

# TECHNICAL SUPPORT DOCUMENT

TECHNICAL INFORMATION PRESENTED IN REVIEW OF AN  
APPLICATION FOR AN AUTHORITY TO CONSTRUCT PERMIT

APPLICATION SUBMITTED BY

MGM Resorts International  
4882 Frank Sinatra Drive  
Las Vegas, Nevada 89109

For

MGM Resorts International – City Center  
3780 S. Las Vegas Blvd  
Las Vegas, Nevada 89109

**Source: 825  
(ATC Significant Revision)**

SIC Code 7011: Hotels and Motels  
NAICS Code 721120: Hotels, Resort, with Casinos



Clark County  
Department of Air Quality  
Permitting Section

**August 2013**

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Proposed

## Source Information

**Preparer:** Michael Rael  
**Date:** March 1, 2012  
**Company:** MGM Resorts International  
**Submitter:** MGM Resorts International  
**Source:** 825  
**Action Requested:** June 23, 2011  
**Hydrographic Area:** 212  
**Subject:** City Center  
3780 S. Las Vegas Blvd, Las Vegas, Nevada 89109  
T21S, R61E, Section 21

## Source Description

MGM Resorts International (MGM) owns and operates multiple hotel/casinos on Las Vegas Blvd, in the Las Vegas Valley airshed, hydrographic basin number 212. Hydrographic basin 212 is nonattainment for PM<sub>10</sub> and ozone, and attainment for all other regulated air pollutants.

The source operates under Standard Industrial Classification (SIC) Code 7011: Hotels and Motels and North American Industrial Classification System (NAICS) Code 721120: Hotels, Resort, with Casinos. The source meets or exceeds the major source thresholds for PM<sub>10</sub>, NO<sub>x</sub>, and CO, and is a minor source for PM<sub>2.5</sub>, SO<sub>x</sub>, VOC, HAP, and H<sub>2</sub>S.

## Permitting Action

MGM requested on June 3, 2011, to revise the initial Authority to Construct (ATC) for City Center issued on March 30, 2006, and the ATC, Modification 13 issued on December 31, 2009. The following items were requested to be corrected:

1. CO control requirement for the Solar Turbines (EUs: CC007 and CC008)
2. NO<sub>x</sub> emission limit for the English Boilers (EUs: CC026 through CC028)
3. Cooling Tower TDS limits (EUs: CC029 through CC034)

Additional information regarding the Turbines' CO control and monitoring was submitted on January 23, 2012. This document is from the turbine manufacturer.

The Control Officer agrees that the proposed changes are acceptable and will issue a significant revision to the original ATC under the provisions of AQR 12.4, to incorporate the changes requested by MGM.

## Turbines

MGM requested that the requirement for an oxidation catalyst for CO control be removed. The oxidation catalyst requirement was based on a Lowest Achievable Emission Rate (LAER) decision of 2.5 ppmv CO. In operation, the pressure drop across the catalyst bed also resulted in a loss of performance, but met the permitted emission limits. Testing conducted with the catalyst removed also resulted in emissions less than 2.5 ppm CO.

The turbines also utilize an ultra lean-premix (ULP) design. The combustor liner is cooled with augmented backside cooling (ABC) and uses a thermal barrier coating (TBC). In conjunction with an air diverter valve (ADV) upstream of the combustor, CO emissions can be controlled to the permitted levels without the decrease in thermal efficiency that resulted with the catalyst.

Performance testing will demonstrate compliance on a regular interval, currently once every five years. DAQ's concern was compliance with the permitted emission limits on an on-going basis and requested that MGM submit a monitoring plan.

The turbine manufacture's documentation states that there are two instances in the turbines' operation that may result in an increase in emission. The first is a liner failure of the TBC. The other is if the combustion Primary Zone Temperature (PZT) is outside the typical operating range of 2250°F to 2750°F. A liner failure would cause an engine alarm or shutdown due to a turbine exhaust gas temperature spread issue. An inspection is normally conducted after a liner failure to identify the issue which caused the failure. TPZ is monitored and controlled. When outside the normal operating range, the temperature is recorded and can be adjusted.

Another issue that is corrected with this ATC is the applicability of 40 CFR 60 Subparts GG and KKKK. When the ATC was issued in March, 2006, the turbines were identified as subject to GG. Since the turbines were built and installed after February 18, 2005, KKKK applies. MGM is in compliance with this regulation as stated in this TSD.

### Boilers

MGM requested that the NO<sub>x</sub> emission limit for the three English boilers (EUs: CC026 through CC028) be increased from 9 ppm to 15 ppm. The burner manufacturer originally guaranteed 9 ppm, but the boilers did not comply with this limit during the initial performance tests conducted on June 14, 2010. Over the next several months, MGM worked with the manufacturer to try to meet the permitted limit. Removal of the burner head multiple times, remanufacturing the burner heads, lengthy tuning adjustments, and introduction of humidity to the source air were all done to lower the NO<sub>x</sub>.

MGM contends that the burner manufacturer's NO<sub>x</sub> guarantees were faulty and not representative of the operating conditions in the Las Vegas Valley. The higher elevation and the dryer desert air were identified by MGM as causes of this situation, as the burner manufacturer's guarantees were based on a more humid climate at sea level. Also, the boilers were custom built before the burners were installed, causing a situation where the boiler could not be factory tested. Also, space constraints allowed for only a flextube boiler to be installed, instead of a firetube boiler. In order to achieve the 9 ppm NO<sub>x</sub> limit, the flextube boiler would have to operate under conditions that could cause safety issues and ultimately boiler failure.

The boiler controller was tested and minor adjustments and corrections were made. In an attempt to meet the permitted limit, the burner manufacture made the following modifications:

1. Orifices were resized to aid in the fuel/air mixture.
2. The burner port was extended in order to reduce turbulence near the flame.
3. Burner heads were removed and adjusted to allow for better combustion.
4. Humidifiers were brought into the boiler area to better replicate conditions in Southern California where the burners were manufactured.

Subsequent performance tests showed that achieving 9 ppm NO<sub>x</sub> is infeasible under the operating conditions of the Las Vegas Valley for these boilers. MGM submitted a Best Available Control Technology (BACT) analysis resulting in fuel selection of natural gas, combined with Low-NO<sub>x</sub> burners rated at 15 ppm which the manufacturer will guarantee. DAQ agrees that these control options satisfy the BACT requirements.

### Cooling Towers

MGM requested that the Total Dissolved Solids (TDS) in the cooling tower water be increased from 3,600 ppm to 4,500 ppm. The manufacturer did not tie the drift rating to a particular TDS concentration, but based it on MGM using proper maintenance procedures to prevent scaling and particulate deposition within the cooling towers. MGM will maintain the BACT determination of 0.001% drift by adjusting the water chemistry and proper maintenance with the increased TDS.

The emission units affected by the significant revision are the only emission units addressed in this TSD.

### Acronyms

**Table 1: Acronyms**

Acronym	Term
ABC	Augmented Backside Cooling
ADV	Air Diverter Valve
AQR	Clark County Air Quality Regulations
ATC	Authority to Construct
BACT	Best Available Control Technology
BCC	Clark County Board of County Commissioners
BHP	Brake Horse Power
CE	Control Efficiency
CEM	Continuous Emissions Monitoring System
CF	Control Factor
CFR	United States Code of Federal Regulations
CO	Carbon Monoxide
CPI	Urban Consumer Price Index
DAQ	Clark County Department of Air Quality
DOM	Date of Manufacture
EF	Emission Factor
EPA	United States Environmental Protection Agency
EU	Emission Unit
HAP	Hazardous Air Pollutant
HHV	High Heating Value
HP	Horse Power
HVLP	High Volume, Low Pressure
kW	kilowatt
LAQER	Lowest Achievable Emission Rate
LON	Letter of Noncompliance
MGM	MGM Resorts International
MMBtu	Millions of British Thermal Units
NEI	Net Emission Increase

Acronym	Term
NO <sub>x</sub>	Nitrogen Oxides
NOV	Notice of Violation
NRS	Nevada Revised Statutes
NSPS	New Source Performance Standards
NSR	New Source Review
OP	Operating Permit
PM <sub>2.5</sub>	Particulate Matter less than 2.5 microns
PM <sub>10</sub>	Particulate Matter less than 10 microns
ppm	Parts per Million
PSD	Prevention of Significant Deterioration
PTE	Potential to Emit
PZT	Primary Zone Temperature
scf	Standard Cubic Feet
SCC	Source Classification Codes
SCR	Selective Catalytic Reduction
SIP	State Implementation Plan
SO <sub>x</sub>	Sulfur Oxides
TBC	Thermal Barrier Coating
TCS	Toxic Chemical Substance
TBD	To Be Determined
TDS	Total Dissolved Solids
TSD	Technical Support Document
ULP	Ultra Lean-Premix
USGS	United States Geological Survey
VOC	Volatile Organic Compound

## Emission Units

**Table 2: Summary of Emission Units**

EU	Rating	Type	Manufacturer	Model No.	Serial No.
CC007	4.6 MW (Nominal Electric Rating)	Combustion Gas Turbine	Solar	Mercury 50- 6000R	PG06N11
CC008	4.6 MW (Nominal Electric Rating)	Combustion Gas Turbine	Solar	Mercury 50- 6000R	PG06N12
CC026	44 MMBtu/hr	Boiler	English	ACT08GSLE	26001-1
CC027	44 MMBtu/hr	Boiler	English	ACT08GSLE	26001-2
CC028	44 MMBtu/hr	Boiler	English	ACT08GSLE	26001-3
CC029	10,890 gpm	Cooling Tower	Composite Cooling Systems	FM-4242-250-P6	1163
CC030	10,890 gpm	Cooling Tower	Composite Cooling Systems	FM-4242-250-P6	1163
CC031	10,890 gpm	Cooling Tower	Composite Cooling	FM-4242-250-P6	1163

EU	Rating	Type	Manufacturer	Model No.	Serial No.
			Systems		
CC032	10,890 gpm	Cooling Tower	Composite Cooling Systems	FM-4242-250-P6	1163
CC033	10,890 gpm	Cooling Tower	Composite Cooling Systems	FM-4242-250-P6	1163
CC034	10,890 gpm	Cooling Tower	Composite Cooling Systems	FM-4242-250-P6	1163

### Calculation of PTE and NEI

**Table 3: PTE (tons per rolling 12-months)**

EU	PM <sub>10</sub>	NO <sub>x</sub>	CO	SO <sub>x</sub>	VOC	HAP
CC007	3.75	3.28	1.00	0.13	0.46	1.83E-01
CC008	3.75	3.28	1.00	0.13	0.46	1.83E-01
CC026	0.95	2.34	1.89	0.08	0.69	0.24
CC027	0.95	2.34	1.89	0.08	0.69	0.24
CC028	0.95	2.34	1.89	0.08	0.69	0.24
CC029	0.51	0.00	0.00	0.00	0.00	0.00
CC030	0.51	0.00	0.00	0.00	0.00	0.00
CC031	0.51	0.00	0.00	0.00	0.00	0.00
CC032	0.51	0.00	0.00	0.00	0.00	0.00
CC033	0.51	0.00	0.00	0.00	0.00	0.00
CC034	0.51	0.00	0.00	0.00	0.00	0.00

The updated PTE reflects the changes requested in the ATC:

1. Turbines: No change in PTE
2. Boilers: Increase in NO<sub>x</sub> PTE (2.82 tpy)
3. Cooling Towers: Increase in PM<sub>10</sub> PTE (0.66 tpy)

**Table 4: PTE (pounds per hour)**

EU	Rating	Conditions	NO <sub>x</sub>	CO
CC026	44 MMBtu/hr	5,800 hrs/yr	0.81	0.65
CC027	44 MMBtu/hr	5,800 hrs/yr	0.81	0.65
CC028	44 MMBtu/hr	5,800 hrs/yr	0.81	0.65

**Table 5: Emission Concentrations, Normal Operation**

EU	NO <sub>x</sub>	CO <sup>2</sup>	VOC <sup>3</sup>
CC007	5 <sup>1</sup>	2.5 <sup>2</sup>	2.0
CC008	5 <sup>1</sup>	2.5 <sup>2</sup>	2.0
CC026	15	20	N/A
CC027	15	20	N/A
CC028	15	20	N/A

<sup>1</sup>NO<sub>x</sub> concentration based on a 3-hour rolling average.

<sup>2</sup>CO concentration based on a rolling hourly average of 15 minute values.

<sup>3</sup>Annual emission limitation as CH<sub>4</sub>.

## Operational Limits

MGM did not request any changes to the operating limits of the emission units covered by this ATC.

## Review of Applicable Regulations

The two Solar Turbines are not included in the emissions change analysis as there was no change in the PTE for these two units.

The NEI was calculated based on the increase in NO<sub>x</sub> emissions from the English boilers and the increase in PM<sub>10</sub> emissions is from the increase in TDS content of the cooling towers' water. The increase in PTE is not above the significance levels, therefore a RACT analysis is not required per AQR 12.4. As this is a revision to an ATC, the original control analyses are applicable: BACT for both NO<sub>x</sub> and PM<sub>10</sub>.

**Table 6: Permitting Action Summary**

	PM <sub>10</sub>	PM <sub>2.5</sub>	NO <sub>x</sub>	CO	SO <sub>x</sub>	VOC	HAP
Modification 13 revision 1 PTE <sup>1</sup>	12.75	10.41	10.76	7.67	0.50	2.99	1.09
12.4 ATC (Current Permitting Action)	13.41	10.41	13.58	7.67	0.50	2.99	1.09
<b>Total PTE Increase for 12.4 ATC</b>	<b>0.66</b>	<b>0.00</b>	<b>2.82</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
12.4 Significance Levels	7.5	5.0	20	50	20	20	--

<sup>1</sup>The Turbines were not included in the Modification 13 Revision 1 permit and the PTE for these two units has not changed, but is included in this table.

### Applicable Regulations:

The English boilers are subject to 40 CFR 60 Subpart Dc. Requirements to ensure compliance with the regulation were established in the original ATC and have not changed in this permitting action.

## Subpart KKKK – Standards of Performance for Stationary Combustion Turbines

### 40 CFR 60.4305 – Applicability

**Discussion:** Subpart KKKK applies to the Solar Turbines, as construction commenced after the applicability date.

### 40 CFR 60.4320 – Standard for nitrogen oxides

**Discussion:** The NO<sub>x</sub> limit from Subpart KKKK is 42 ppmvd at 15 percent oxygen. The source has a limit in the Part 70 OP. This limit has been achieved by the BACT requirement of 5 ppm NO<sub>x</sub> at 15 percent oxygen.

### 40 CFR 60.4330 – Standard for sulfur dioxide

**Discussion:** The source meets this condition by combusting low sulfur pipeline quality natural gas.

#### **40 CFR 60.4333 – Compliance Determination Procedures and Methods**

**Discussion:** MGM is required to operate and maintain the turbines, air pollution control equipment and monitoring equipment in a manner consistent with good air pollution control practices for minimizing emissions at all times including startup, shutdown, and malfunction.

#### **40 CFR 60.4340 - Monitoring of operations**

**Discussion:** MGM is required to monitor when the turbines are in Low-NO<sub>x</sub> mode. Startup and shutdown modes are the only time, the manufacturer states, when the turbines are not operating in Low-NO<sub>x</sub> mode. Therefore by monitoring the turbine loads and when the turbines are in startup and shutdown modes, MGM meets this requirement.

#### **40 CFR 60.4355 – Parameter Monitoring Plan**

**Discussion:** MGM will develop and keep on-site a monitoring plan to show compliance with this regulation.

#### **40 CFR 60.4360 – Monitoring of Sulfur Content**

**Discussion:** MGM will obtain records from the fuel supplier to show compliance with this regulation.

#### **40 CFR 60.4375(a) – Reporting Requirements**

**Discussion:** Reporting requirements in the ATC are sufficient to meet the requirements of this regulation.

### **Control Technology**

The change in control technology for the Solar Turbines was to eliminate the requirement for a catalytic oxidizer. After commissioning start-up and performance testing, MGM and the turbine manufacturer determined that the oxidizer was not necessary to meet the established LAER of 2.5 ppm CO. With the turbines utilizing ULP technology and the thermal barrier on the combustor liners, the turbines will meet the CO limit. Monitoring of the liner and the combustion temperature with alarms, automatic shutdowns, and manual temperature adjustments will ensure continued compliance with the CO limit.

The English boilers' BACT determination was increased from 9 ppm NO<sub>x</sub> to 15 ppm NO<sub>x</sub>. After extensive testing, the original NO<sub>x</sub> limit was unachievable. The use of natural gas and Low-NO<sub>x</sub> burners remains BACT to meet the increased NO<sub>x</sub> limit.

The use of 0.001% drift eliminators remains as BACT for the cooling towers. The increase in TDS will not affect the performance of these, per the manufacturer.

### **Monitoring**

Standard monitoring conditions from the original ATC are carried through to the current version. Additional conditions were added to ensure compliance with the turbines' CO limit without the use of the catalytic oxidizer. Monitoring conditions were also updated to reflect the application of 40 CFR 60 Subpart KKKK instead of 40 CFR 60 Subpart GG. The updated and new conditions are listed below:

1. The 4.6 MW combustion gas turbines (EUs: CC007 and CC008) are subject to 40 CFR 60 Subpart KKKK. Compliance with the turbine emission limitations specified in Subpart KKKK and this permit shall be demonstrated by an initial performance test, a performance test at least once every five years thereafter, and record keeping. The number of start-up/shut-down events shall be tracked, and the emissions from such shall be used to verify compliance with the annual emission limitations for the combustion turbines. [40 CFR 60.4320]
2. Compliance with the sulfur standards of the natural gas fuel according to 40 CFR 60 Subpart KKKK shall be demonstrated using methods described in the subpart. [40 CFR 60.4330]
3. Pursuant to Subpart KKKK, for any lean premix stationary combustion turbine the owner or operator shall continuously monitor the appropriate parameters to determine whether the unit is operating in the lean premixed (dry low-NO<sub>x</sub> (DLN) or ultra lean premixed (ULP)) combustion mode. The Permittee shall identify the parameters and develop a monitoring procedure before starting operation. [40 CFR 60.4340]
4. The Permittee shall monitor and record the Primary Zone Temperature in the turbines (EUs: CC007 and CC008). [AQR 12.4.3.1(e)(10)]
5. The Permittee shall monitor the turbine exhaust gas temperature (EUs: CC007 and CC008). [AQR 12.4.3.1(e)(10)]

The PZT is automatically recorded for the turbines. In the event of a shutdown, the PZT is recorded in the startup/shutdown log as well. This allows to the source to investigate if the PZT was outside of the normal operating range and was the cause of the turbine shutdown.

## Testing

No new performance testing requirements were added in this permitting action. The turbines and the boilers were extensively tested during the process of bringing them into compliance and updating the BACT and LAER determinations.

## Mitigation

1. The Permittee has no Federal offset obligation with this permitting action.

## Increment

MGM Mirage is a major source in Hydrographic Area 212 (Las Vegas Valley). Permitted emission units include boilers, generators, cooling towers (374 emission units) for the operation of ten facilities. Since minor source baseline dates for NO<sub>x</sub> (October 21, 1988) and SO<sub>2</sub> (June 29, 1979) have been triggered, Prevention of Significant Deterioration (PSD) increment analysis is required. DAQ modeled the source using AERMOD to track the increment consumption.

The source was modeled for the NO<sub>x</sub> and SO<sub>2</sub> increment consumption. Stack data submitted by the applicant were supplemented with information available for similar emission units. Five years (1999 to 2003) of meteorological data from the McCarran Station and Desert Rock Station were used in the model. United States Geological Survey (USGS) 7.5-minute Digital Elevation

Model (DEM) terrain data was used to calculate elevations. Table 7 presents the results of the modeling.

**Table 7: PSD Increment Consumption**

Pollutant	Averaging Period	PSD Increment Consumption by the Source ( $\mu\text{g}/\text{m}^3$ )	Location of Maximum Impact	
			UTM X (m)	UTM Y (m)
SO <sub>2</sub>	3-hour	141.49 <sup>1</sup>	663869	3997459
SO <sub>2</sub>	24-hour	48.83 <sup>1</sup>	663869	3997459
SO <sub>2</sub>	Annual	11.80	663800	3997700
NO <sub>x</sub>	Annual	15.77	664923	3997357

<sup>1</sup>Modeled 2<sup>nd</sup> High Concentration

Table 7 shows the location of the maximum impact and the potential PSD increment consumed by the source at that location. The impacts are below the PSD increment limits.

### Public Notice

This permitting action is a significant revision and is therefore required to undergo the permitting procedures outlined in 12.4.3.4(a)(3) including public notice.

### Permitting History

1. An ATC for City Center was issued for the Solar Turbines on March 30, 2006.
2. An ATC/OP issued for the English boilers and the cooling towers on December 31, 2009.
3. The Title V Permit for MGM Resorts, not including the City Center units, was issued on December 30, 2010.
4. An Application for revision to the units covered in this ATC was received on June 3, 2011.
5. A letter requesting more information was issued by DAQ on November 21, 2011.
6. A Supplemental ATC application was submitted by the source on January 23, 2012.

### Attachments