0015[12] | 7 | Use of natural gas and ULSD |
| $NH_3$ | 60-100% | All | 2.0 | 0.0027 | 2.0 | 0.0029 | 26 | |

# Brockton Power:
# Air Pollution

- 109 tons per year of Carbon Monoxide
- 107 tons per year of Nitrous Oxide
- 85 tons per year of particulate matter (PM10/PM2.5)
- 31 tons per year of volatile organic compounds
- 26 tons per year of ammonia
- 7 tons per year of sulfuric acid
- Less than 25 tons per year of total Hazardous Air Pollutants (HAPs) and less than 10 tons per year of each individual HAP

# Brockton Power:
# Air Pollution

- The potential emissions are calculated based on the equivalent of 8,760 hours per year of full load operation, (the equivalent of 2,000 hours at full load on natural gas while duct firing,5,320 hours on natural gas at full load without duct firing, and 1,440 hours on ULSD,720 hours with duct firing and 720 hours without duct firing).

# Brockton Power:
# Air Pollution

- BP must purchase NOx offsets because Massachusetts is in non-attainment for ozone, and BP will emit more than 50 TPY of NOx, an ozone precursor.
- Buying the offsets (from other emitters that stopped emitting NOx or emit less NOx than their limit) does not actually decrease NOx emissions because those offsets already exist.
- The offsets are not required to be from MA.

# Brockton Power: Air Pollution

- Brockton Power's estimate of its particulate matter emissions includes particulate matter as it leaves the plant's smokestack (known as primary PM) but does not include particulate matter that forms from the exhaust gases after they have left the stack (known as secondary PM).
- PM10 is generally derived from primary PM, but PM2.5 is derived from both primary PM and the secondary PM that forms from the stack emissions.

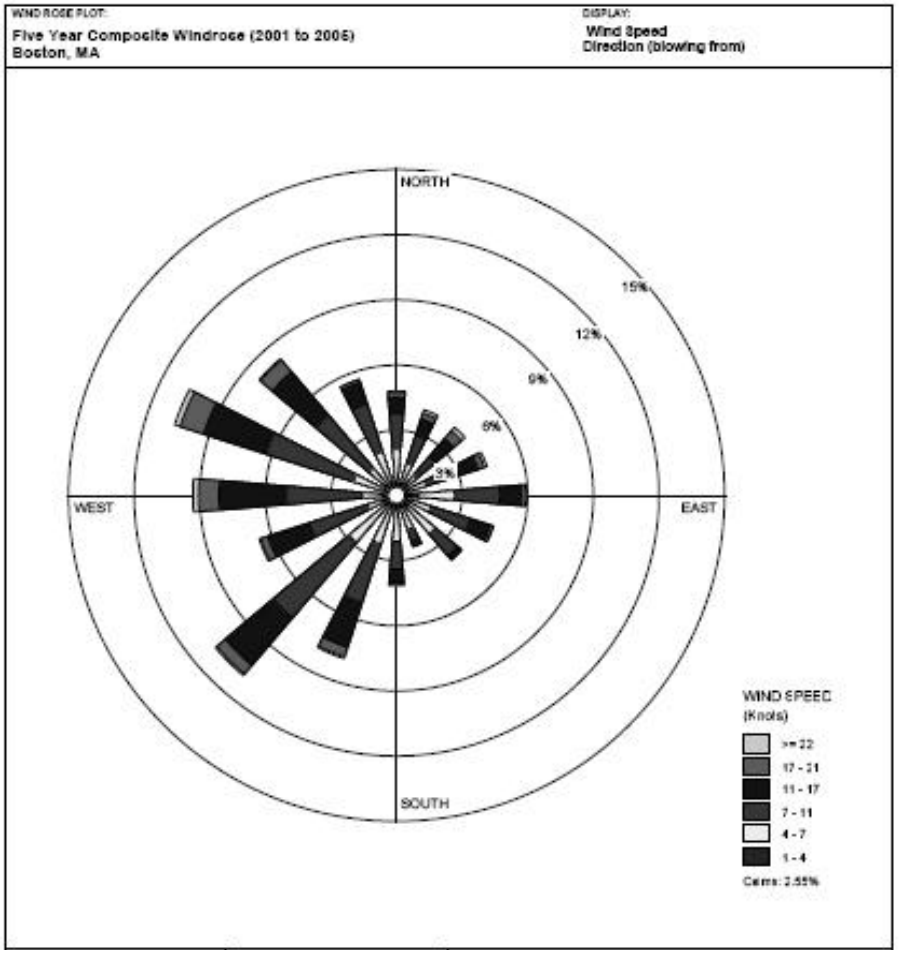
# Brockton Power:
# Air Pollution

- No SIL set for PM 2.5 yet
- No PSD set for PM 2.5 yet
- If NESCAUM's recommendations for PM 2.5 are adopted, Brockton Power would violate the SIL for PM 2.5.

# Brockton Power: Air Pollution

- Air Quality Modeling
  - Screen 3
  - Aermod Prime
  - Estimated emissions, meteorological data, terrain, smokestack height, etc. = dispersion
  - Local pollution from the power plant = local air quality impact.
  - Add background air quality data.

# Brockton Power: Air Pollution



# Brockton Power: Air Pollution

Table 6.4-1 Comparison of Maximum Predicted AERMOD PRIME Modeling Results with Significant Impact Levels

| Pollutant | Averaging Period | AERMOD PRIME Maximum Concentration ($\mu g/m^3$) | Significant Impact Level ($\mu g/m^3$) | % of SIL | Delta (X) meters | Delta (Y) meters | Meteorological Year |
|---|---|---|---|---|---|---|---|
| $NO_2$ | Annual | 0.0325 | 1 | 3.3% | 332937 | 4657482 | 2005 |
| $SO_2$ | 3-Hour | 0.229 | 25 | 0.9% | 334537 | 4657782 | 2005 |
| | 24-Hour | 0.137 | 5 | 2.7% | 333237 | 4656182 | 2005 |
| | Annual | 0.00225 | 1 | 0.2% | 332837 | 4657482 | 2005 |
| $PM_{10}$ | 24-Hour | 3.43 | 5 | 68.6% | 333337 | 4656382 | 2005 |
| | Annual | 0.25 | 1 | 25.0% | 333972 | 4657036 | 2002 |
| CO | 1-Hour | 7.78 | 2,000 | 0.4% | 338837 | 4657582 | 2003 |
| | 8-Hour | 4.43 | 500 | 0.9% | 333237 | 4656282 | 2005 |

Notes: Annual concentrations based on 7,320 hours firing natural gas and 1,440 hours firing ULSD.

# Brockton Power: Air Pollution

Table 6.4-2 Predicted Impact Concentrations with National Ambient Air Quality Standards

| Pollutant | Averaging Period | Total Modeled Concentration ($\mu g/m^3$) | Monitored Background ($\mu g/m^3$) | Cumulative Impact ($\mu g/m^3$) | NAAQS ($\mu g/m^3$) | % of NAAQS | Delta (X) meters | Delta (Y) meters | Meteorological Year |
|---|---|---|---|---|---|---|---|---|---|
| $NO_2$ | Annual | 0.0325 | 9.4 | 9.4 | 100 | 9.4% | 338837 | 4657582 | 2005 |
| $SO_2$ | 3-Hour | 0.21 | 84 | 84.2 | 1300 | 6.5% | 333537 | 4656182 | 2005 |
| | 24-Hour | 0.06 | 50 | 50 | 365 | 13.7% | 333237 | 4656182 | 2005 |
| | Annual | 0.00225 | 8 | 8 | 80 | 10.0% | 332837 | 4657482 | 2005 |
| $PM_{10}$ | 24-Hour | 1.67 | 39 | 40.7 | 150 | 27.1% | 334137 | 4657982 | 2003 |
| | Annual | 0.25 | 20.1 | 20.4 | 50 | 41.0% | 333972 | 4657036 | 2002 |
| $PM_{2.5}$ | 24-Hour | 1.15 | 30.7 | 31.85[2] | 35 | 91.0% | 334008 | 4657101 | 2001 |
| | Annual | 0.25 | 9.9 | 10.15[2] | 15 | 67.7% | 333972 | 4657036 | 2002 |
| CO | 1-Hour | 6.12 | 4,176 | 4,182 | 40,000 | 10.5% | 333937 | 4657982 | 2005 |
| | 8-Hour | 3.65 | 2,668 | 2,672 | 10,000 | 26.7% | 333237 | 4656182 | 2005 |

# Brockton Power: Air Pollution

- Brockton Power has requested a permit that requires it to monitor its smokestack emissions only for:
  - a) Oxygen (O2)
  - b) Oxides of Nitrogen (NOx)
  - c) Carbon Monoxide (CO)
  - d) Ammonia (NH3)
  - e) Opacity
- Note: no monitoring for PM or SO

# Brockton Power:
# Air Pollution

NAAQS

Or

Health Impact?

# Brockton Power: Air Pollution and Public Health

- EPA has reported that:
  - "The health effects associated with PM2.5 are significant."
  - "[even] relatively small reductions in PM2.5 levels are estimated to result in worthwhile public health benefits." (The reverse must also be true: relatively small increases in PM2.5 levels result in significant public health effects.)
  - Important progress in advancing our understanding of the potential mechanisms by which ambient PM2.5, alone and in combination with other pollutants, is causally linked to a number of key health effects. . . . . involving premature mortality and indices of morbidity, including respiratory hospital admissions and emergency-room visits, school absences, work-lost days, restricted-activity days, effects on lung function and symptoms, morphological changes, and altered host-defense mechanisms associated with both long- and short-term exposure to PM2.5.

# Brockton Power: Air Pollution and Public Health

- Studies have confirmed that:
- A health effects threshold for PM2.5 has not been determined.
  - "The apparent absence of a threshold has important implications. Air pollution standards that focus solely on reducing particle concentrations to an arbitrary standard will expose large populations to unnecessary risks in cities that meet the standard, but could reduce exposure further."

# Brockton Power:
# Air Pollution and Public Health

- **May 22, 2008**
- **SACRAMENTO -** The California Air Resources Board was presented with research today showing long-term exposures to fine particle pollution pose a greater health threat than previously estimated.

  Annually, 14,000 to 24,000 premature deaths [in California] are estimated to be associated with exposures to PM2.5, a mix of microscopic particles less than 2.5 microns in size.

  "Particle pollution is a silent killer," said ARB Chairman Mary D. Nichols. "We must work even harder to cut these life-shortening emissions by further addressing pollution sources head-on."

# Brockton Power:
# Air Pollution and Public Health

(Continued from previous slide)

- Hospitalizations, emergency room visits and doctor visits for respiratory illnesses or heart disease have been associated with PM2.5 exposure. Other studies suggest that PM2.5 exposure may influence asthma symptoms and acute and chronic bronchitis. Children, the elderly and people with pre-existing chronic disease are most at risk of experiencing adverse health effects from PM2.5 exposure. Even small increases in PM2.5 exposures may increase health risks.

  Major contributors to PM2.5 include trucks, passenger cars, off-road equipment, electric power generation and industrial processes, residential wood burning, and forest and agricultural burning. All combustion processes generally produce PM2.5.

# Brockton Power: Air Pollution and Public Health

- Dr. Jonathan Levy (Associate Professor of Environmental Health and Risk Assessment, Harvard School of Public Health, Departments of Environmental Health and Health Policy and Management) writes:
  - The current regulatory limits for PM2.5 and some other pollutants are not intended to result in zero risk to public health. There are health effects at levels below the limits.
  - Minimizing public health risks for proposed facilities should be based on the estimated health impacts for a given tonnage of emissions, which could in theory involve formal risk modeling but more practically includes reviewing factors such as downwind population density and population vulnerability near a proposed power plant site in determining where to site a power plant. Without such review one cannot determine whether a power plant would have a minimum impact on the public health relative to other alternative options.

# Brockton Power: Air Pollution and Public Health

- Dr. Levy's preliminary health risk calculation (based on data provided by BP) of BP's primary PM 2.5 emissions:
  - One additional death every seven years
  - 90 additional asthma attacks per year
  - 70 additional minor restricted activity days per year
- Does not include effects of increased secondary PM 2.5, ozone, and other air pollutants.
- Based on a small radius around the plant, capturing only a small fraction of the impacts.
- "These are substantial underestimates of the total public health burden of the power plant."

# Brockton Power: Effect on other power plants

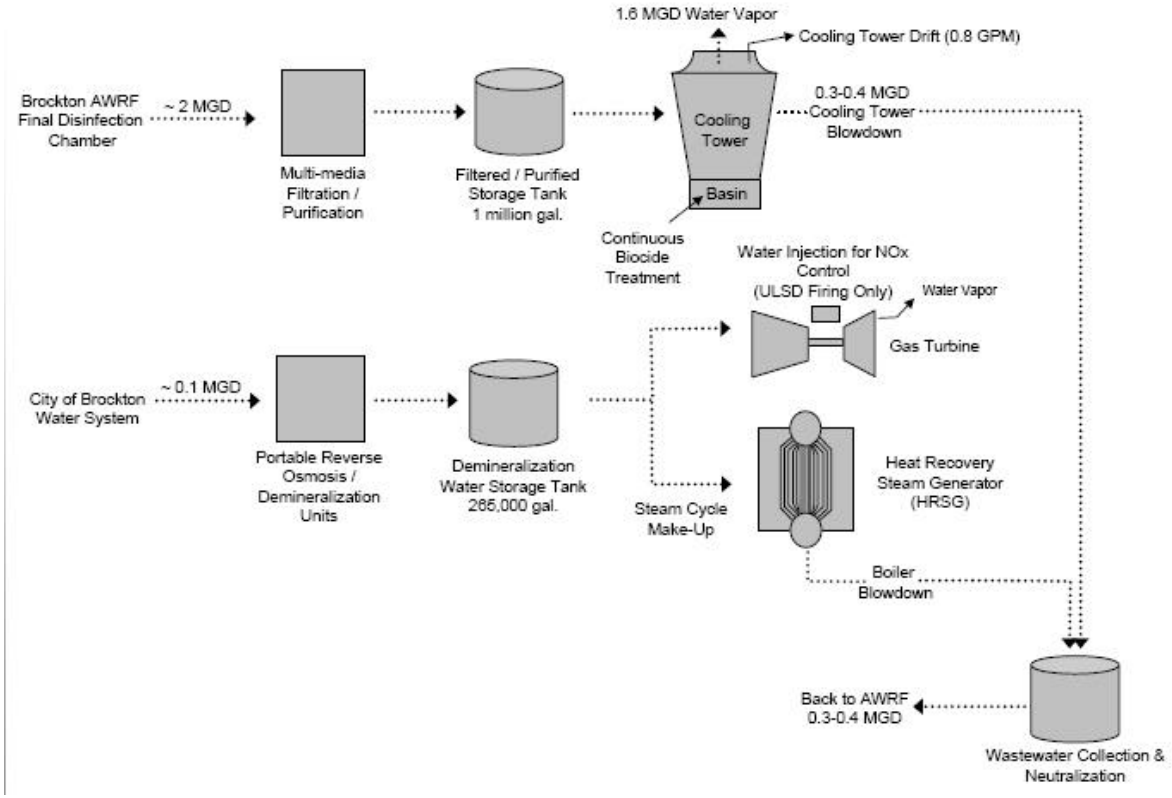
- BP's operation will not cause one or more of the "filthy five" power plants to go off-line, close, or significantly reduce operations.
- "Construction of the proposed power plant is not a guarantee that older facilities will be shut down." MA Secretary of Energy and Environmental Affairs, 11/1/07, certificate on the DEIR for the power plant.
- The most likely impact of BP's operation, if there is excessive supply, is that similar gas-fired power plants elsewhere in New England might operate less often.

# Brockton Power: Effect on other power plants

- There has been no airshed monitoring to determine what impact, if any, changes in other power plants' operations might have on air quality in and around Brockton.
- It is clear, nonetheless, that BP will add significant amounts of pollutants to local air.

# Brockton Power: Water Resources Impacts

- Reduce flow in the Salisbury Plain River by about 1.6 MGD



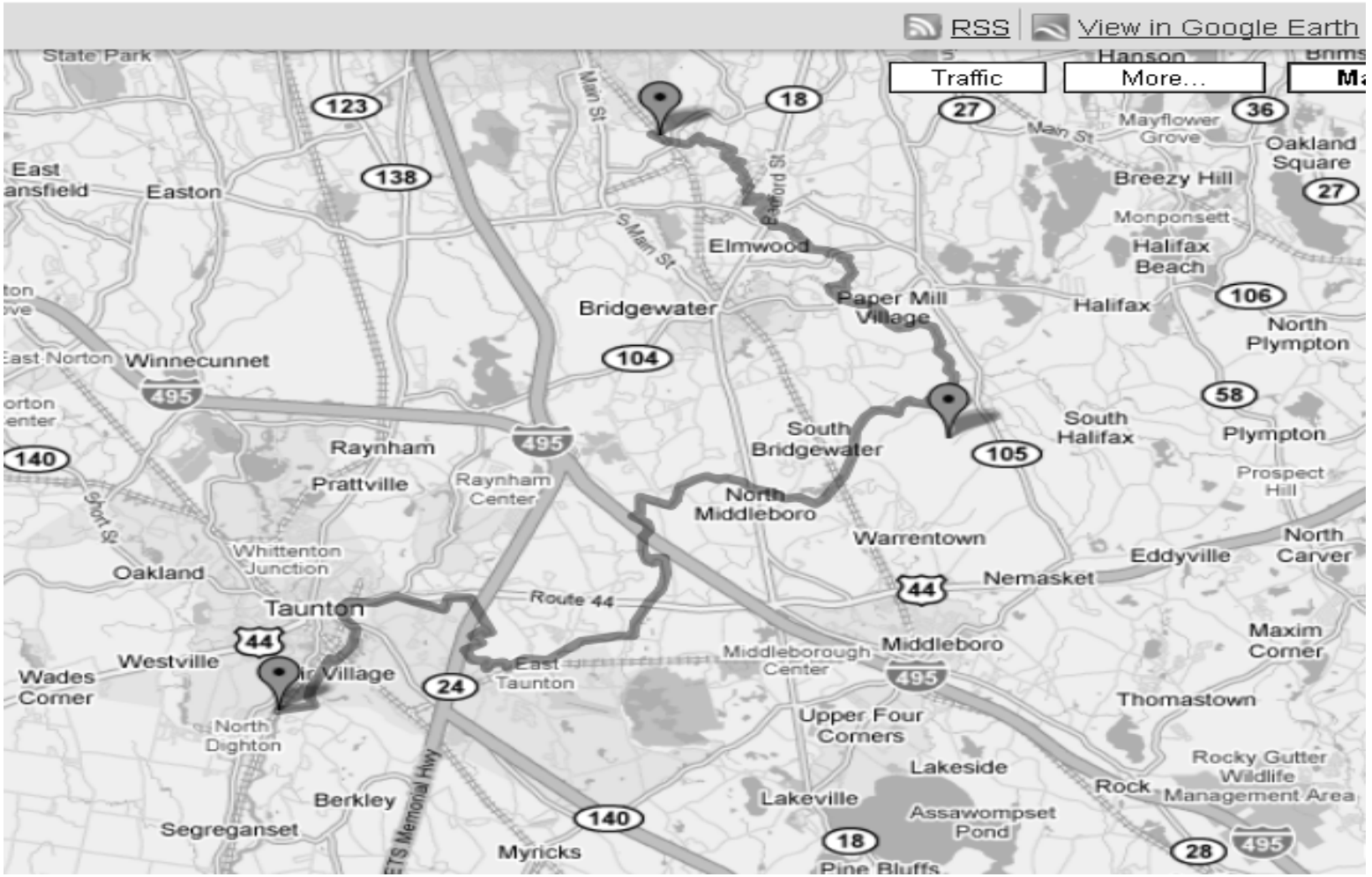
# Brockton Power: Water Resources Impacts

- BP would reduce Salisbury Plain river flow by:
  - About 8% on an annual average basis
  - Up to 13.4% on a monthly basis
  - About 15% during very dry periods when BP would use maximum amounts of water (usually summer)

# Brockton Power: Water Resources Impacts

- Reductions in river flow during very low flow periods:
  - 15% just downstream of the outfall from the Brockton Wastewater Treatment plant (near the Brockton-West Bridgewater line).
  - 10.7% at the Oak Point Community
  - 9% at the Taunton Wastewater Treatment Plant

# Brockton Power:
# Water Resources Impacts



# Brockton Power: Water Resources Impacts

- Dr. Kevin Curry testified that reductions in flow in the Salisbury Plain River would impact stream ecology:
- The principal reason a reduction in the discharge quantity to the Salisbury Plain River will impact the stream ecosystem is if the flow is reduced by 15%. During summer, low flow conditions, there will be less water in the river and more of the river bottom exposed in shallow riffle and shore line areas. The animal life dependent on the Salisbury Plain River will be adversely effected by the changes in flow. They either move to more suitable habitat, which there will be less of because there is less water, or they can no longer survive in that section of the river.

# Brockton Power: Water Resources Impacts

- A small fish known as the Tesselated Darter lives in the water column and on the bottom of the river. This species particularly likes small riffled areas. Its habitat is moving water with a sand or gravel bottom. The Tesselated Darters require moving water. Therefore, to reduce flow in the Salisbury Plain River would be to shrink their habitat
- The presence of these fish is a significant part of the benthic ecosystem. The fish feed on aquatic insect larvae. The reduction in habitat and potential for increased stress from elevated water temperature could put these fish at risk and not only impact their population but other fish in the river that feed on them as a food source.

# Brockton Power:
# Water Resources Impacts

- The town of West Bridgewater draws all of its drinking water from wells fed by a Zone II aquifer in West Bridgewater located, at its nearest point, approximately 3,000 feet from the site of the proposed facility.
- Within that Zone II area, there is an approximately 0.6 mile long portion of the Salisbury Plain River.
- Under sustained pumping conditions, which would most likely occur during low flow summer months, the direction of groundwater flow changes in the area of the pumping wells and the Salisbury Plain River contributes water to the aquifer.

# Brockton Power: Water Resources Impacts

- There have been no detailed studies or tests to determine how that might affect West Bridgewater's drinking water supply.
- It seems likely that during low flow periods the reduced flow in the Salisbury Plain River will affect adversely the saturated thickness of the Zone II aquifer in West Bridgewater and/or alter the slope of the groundwater table, affecting adversely the ability of the aquifer to replenish itself.

# Brockton Power: Conclusion

- Will add significant amounts of pollution to the local air.
- Lack of local meteorological data in BP's air modeling raises doubts about the accuracy of the results.
- Will cause adverse public health impacts but there have been no studies to determine the extent of the impacts.
- Will adversely affect water resources but there have been no studies to determine the extent of the impacts.

# Brockton Power: Conclusion

- Not needed now or in the next ten years.
- If other plants come on line during that time or if there is more conservation, will not be needed beyond then.
- Will not cause older power plants to shut down.