DRAFT Environmental and Social Impact Assessment Report

Project Number: 50182-001
November 2018

INO: Riau Natural Gas Power Project
ESIA Vol.5_Technical Appendices Part F

Prepared by ESC for the Asian Development Bank

Appendix E. KA-ANDAL Approval Letter

PEMERINTAH KOTA PEKANBARU
DINAS LINGKUNGAN HIDUP DAN KEBERSIHAN
JALAN DATUK SETIA MAHARAJA NO. 04 TELP. (0761) 31516 FAX. (0761) 31512
PEKANBARU

KEPUTUSAN KEPALA DINAS LINGKUNGAN HIDUP DAN KEBERSIHAN KOTA PEKANBARU SELAKU KETUA KOMISI PENILAI AMDAL KOTA PEKANBARU

NOMOR 57 TAHUN 2018

T E N T A N G

PERSETUJUAN KERANGKA ACUAN KEGIATAN PEMBANGUNAN DAN PENGOPERASIAN PEMBANGKIT LISTRIK TENAGA GAS DAN UAP (PLTGU) RIAU 275 MW OLEH PT. MEDCO RATCH POWER RIAU

KEPALA DINAS LINGKUNGAN HIDUP DAN KEBERSIHAN KOTA PEKANBARU

Menimbang :

a. bahwa rencana usaha dan/atau kegiatan Pembangunan dan Pengoperasian Pembangkit Listrik Tenaga Gas dan Uap (PLTGU) Riau 275 MW oleh PT. Medco Ratch Power Riau berlokasi di Jalan Empat Lima, Kelurahan Industri Tenayan, Kecamatan Tenayan Raya, Kota Pekanbaru merupakan usaha dan/atau kegiatan yang wajib memiliki Analisis Mengenai Dampak lingkungan Hidup (AMDAL);

b. bahwa Kerangka Acuan kegiatan Pembangunan dan Pengoperasian Pembangkit Listrik Tenaga Gas dan Uap (PLTGU) Riau 275 MW oleh PT. Medco Ratch Power Riau sebagai salah satu bagian dari studi AMDAL wajib mendapatkan Keputusan Persetujuan berdasarkan hasil penilaian Komisi Penilai AMDAL Kota Pekanbaru;

c. bahwa berdasarkan pertimbangan sebagaimana dimaksud pada huruf a dan huruf b di atas perlu menetapkan dengan Keputusan Kepala Dinas Lingkungan Hidup dan Kebersihan Kota Pekanbaru tentang Persetujuan Kerangka Acuan kegiatan Pembangunan dan Pengoperasian Pembangkit Listrik Tenaga Gas dan Uap (PLTGU) Riau 275 MW oleh PT. Medco Ratch Power Riau.

Mengingat :

1. Undang - undang Nomor 8 Tahun 1956 tentang Pembentukan Daerah Otonom Kota Kecil Dalam Lingkungan Provinsi Sumatera Tengah (Lembaran Negara Republik Indonesia Tahun 1956 Nomor 19).
2. Undang-undang Nomor 26 Tahun 2007 tentang Penataan Ruang (Lembaran Negara Republik Indonesia Tahun 2007 Nomor 68, Tambahan Lembaran Negara Republik Indonesia Nomor 4725).
3. Undang-undang Nomor 22 Tahun 2009 tentang Lalulintas dan Angkutan Jalan (Lembaran Negara Republik Indonesia Tahun 2009 Nomor 96, Tambahan Lembaran Negara Republik Indonesia Nomor 5025).
4. Undang-undang Nomor 32 Tahun 2009 tentang Perlindungan dan Pengelolaan Lingkungan Hidup (Lembaran Negara Republik Indonesia Tahun 2009 Nomor 140); Tambahan Lembaran Negara Republik Indonesia Nomor 5095).
5. Undang - Undang Nomor 23 Tahun 2014 tentang Pemerintah Daerah (Lembaran Negara Republik Indonesia Tahun 2014 Nomor 244, Tambahan Lembaran Negara Republik Indonesia Nomor 5587), sebagaimana telah diubah

dengan Peraturan Pemerintah Pengganti Undang-Undang Nomor 2 Tahun 2014 tentang Perubahan Atas Undang-Undang Nomor 23 Tahun 2014 tentang Pemerintah Daerah (Lembaran Negara Republik Indonesia Tahun 2014 Nomor 246, Tambahan Lembaran Negara Republik Indonesia Nomor 5589).

6. Peraturan Pemerintah RI Nomor 38 Tahun 2007 tentang Pembagian Urusan Pemerintahan Antara Pemerintah, Pemerintahan Daerah Provinsi dan Pemerintahan Daerah Kabupaten/Kota (Lembaran Negara Republik Indonesia Tahun 2007 Nomor 82, Tambahan Lembaran Negara Republik Indonesia Nomor 4737).

7. Peraturan Pemerintah RI Nomor 27 Tahun 2012 tentang Izin Lingkungan (Lembaran Negara Republik Indonesia Tahun 2012 Nomor 48).

8. Peraturan Menteri Negara Lingkungan Hidup Republik Indonesia Nomor 5 Tahun 2012 tentang Jenis Rencana Usaha dan/atau Kegiatan yang Wajib Memiliki Analisis Mengenai Dampak Lingkungan.

9. Peraturan Menteri Negara Lingkungan Hidup Republik Indonesia Nomor 16 Tahun 2012 tentang Pedoman Penyusunan Dokumen Lingkungan Hidup.

10. Peraturan Menteri Negara Lingkungan Hidup Republik Indonesia Nomor 17 Tahun 2012 tentang Pedoman Keterlibatan Masyarakat dalam Proses AMDAL.

11. Peraturan Menteri Negara Lingkungan Hidup Republik Indonesia Nomor 8 Tahun 2013 tentang Tata Laksana Penilaian dan Pemeriksaan Dokumen Lingkungan Hidup serta Penerbitan Izin Lingkungan.

12. Peraturan Daerah Kota Pekanbaru Nomor 9 Tahun 2016 tentang Susunan Perangkat Daerah (Lembaran Daerah Kota Pekanbaru Tahun 2016 Nomor 9, Tambahan Lembaran Daerah Kota Pekanbaru Nomor 7).

13. Keputusan Walikota Pekanbaru Nomor 143 Tahun 2017 tentang Pembentukan Komisi Penilai AMDAL Kota Pekanbaru.

MEMUTUSKAN :

Menetapkan :

KESATU : Persetujuan Kerangka Acuan kegiatan Pembangunan dan Pengoperasian Pembangkit Listrik Tenaga Gas dan Uap (PLTGU) Riau 275 MW oleh PT. Medco Ratch Power Riau;

KEDUA : Kerangka Acuan disusun berdasarkan ketentuan peraturan perundang-undangan yang berlaku;

KETIGA : Kerangka Acuan sebagaimana dimaksud dalam diktum Kedua terdiri dari :

a. BAB I PENDAHULUAN
b. BAB II PELINGKUPAN
c. BAB III METODE STUDI
d. DAFTAR PUSTAKA
e. LAMPIRAN

Sebagaimana tercantum dalam Kerangka Acuan kegiatan Pembangunan dan Pengoperasian Pembangkit Listrik Tenaga Gas dan Uap (PLTGU) Riau 275 MW oleh PT. Medco Ratch Power Riau;

KEEMPAT : Untuk selanjutnya Pemrakarsa dapat melanjutkan kajian ANDAL dan RKL-RPL;

KELIMA : Pada dokumen ANDAL memuat lingkup kajian, yang meliputi:

1. Kajian Dampak Penting Hipotetik, yang terdiri dari:

   A. Tahap Konstruksi
      1. Penurunan Kualitas Udara;
      2. Peningkatan Kebisingan;
      3. Peningkatan Air Limpasan;
      4. Penurunan Kualitas Air Sungai;
      5. Peningkatan Kemacetan Lalu Lintas Darat;
      6. Penurunan Debit Sungai;
      7. Penurunan Biota Perairan Sungai;
      8. Peningkatan Kesempatan Kerja;
      9. Peningkatan Peluang Usaha;
      10. Peningkatan Gangguan Kesehatan.

   B. Tahap Operasi
      1. Penurunan Kualitas Udara;
      2. Peningkatan Kebisingan;
      3. Peningkatan Getaran;
      4. Penurunan Kualitas Air Sungai;
      5. Penurunan Debit Sungai;
      6. Penurunan Biota Perairan Sungai;
      7. Peningkatan Kesempatan Kerja;
      8. Peningkatan kesempatan Usaha;
      9. Peningkatan Gangguan Kesehatan.

2. Kajian Dampak Tidak Penting Hipotetik yang dipantau dan dikelola, yang terdiri dari:

   A. Tahap Pra Konstruksi
      1. Perubahan Persepsi Masyarakat.
   B. Tahap Konstruksi
      1. Penurunan Kualitas Air Sungai;
      2. Penurunan Biota Perairan.
   C. Tahap Operasi
      1. Penurunan Sanitasi Lingkungan.

3. Kajian Batas Wilayah Studi, sesuai dengan Kerangka Acuan yang telah disetujui meliputi Batas Proyek, Batas Ekologis, Batas Sosial dan Batas Administrasi;

4. Batas Waktu Kajian, sesuai dengan Kerangka Acuan yang telah disetujui;

KEENAM : Langkah - langkah kegiatan fisik Pembangunan dan Pengoperasian Pembangkit Listrik Tenaga Gas dan Uap (PLTGU) Riau 275 MW oleh PT. Medco Ratch Power Riau tidak dibenarkan untuk dilakukan sampai diterbitkannya keputusan kelayakan lingkungan hidup berdasarkan hasil Analisis Dampak Lingkungan Hidup (ANDAL) dan Rencana Pengelolaan Lingkungan Hidup - Rencana Pemantauan Lingkungan Hidup (RKL-RPL) serta Izin Lingkungan;

KETUJUH : Setiap kelalaian dan/atau penyimpangan yang dilakukan di luar Keputusan Persetujuan ini dapat dikenakan sanksi sesuai peraturan perundang – undangan yang berlaku;

KEDELAPAN : Kerangka Acuan kegiatan Pembangunan dan Pengoperasian Pembangkit Listrik Tenaga Gas dan Uap (PLTGU) Riau 275 MW oleh PT. Medco Ratch Power Riau berlaku sesuai dengan Pasal 25 Peraturan Pemerintah Nomor 27 Tahun 2012 tentang Izin Lingkungan;

KESEMBILAN : Keputusan ini berlaku sejak tanggal ditetapkan.

Ditetapkan di Pekanbaru
pada tanggal 28 Juni 2018

KEPALA DINAS LINGKUNGAN HIDUP
DAN KEBERSIHAN KOTA PEKANBARU
Selaku Ketua Komisi Penilai AMDAL Kota Pekanbaru

M. ZULFIKRI, SH
Pembina Utama Muda
NIP. 19620621 199003 1 007

Tembusan disampaikan kepada Yth :
1. Menteri Dalam Negeri RI di Jakarta;
2. Menteri Lingkungan Hidup dan Kehutanan RI di Jakarta Cq. Kepala Pusat Pengendalian Pembangunan Ekoregion Sumatera;
3. Gubernur Riau Cq. Kepala Dinas Lingkungan Hidup dan KehutananProvinsi Riau;
4. Walikota Pekanbaru;
5. Kepala Badan Perencanaan Pembangunan Daerah Kota Pekanbaru;
6. Kepala Dinas Penanaman Modal dan Pelayanan Terpadu Satu Pintu Kota Pekanbaru;
7. Kepala Dinas Pemadam Kebakaran dan Penyelamatan Kota Pekanbaru;
8. Kepala Dinas Perhubungan Kota Pekanbaru;
9. Kepala Dinas Penataan Ruang dan Pekerjaan Umum Kota Pekanbaru;
10. Kepala Dinas Perdagangan dan Perindustrian Kota Pekanbaru;
11. Kepala Dinas Tenaga Kerja Kota Pekanbaru;
12. Kepala Badan Pertanahan Kota Pekanbaru.

Appendix F. The Ministry of Agraria and Spatial Planning issued Recommendation Letter

KEMENTERIAN AGRARIA DAN TATA RUANG/ BADAN PERTANAHAN NASIONAL

Jakarta, 21 Maret 2018

Nomor : 129/200/III/2018
Sifat : Penting
Lampiran : 1 (satu) berkas
Hal : **Rekomendasi Rencana Pembangunan Pembangkitan Tenaga Listrik di Kota Pekanbaru dan Infrastruktur Pendukungnya**

Yth.:
Gubernur Riau
di
tempat

Sehubungan surat Dinas Penanaman Modal dan Pelayanan Terpadu Satu Pintu Kota Pekanbaru Nomor 503/167-DPMPTSP/2018 tanggal 30 Januari 2018 perihal Permintaan Dukungan Untuk Penyelesaian Perijinan karena Belum Disahkannya RTRW Provinsi Riau (terlampir), telah dilaksanakan Rapat Koordinasi Kesesuaian Tata Ruang dan Perizinan Pembangunan di Provinsi Riau pada tanggal 2 Maret 2018, maka dengan ini disampaikan hal-hal yang disepakati sebagai berikut :

1. Berdasarkan Pasal 114A Ayat (1) Peraturan Pemerintah Nomor 13 Tahun 2017 tentang Perubahan Atas Peraturan Pemerintah Nomor 26 Tahun 2008 tentang Rencana Tata Ruang Wilayah Nasional, maka dalam hal rencana kegiatan pemanfaatan ruang bernilai strategis nasional dan/atau berdampak besar yang belum dimuat dalam peraturan daerah tentang rencana tata ruang provinsi, rencana tata ruang wilayah kabupaten/kota, dan/atau rencana rincinya, izin pemanfaatan ruang dapat didasarkan pada Peraturan Pemerintah ini.
2. Berdasarkan Pasal 38 ayat (2) Peraturan Pemerintah Nomor 13 Tahun 2017 tentang Perubahan Atas Peraturan Pemerintah Nomor 26 Tahun 2008 tentang Rencana Tata Ruang Wilayah Nasional, jaringan infrastruktur ketenagalistrikan merupakan segala hal yang berkaitan dengan infrastruktur pembangkitan tenaga listrik dan sarana pendukungnya serta infrastruktur penyaluran tenaga listrik dan sarana pendukungnya.
3. Berdasarkan Pasal 38 ayat (4) Peraturan Pemerintah Nomor 13 Tahun 2017 tentang Perubahan Atas Peraturan Pemerintah Nomor 26 Tahun 2008 tentang Rencana Tata Ruang Wilayah Nasional, jaringan infrastruktur penyaluran tenaga listrik merupakan segala hal yang berkaitan dengan transmisi tenaga listrik gardu induk, distribusi tenaga listrik, dan gardu hubung.
4. Pada Lampiran VA Jaringan Infrastruktur Tenaga Listrik Peraturan Pemerintah Nomor 13 Tahun 2017 tentang Perubahan Atas PeraturanPemerintah Nomor 26

Tahun 2008 tentang Rencana Tata Ruang Wilayah Nasional, tercantum Pembangkitan Tenaga Listrik di Kota Pekanbaru dan Kabupaten Siak (II/1).

5. Pada Lampiran VII Peta Rencana Pola Ruang Wilayah Nasional Peraturan Pemerintah Nomor 13 Tahun 2017 tentang Perubahan Atas Peraturan Pemerintah Nomor 26 Tahun 2008 tentang Rencana Tata Ruang Wilayah Nasional, lokasi rencana pembangunan Pembangkit Tenaga Listrik di Kota Pekanbaru dan infrastruktur pendukungnya terdeliniasi berada pada Kawasan Andalan - Kawasan Pekanbaru dan sekitarnya.
6. Pada Lampiran IX Tabel Kawasan Andalan Peraturan Pemerintah Nomor 13 Tahun 2017 tentang Perubahan Atas Peraturan Pemerintah Nomor 26 Tahun 2008 tentang Rencana Tata Ruang Wilayah Nasional, lokasi rencana pembangunan Pembangkit Tenaga Listrik di Kota Pekanbaru dan infrastruktur pendukungnya ditetapkan sebagai Kawasan Andalan - Kawasan Pekanbaru dan sekitarnya.
7. Berdasarkan Pasal 31 Ayat (2) huruf b Peraturan Presiden Nomor 13 Tahun 2012 tentang Rencana Tata Ruang Pulau Sumatera ditetapkan PLTGU Riau Power di Kota Pekanbaru.
8. Lampiran Peraturan Presiden Nomor 58 Tahun 2017 tentang Perubahan Atas Peraturan Presiden Noomor 3 Tahun 2016 tentang Percepatan Pelaksanaan Proyek Strategis Nasional, bagian X Program Pembangunan Infrasruktur Ketenagalistrikan ditetapkan lokasinya secara Nasional.
9. Berdasarkan Peraturan Presiden Nomor 4 Tahun 2016 Pasal 1 angka 1 Infrastruktur Ketengalistrikan adalah segala hal yang berkaitan dengan pembangkitan tenaga listrik, transmisi tenaga listrik, distribusi tenaga listrik, gardu induk, dan sarana pendukung lainnya.
10. Berdasarkan Keputusan Menteri Energi dan Sumber Daya Mineral Nomor 1415/K/20/MEM/2017 tentang Pengesahan Rencana Usaha Penyediaan Tenaga Listrik PT. Perusahaan Listrik Negara 2017-2026, rencana pembangunan Pembangkitan Tenaga Listrik di Kota Pekanbaru dan infrastruktur pendukungnya telah terakomodir.
11. Pada Keputusan Menteri ESDM Nomor 2700 K/11/MEM/2012 tentang Rencana Induk Jaringan Transmisi dan Distribusi Gas Bumi Nasional Tahun 2012-2025, Kabupaten Siak berada didalam deliniasi Rencana Wilayah Jaringan Distribusi Gas di Provinsi Riau.
12. Berdasarkan peta hasil *overlay* dengan Keputusan Menteri LHK Nomor SK.903/MENLHK/SETJEN/PLA.2/12/2016 tentang Kawasan Hutan Provinsi Riau, lokasi rencana pembangunan Pembangkit Tenaga Listrik di Kota Pekanbaru dan infrastruktur pendukungnya berada pada Areal Penggunaan Lain (APL).
13. Berdasarkan butir (1) hingga (12), maka lokasi rencana pembangunan Pembangkit Tenaga Listrik Kota Pekanbaru dan infrastruktur pendukungnya telah sesuai dengan Peraturan Pemerintah Nomor 13 Tahun 2017 tentang Perubahan Atas Peraturan Pemerintah Nomor 26 Tahun 2008 tentang Rencana Tata Ruang Wilayah Nasional, sehingga proses pengurusan izin lokasi dan/atau izin

penetapan lokasi, izin lingkungan, dan izin mendirikan bangunan dapat dilanjutkan.

14. Pemerintah, Pemerintah Provinsi Riau, Pemerintah Kota Pekanbaru, dan Pemerintah Kabupaten Siak agar mempercepat penyelesaian Perda Rencana Tata Ruang Wilayah Provinsi Riau, Perda Rencana Tata Ruang Wilayah Kota Pekanbaru, dan Perda Rencana Tata Ruang Wilayah Kabupaten Siak dengan mengakomodir lokasi rencana Pembangunan Pembangkit Tenaga Listrik dan infrastruktur pendukungnya tersebut.

Demikian disampaikan, atas perhatian Saudara diucapkan terima kasih.

a.n. Menteri Agraria dan Tata Ruang/
Kepala Badan Pertanahan Nasional
Direktur Jenderal Tata Ruang

Dr. Ir. Abdul Kamarzuki, MPM
NIP. 19610922 198902 1 001

Tembusan:
1. Menteri Agraria dan Tata Ruang/Kepala BPN Republik Indonesia (sebagai laporan);
2. Menteri Koordinator Bidang Perekonomian Republik Indonesia;
3. Menteri Energi dan Sumber Daya Mineral Republik Indonesia;
4. Menteri Lingkungan Hidup dan Kehutanan Republik Indonesia;
5. Kepala Badan Koordinasi Penanaman Modal;
6. Bupati Siak;
7. Walikota Pekanbaru;
8. Kepala Dinas Penanaman Modal dan Pelayanan Terpadu Satu Pintu Provinsi Riau;
9. Kepala Dinas Penanaman Modal dan Pelayanan Terpadu Satu Pintu Kabupaten Siak;
10. Kepala Dinas Penanaman Modal dan Pelayanan Terpadu Satu Pintu Kota Pekanbaru;
11. Kepala Balai Pemantapan Kawasan Hutan XIX Pekanbaru;
12. Direktur Utama PT. PLN (Persero); dan
13. Direktur Utama PT Medco Ratch Riau Power.

PEMERINTAH KOTA PEKANBARU
DINAS PENANAMAN MODAL
DAN PELAYANAN TERPADU SATU PINTU
Jl. Cut Nyak Dien No. 3 Telp. (0761) 28262 Fax. (0761) 42003
P E K A N B A R U - 28126

Pekanbaru, [illegible] Januari 2018

Kepada :
Yth. **Menteri Agraria dan Tata Ruang/ Kepala BPN RI**
c.q. Dirjen Tata Ruang

Nomor : [illegible]
Lampiran :
Perihal : **Permintaan Dukungan Untuk Penyelesaian Perijinan Karena Belum Disahkannya RTRW Provinsi Riau**

Dengan Hormat,

Mempertimbangkan surat yang kami terima dari PT Medco Ratch Power Riau ("MRPR") No.010/MRPR-AK/1/2018 perihal Permohonan Proses Perizinan di Kota Pekanbaru, terdapat 3 (tiga) jenis perizinan yang telah dimohonkan MRPR kepada kami dalam rangka realisasi Proyek Nasional Pembangkit Listrik Tenaga Gas Uap 275 MW yaitu :

1. Izin Lokasi untuk kegiatan pembebasan lahan PLTGU dan infrastuktur pendukungnya di area Kelurahan Industri Tenayan.
2. Izin Pemanfaatan Ruang Milik Jalan (RUMIJA) Untuk Pipa Gas di bahu jalan Kota Pekanbaru.
3. Izin Lingkungan Power Plant dan Izin Lingkungan Transmisi.

Bahwa berdasarkan Peraturan Walikota Pekanbaru No.118 Tahun 2017 Tentang Pendelegasian Wewenang Perizinan dan Non Perizinan Kepada Kepala Dinas Penanaman Modal Dan Pelayanan Terpadu Satu Pintu, maka ketiga jenis perizinan yang dimohonkan oleh MRPR tersebut telah didelegasikan kepada DPMPTSP Kota Pekanbaru dan oleh karenanya akan menjadi kewenangan kami untuk menerbitkan izin-izin yang dimohonkan tersebut untuk dan atas nama Pemerintah Kota Pekanbaru.

Sehubungan dengan izin-izin yang dimohonkan MRPR tersebut maka kami bermaksud untuk meminta dukungan/rekomendasi Bapak sehubungan dengan adanya izin-izin yang belum dapat diproses terkait belum ditetapkannya Rencana Tata Ruang Wilayah/RTRW Provinsi Riau sehingga hal tersebut juga mengakibatkan Peraturan Daerah Tentang Pengesahan RTRW baik di tingkat Provinsi maupun Kota belum dapat diterbitkan, yang mana hal tersebut seyogyanya berfungsi sebagai dasar hukum bagi kami sebelum menerbitkan izin-izin bagi realisasi Proyek Nasional Pembangkit Listrik Tenaga Gas Uap 275 MW.

Besar harapan kami dengan dukungan/rekomendasi dari Bapak akan menjadi pertimbangan yang cukup bagi kami untuk membantu proses perizinan yang terhambat sehingga kepentingan umum tetap menjadi prioritas tanpa melanggar peraturan perundang-undangan yang berlaku di Indonesia.

Demikian disampaikan, atas perhatian Bapak diucapkan terima kasih.

a.n. WALIKOTA PEKANBARU
KEPALA DINAS PENANAMAN MODAL DAN PELAYANAN TERPADU SATU PINTU KOTA PEKANBARU

MUHAMMAD JAMIL, M. Ag, M. Si
Pembina Tk. I
NIP. 19780603 200112 1 003

Tembusan disampaikan kepada Yth:

1. Ketua DPRD Kota Pekanbaru;
2. Kepala Dinas Pekerjaan Umum dan Penataan Ruang Kota Pekanbaru;
3. Kepala Dinas Lingkungan Hidup dan Kebersihan Kota Pekanbaru;
4. Kepala Dinas Pertanahan Kota Pekanbaru;
5. Arsip.

Appendix G. Comparison of WBG EHS Guidelines with Indonesian Regulations

Appendix A. Comparisons of Standards

Comparison of World Bank Group IFC Environmental Health and Safety (EHS) Guidelines with Indonesian Environmental Standards

Table A1: Gaseous emission for Natural Gas (all turbine types)

Parameter	IFC Guidelines for Thermal Power Plant		Indonesian Standard**	Remark
	Non DA (mg/m^3)	DA (mg/m^3)	Limit (mg/Nm^3)	
Particulate Matter	N/A	N/A	30 mg/Nm^3	Indonesian standards are stricter
CO	NA	NA	NA	-
NOx	51*	51*	400 mg/Nm3	IFC guidelines are stricter
SO2	NA	NA	150 mg/Nm3	Indonesian standards are stricter
Opacity	NA	NA	N/A	-

Note: The figures in red are the more stringent requirements

***At dry gas, excess O_2 content 15%*
***Gas volume counted on standard (25 deg C and 1 bar atm)*
***this is for 95% normal operation in 3 (three) months period*
****Source: Ministry of Environmental Regulation No. 21 of 2008 regarding Air Emission Standard from Static Source for Thermal Power Plant Appendix IIIA*
Notes:
NDA: Non-degraded airshed; D: Degraded airshed (poor air quality); Airshed should be considered as being degraded if national legislated air quality standard is exceeding or, in their absence, if WHO Air Quality Guidelines are exceeded significantly.

Table A2: Ambient Air Quality Standards

Parameter		IFC General EHS Guidelines		Indonesian Standards		Remarks
		Limit	Source	Limit	Source	
Particulate Matter (PM_{10})	24 hour	150 μg/m³ (interim target-1)	A	-	-	-
		100 μg/m³ (interim target-2)		-	-	-
		75 μg/m³ (interim target-3)		-	-	-
		50 μg/m³		150 μg/Nm³	C	IFC guidelines are stricter
	Annual Average	70 μg/m³ (interim target-1)		-	-	-
		50 μg/m³ (interim target-2)		-	-	-
		30 μg/m³ (interim target-3)		-	-	-
		20 μg/m³		-	-	-
Particulate Matter ($PM_{2.5}$)	24 hour	75 μg/m³ (interim target-1)	A	-	-	-
		50 μg/m³ (interim target-2)		-	-	-
		37.5 μg/m³ (interim target-3)		-	-	-
		25 μg/m³		65 μg/Nm³	C	IFC guidelines are stricter
	Annual Average	35 μg/m³ (interim target-1)		-	-	
		25 μg/m³ (interim target-2)		-	-	
		15 μg/m³ (interim target-3)		-	-	
		10 μg/m³		15 μg/Nm³	C	IFC guidelines are stricter
Total Suspended Particulates	1 hour	-	-	-	-	-
	24 hour	-	-	230 μg/Nm³	C	Indonesian standards are stricter
	Annual Average	-		90 μg/Nm³	C	Indonesian standards are stricter
Sulphur Dioxide	24 hour	125 μg/m³	A	-	-	-

Parameter		IFC General EHS Guidelines		Indonesian Standards		Remarks
		Limit	Source	Limit	Source	
		(interim target-1)				
		50 µg/m^3 (interim target-2)		365 µg/Nm^3	C	IFC guidelines are stricter
		20 µg/m^3		-	-	-
	Annual Average	-	-	60 µg/Nm^3	C	-
	1 hour	-	-	900 µg/Nm^3		-
	10 Minutes	500 µg/m^3	A	-	-	-
Nitrogen Oxides (as NO_2)	24 hour	-	-	150 µg/Nm^3	C	-
	Annual Average	40 µg/m^3	A	100 µg/Nm^3	C	IFC guidelines are stricter
	1 Hour	200 µg/m^3	A	400 µg/Nm^3	C	IFC guidelines are stricter
Ozone	8 Hour Maximum	160 µg/m^3 (interim target-1)	A	-	-	-
		100 µg/m^3		-	-	-
	1 hour	-	-	235 µg/Nm^3	C	-
	Annual Average	-	-	50 µg/Nm^3	C	-

Note: The figures in red are the more stringent requirements

Table A3: Liquid Effluents

Parameter	IFC General EHS Guidelines		Indonesian Standards		Remarks
	Limit	Source	Limit	Source	
pH	6-9	B	6-9	D	IFC guidelines are stricter
BOD	30 mg/L	A	30	E	IFC guidelines are stricter
COD	125mg/L	A	100	E	Indonesian standards are stricter
Oil and Grease	10 mg/L	B	10 mg/L	D	IFC guidelines are stricter
Total Nitrogen	10mg/L	A	-	-	-

Parameter		IFC General EHS Guidelines		Indonesian Standards		Remarks
		Limit	Source	Limit	Source	
Total suspended solids (TSS)		50mg/L	A	100 mg/L	D	IFC guidelines are stricter
Total residual Chlorine		0.2 mg/L	B	0.5 mg/L	D	IFC guidelines are stricter
Heavy metals (total)		-	-	-	-	-
Arsenic		0.5mg/L	B	-	-	-
Barium		-	-	-	-	-
Cadmium		0.1 mg/L	B	-	-	-
Chromium	-	0.5 mg/L	-	-	-	-
	-	-	-	-	-	-
Cobalt		-	-	-	-	-
Copper		0.5 mg/L -	B	1 mg/L	D	IFC guidelines are stricter
Iron		1.0 mg/L	B	3 mg/L	D	IFC guidelines are stricter
Lead		0.5mg/L	B	-	-	-
Mercury		0.005mg/L	B	-	-	-
Methylene Blue Active Substances		-	-	-	-	-
Manganese		-	-	-	-	-
Nickel		-	-	-	-	-
Selenium		-	-	-	-	-
Silver		-	-	-	-	-
Zinc		1.0 mg/L	B	1 mg/L	D	IFC guidelines are stricter
Cyanide	-	-	-	-	-	-
	-	-			-	-
Ammonia		-	-	10 mg/L	E	-
Fluoride		-	-	-	-	-
Nitrate		-	-	-	-	-
Nitrite		-	-	-	-	-

Parameter	IFC General EHS Guidelines		Indonesian Standards		Remarks
	Limit	Source	Limit	Source	
Phenols	-	-	-	-	-
Phosphorus	2.0 mg/L	A	10 mg/L	D	IFC guidelines are stricter
Sulphide	-	-	-	-	-
Stannum / Tin	-	-	-	-	-
Total Hydrocarbons	-	-	-	-	-
Total Coliform Bacteria	400 MPN / 100 ml	A	3000 MPN/100ml	E	IFC guidelines are stricter
Dioxins, Furans, other toxics such as PAH (Polyaromatic Hydrocarbons)	-	-	-	-	-
Temperature	< 32ºC[1] (after mixing)	B	40 ºC discharge and 2 ºC at 150 m.	D	IFC guidelines are stricter

Note: The figures in red are the more stringent requirements

Table A4: Noise Emissions

Parameter	IFC EHS General Guidelines		Indonesian Standards		Remarks
	Limit	Source	Limit	Source	
Industrial; Commercial	70 dBA (both day and night)	A	70 dbA (industrial boundary day and night) 85 dbA (for 8 hour exposure at workplace)	F G	For Indonesian standard, 70 dbA is the site boundary limit while 85 dbA is the point source limit
Residential; institutional; educational	55 dBA day and 45 dBA at night		55 dBA residential area day and night	F	

Note: The figures in red are the more stringent requirements

Source:

A – International Finance Corporation: Environmental Health and Safety Guidelines, April 30 2007.

B – International Finance Corporation: Environmental Health and Safety Guidelines for Thermal Power Plants, December 2008

C- Government Regulation No. 41 of 1999 regarding Air Pollution Control

[1] Elevated temperature areas due to discharge of once through cooling water should be minimised by adjusting intake and outfall design through the project specific EA depending on sensitive aquatic ecosystems around the discharge point.

D – Ministry of Environment Regulation No. 08 of 2009 regarding Waste water standard for thermal power plant.

E – Ministry of Environment and Forestry Regulation No. 68 of 2016 regarding Domestic Waste Water Standard.

F – Ministry of Environmental Decree No. 48 of 1996 regarding Noise Standard

G – Ministry of Manpower Regulation No. 13 of 2011 regarding Limited Value of Physical and Chemical Factors at Workplace.

Table A5: Relevant WHO drinking water chemical parameters

Table A3.3 Guideline values for chemicals that are of health significance in drinking-water

Chemical	Guideline value mg/l	Guideline value µg/l	Remarks
Acrylamide	0.0005[a]	0.5[a]	
Alachlor	0.02[a]	20[a]	
Aldicarb	0.01	10	Applies to aldicarb sulfoxide and aldicarb sulfone
Aldrin and dieldrin	0.000 03	0.03	For combined aldrin plus dieldrin
Antimony	0.02	20	
Arsenic	0.01 (A, T)	10 (A, T)	
Atrazine and its chloro-s-triazine metabolites	0.1	100	
Barium	1.3	1 300	
Benzene	0.01[a]	10[a]	
Benzo[*a*]pyrene	0.0007[a]	0.7[a]	
Boron	2.4	2 400	
Bromate	0.01[a] (A, T)	10[a] (A, T)	
Bromodichloromethane	0.06[a]	60[a]	
Bromoform	0.1	100	

Table A3.3 (continued)

Chemical	Guideline value mg/l	Guideline value µg/l	Remarks
Cadmium	0.003	3	
Carbofuran	0.007	7	
Carbon tetrachloride	0.004	4	

Table A3.3 (continued)

	Guideline value		
Chemical	**mg/l**	**µg/l**	**Remarks**
Chlorate	0.7 (D)	700 (D)	
Chlordane	0.0002	0.2	
Chlorine	5 (C)	5 000 (C)	For effective disinfection, there should be a residual concentration of free chlorine of ≥ 0.5 mg/l after at least 30 min contact time at pH < 8.0. A chlorine residual should be maintained throughout the distribution system. At the point of delivery, the minimum residual concentration of free chlorine should be 0.2 mg/l.
Chlorite	0.7 (D)	700 (D)	
Chloroform	0.3	300	
Chlorotoluron	0.03	30	
Chlorpyrifos	0.03	30	
Chromium	0.05 (P)	50 (P)	For total chromium
Copper	2	2 000	Staining of laundry and sanitary ware may occur below guideline value
Cyanazine	0.0006	0.6	
2,4-D[b]	0.03	30	Applies to free acid
2,4-DB[c]	0.09	90	
DDT[d] and metabolites	0.001	1	
Dibromoacetonitrile	0.07	70	
Dibromochloromethane	0.1	100	
1,2-Dibromo-3-chloropropane	0.001[a]	1[a]	
1,2-Dibromoethane	0.0004[a] (P)	0.4[a] (P)	
Dichloroacetate	0.05[a] (D)	50[a] (D)	
Dichloroacetonitrile	0.02 (P)	20 (P)	
1,2-Dichlorobenzene	1 (C)	1 000 (C)	
1,4-Dichlorobenzene	0.3 (C)	300 (C)	
1,2-Dichloroethane	0.03a	30[a]	
1,2-Dichloroethene	0.05	50	
Dichloromethane	0.02	20	
1,2-Dichloropropane	0.04 (P)	40 (P)	
1,3-Dichloropropene	0.02[a]	20[a]	
Dichlorprop	0.1	100	
Di(2-ethylhexyl)phthalate	0.008	8	
Dimethoate	0.006	6	
1,4-Dioxane	0.05[a]	50[a]	Derived using tolerable daily intake approach as well as linearized multistage modelling

Table A3.3 (continued)

	Guideline value		
Chemical	**mg/l**	**μg/l**	**Remarks**
Edetic acid	0.6	600	Applies to the free acid
Endrin	0.0006	0.6	
Epichlorohydrin	0.0004 (P)	0.4 (P)	
Ethylbenzene	0.3 (C)	300 (C)	
Fenoprop	0.009	9	
Fluoride	1.5	1 500	Volume of water consumed and intake from other sources should be considered when setting national standards
Hexachlorobutadiene	0.0006	0.6	
Hydroxyatrazine	0.2	200	Atrazine metabolite
Isoproturon	0.009	9	
Lead	0.01 (A, T)	10 (A, T)	
Lindane	0.002	2	
Mecoprop	0.01	10	
Mercury	0.006	6	For inorganic mercury
Methoxychlor	0.02	20	
Metolachlor	0.01	10	
Microcystin-LR	0.001 (P)	1 (P)	For total microcystin-LR (free plus cell-bound)
Molinate	0.006	6	
Monochloramine	3	3 000	
Monochloroacetate	0.02	20	
Nickel	0.07	70	
Nitrate (as NO_3^-)	50	50 000	Based on short-term effects, but protective for long-term effects
Nitrilotriacetic acid	0.2	200	
Nitrite (as NO_2^-)	3	3 000	Based on short-term effects, but protective for long-term effects
N-Nitrosodimethylamine	0.0001	0.1	
Pendimethalin	0.02	20	
Pentachlorophenol	0.009[a] (P)	9[a] (P)	
Perchlorate	0.07	70	
Selenium	0.04 (P)	40 (P)	
Simazine	0.002	2	
Sodium dichloroisocyanurate	50 40	50 000 40 000	As sodium dichloroisocyanurate As cyanuric acid
Styrene	0.02 (C)	20 (C)	
2,4,5-T[a]	0.009	9	
Terbuthylazine	0.007	7	

Table A3.3 (continued)

	Guideline value		
Chemical	**mg/l**	**µg/l**	**Remarks**
Tetrachloroethene	0.04	40	

Table A3.3 (continued)

	Guideline value		
Chemical	**mg/l**	**µg/l**	**Remarks**
Toluene	0.7 (C)	700 (C)	
Trichloroacetate	0.2	200	
Trichloroethene	0.02 (P)	20 (P)	
2,4,6-Trichlorophenol	0.2[a] (C)	200[a] (C)	
Trifluralin	0.02	20	
Trihalomethanes			The sum of the ratio of the concentration of each to its respective guideline value should not exceed 1
Uranium	0.03 (P)	30 (P)	Only chemical aspects of uranium addressed
Vinyl chloride	0.0003[a]	0.3[a]	
Xylenes	0.5 (C)	500 (C)	

A, provisional guideline value because calculated guideline value is below the achievable quantification level; C, concentrations of the substance at or below the health-based guideline value may affect the appearance, taste or odour of the water, leading to consumer complaints; D, provisional guideline value because effective disinfection may result in the guideline value being exceeded; P, provisional guideline value because of uncertainties in the health database; T, provisional guideline value because calculated guideline value is below the level that can be achieved through practical treatment methods, source protection, etc.

[a] For substances that are considered to be carcinogenic, the guideline value is the concentration in drinking-water associated with an upper-bound excess lifetime cancer risk of 10^{-5} (one additional case of cancer per 100 000 of the population ingesting drinking-water containing the substance at the guideline value for 70 years). Concentrations associated with upper-bound estimated excess lifetime cancer risks of 10^{-4} and 10^{-6} can be calculated by multiplying and dividing, respectively, the guideline value by 10.

[b] 2,4-Dichlorophenoxyacetic acid.

[c] 2,4-Dichlorophenoxybutyric acid.

[d] Dichlorodiphenyltrichlorethane.

[e] 2,4,5-Trichlorophenoxyacetic acid.

Appendix H. Technical Report – Air Quality Impact Assessment

Riau 275 MW Gas Combined Cycle Power Plant IPP - ESIA

Technical Report - Air Quality Assessment

AM039100-400-GN-RPT-1010 | V5

October 2018

Project Name

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V1	April 2018	Final Draft for Issue	A Kubale	B Clarke	E Morrissey
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V3	July 2018	Final Draft for IFC Disclosure	C Bender	B Clarke	E Morrissey
V4	July 2018	Revision to address ADB comments	C Bender	B Clarke	E Morrissey
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Revision	Issue approved	Date Issued	Issued to	Comments
V0	4 April 2018	5 April 2018	MRPR	Draft for client review
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V3	July 2018	July 2018	MRPR	Final Draft for IFC Disclosure

Contents

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The sole purpose of this report and the associated services performed by Jacobs New Zealand Limited (Jacobs) is to describe the air quality impacts for Riau IPP Project Environmental and Social Impact Assessment (ESIA), in accordance with the scope of services set out in the contract between Jacobs and the Client. That scope of services, as described in this report, was developed with the Client.

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1. Introduction

1.1 Overview

This Technical Report is part of an Environmental and Social Impact Assessment (ESIA) for the construction and operation of the Riau 275 MW Gas Combined Cycle Power Plant IPP Project (hereafter referred to as 'the Project'). The Project comprises the construction, completion, testing, commissioning, and operation of the Combined Cycle Power Plant (CCPP), associated gas pipeline, transmission lines, water supply lines, and cooling tower.

This document is a technical assessment of the potential impacts of the Project on the air quality in the vicinity of the project.

1.2 Project Description

The Riau 275 MW CCPP will be a new power station constructed on a greenfield site.

The key components of the Project include a 275 megawatt (MW) combined cycle power plant (CCPP), a 40 km long gas supply pipeline which will bring fuel to the site, a 150 kilovolt (kV) switchyard, and an approximately 750 m long transmission line to connect the power plant to the PT Perusahaan Listrik Negara (Persero) ("PLN") grid. Once constructed, ownership of the switchyard and transmission line collectively known as the Special Facilities will be transferred to PLN. At the end of the 20-year term of the Power Purchase Agreement (PPA), PLN will take ownership of the power plant and gas supply pipeline.

The Project will be located approximately 10 km due east of Pekanbaru City, approximately 3 km south of the Siak River. The power plant and switchyard will be comfortably accommodated inside the 9 ha of land being procured by the Project Sponsors. The power plant is a 2 x 1 combined cycle plant, designed to deliver up to 275 MW over the 20-year term of the PPA. It will burn natural gas fuel only. It will consist of:

- 2 x GE 6F.03 gas turbine (GT) generator sets;
- 2 x supplementary fired heat recovery steam generators (HRSGs);
- 1 x steam turbine (ST) generator set;
- A wet mechanical draft cooling tower;
- Gas reception area; and
- All normal balance of plant systems.

In addition, there will be:

- A 150 kV switchyard at the plant, with an approximately 750 m double-phi connection to intercept the Tenayan – Pasir Putih 150 kV transmission line;
- A 40 km gas pipeline running from the gas connection point at an offtake location known as SV1401 on the main Grissik to Duri gas pipeline which is located north-east of the power plant in the Siak Regency;
- Temporary jetty constructed on southern bank of Siak River; and
- Water supply and discharge pipelines to and from the Siak River.

The CCPP will have an emergency black start facility, comprising 4 x 1.2 MWe containerised diesel generator sets. This facility is to supply power to the power plant in the unlikely event of a station blackout due to a national grid failure.

An outline of the Project area is detailed in Figure 1.1.

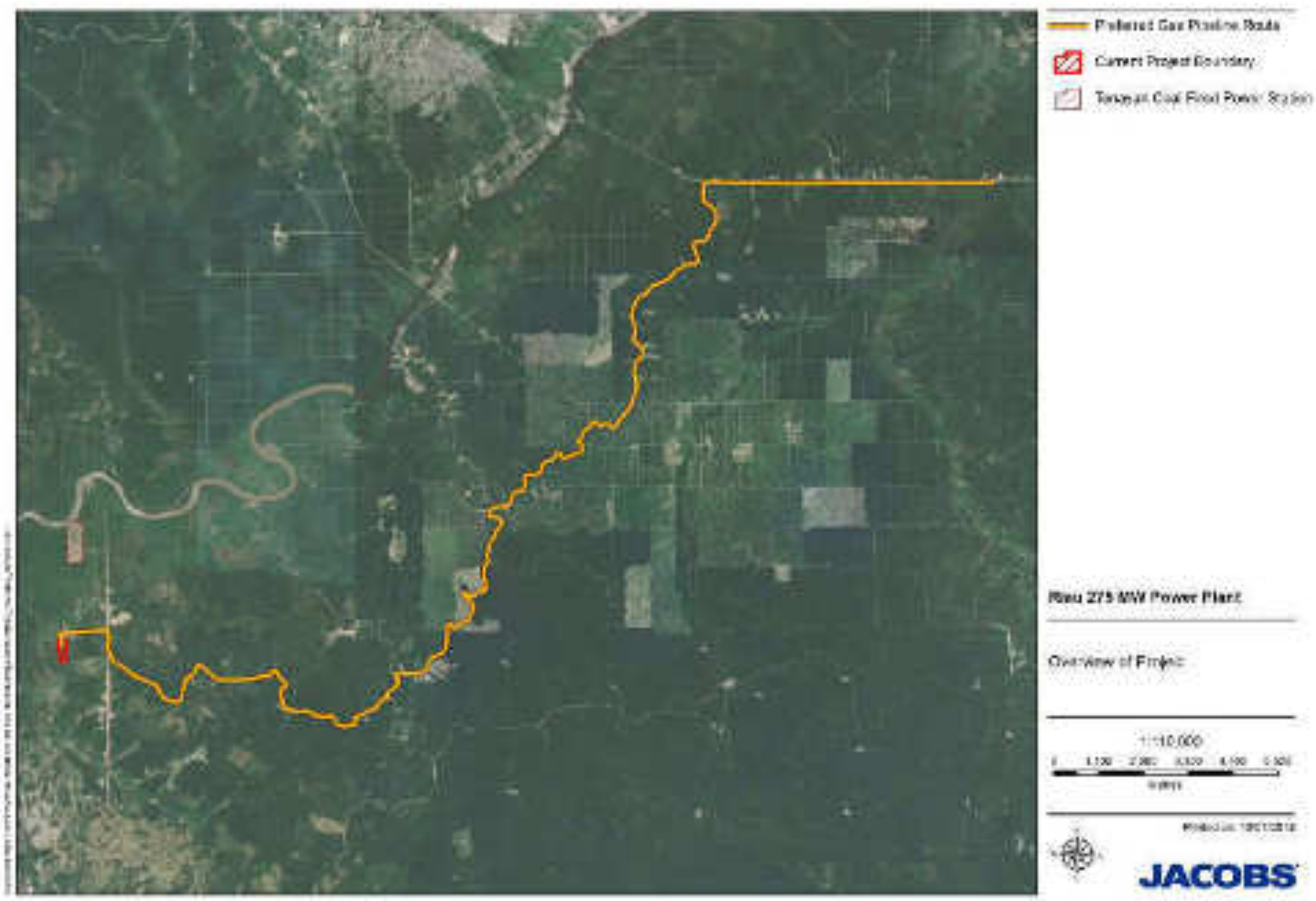

Figure 1.1 : Outline of the Project Area

1.3 Purpose

This report assesses the potential impacts associated with the construction and operation of the Project on air quality, and provides an assessment of potential air quality impacts at nearby residential locations, including:

- Release of air contaminants from the combustion of natural gas, including nitrogen oxides (NO_X), fine particulate matter (PM_{10}), carbon monoxide (CO) and sulphur dioxide (SO_2).
- Dust from construction activities (power plant, gas pipeline and water pipelines).

The report is one of several technical reports prepared as a supporting documentation for the ESIA for the Project.

2. Baseline Air Quality

2.1 Site Description

2.1.1 Terrain and Land Use

The Project area is located in the Sail Sub District, Tenayan Raya District, Pekanbaru City, and Province of Riau. The power plant site is in slightly undulating terrain. The predominant land use in the surrounding area is agricultural, consisting principally of palm oil plantations.

The nearest sensitive receptors to the Project power plant site are residences located approximately 500 m to the south and south-west of the Project site boundary, as indicated in Figure 2.1. These are among other scattered rural residences, though it is understood that these are infrequently inhabited and are predominantly for sheltering agricultural workers. The main residential areas of Pekanbaru are located 10 km to the west of the power plant site and there are rural villages along the pipeline route.

Tenayan CFPP is an existing coal fired power plant located approximately 2 km to the north of the power plant Project area. At the time of writing this report, a new government administration area is also being constructed to the south-west of the Project site.

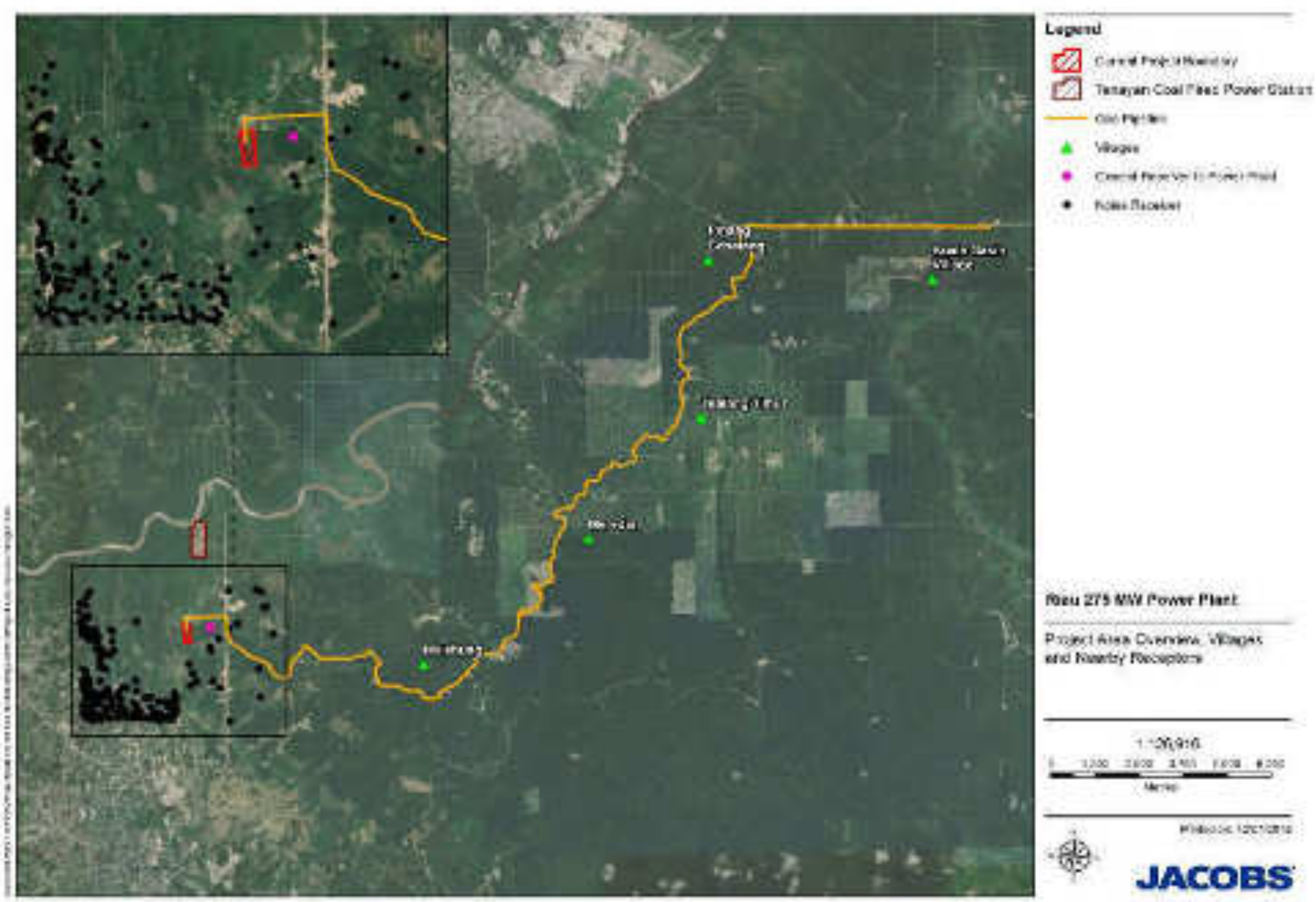

Figure 2.1 : Villages and Receptors surrounding the Project area

2.1.2 Climate and Meteorology

Pekanbaru has a tropical climate, with the area being characterised by seasonally high rainfall and high humidity. Average annual rainfall is around 3,000 mm, and falls mainly between November and April, with a drier period between June and September. Air temperature ranges between 20ºC and 37ºC and humidity ranges between 40 and 100%.

Wind is generally light, but the area is subject to monsoon weather with high winds during the wet months. The predominant wind direction varies throughout the year, with southerly winds occurring primarily during the dry season and northerly winds during the rainy season. The average wind speed is less than 3 m/s. The design and general site climate conditions are provided in Table 2.1.

Table 2.1 : General site ambient climate conditions

Parameter	Value
Ambient air temperature range	20°C-37°C
Design ambient air temperature	28°C
Relative humidity range	40%-100%
Design Relative humidity	80%
River water temperature	Approximately 30°C
Average annual rainfall	Approximately 3,000 mm - rainy season between November and April
Maximum rainfall	Approximately 136 mm/h
Average wind speed	Less than 3 m/s, predominantly from the north or west
Site elevation	Approximately 25 mAMSL

The wind rose shown in Figure 2.2 has been generated from data collected at an ambient air monitoring site in Pekanbaru for 2010 to 2015. The data shows the area is affected by winds predominantly from the north-western and north-eastern sectors, and from the south-southeast. Calm conditions, which are a wind speed of less than 0.5m/s, are predicted to occur for 26.8% of the time and the average wind speed for the data period is 0.54 m/s. A photograph of the monitoring station, provided as Figure 2.6, indicates that the site is in close vicinity to one or more tall buildings which may influence the winds measured at the site. Given the very low wind speeds observed, the wind data is considered to not be representative of meteorological conditions in the wider area.

Meteorological data suitable for running air dispersion models should be measured at a height of 10 m above the ground and away from features that would interfere with the wind speed and direction. For the purpose of this assessment, which includes dispersion modelling of the Project's air discharges, the prognostic meteorological model TAPM has been used to generate a meteorological dataset for the area. This is discussed further in Section 5 of this Technical Report.

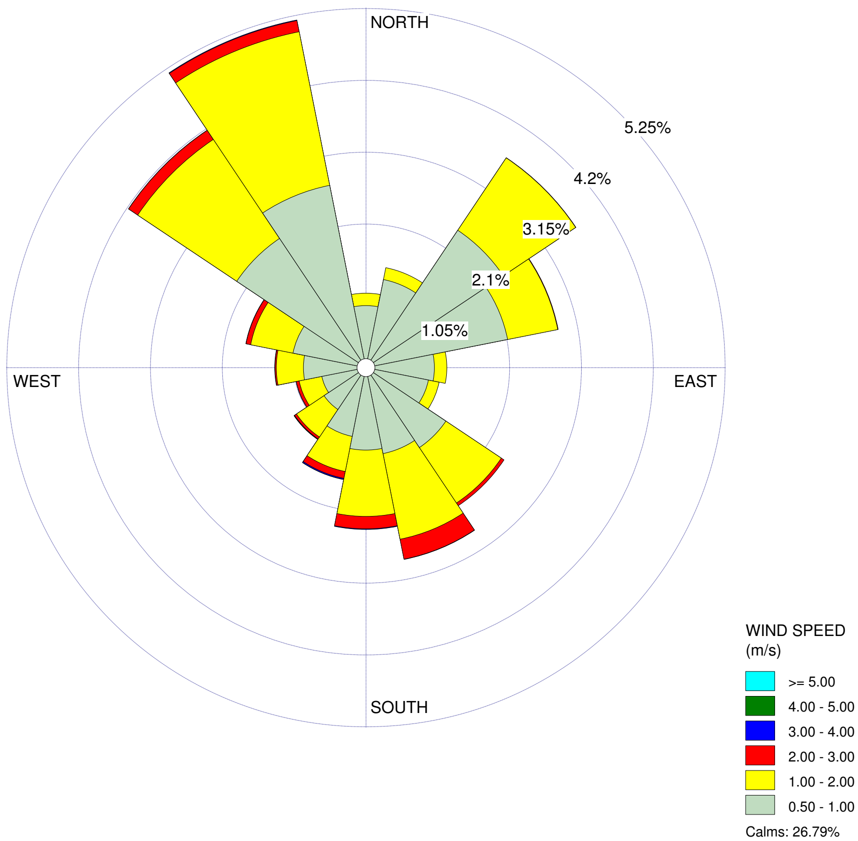

Figure 2.2 : Windrose of Data Collected at Pekanbaru (Years 2010 to 2015)

2.2 Baseline Ambient Air Quality

Energy production, industrial and household discharges from fuel combustion, and vehicular traffic are the primary anthropogenic contributors to air pollution in the Project area. The main pollutants identified of interest are particulate matter (as Total Suspended Particulate (TSP), PM_{10} and $PM_{2.5}$), CO, NO_2, and SO_2.

The Project area primarily consists of palm oil plantations for several kilometres in all directions, with limited residential land use. The main population centre in the area is Pekanbaru City, the nearest residential areas to the power plant site are located more than 3 km to the west of the plant site. The main source of industrial pollution in the local area is the Tenayan CFPP located 2 km to the north of the site.

The scale of residential and industrial activity in the Project area is relatively low, and consequently ambient air quality is expected to be relatively good.

2.2.1 Ambient Air Monitoring Data

Ambient monitoring data has been collected from a variety of sources to assess the existing baseline ambient air quality of the Project area.

<u>Baseline Monitoring for the Project Area (Power Plant)</u>

Baseline ambient monitoring data has been collected in association with the Project at six monitoring sites near the Project area. Two rounds of sampling have been undertaken, one during July 2017 for the dry season, and one during January-February 2018 for the wet season. A map showing the sampling locations is provided in Figure 2.3. The parameters monitored and sampling times conducted at the four sites included:

- Total suspended particulate using high volume sampler (24-hour sampling period per monitoring event) in accordance with Indonesian Standard Method SNI 19-7119.3-2005;
- PM_{10} using low volume sampler fitted with a PM_{10} sampling head (24-hour sampling period per monitoring event) in accordance with Indonesian Standard Method SNI 19-7119.15 (2016);
- $PM_{2.5}$ using low volume sampler fitted with a PM_{10} sampling head (24-hour sampling period per monitoring event) in accordance with Indonesian Standard Method SNI 19-7119.14 (2016);
- Nitrogen dioxide (NO_2) by active sampling (1-hour sampling period) in accordance with Indonesian Standard Method SNI 19-7119.2-2005, and passive sampling (14-day sampling period per monitoring event) in accordance with NIOSH Standard 6700 (1998);
- Sulphur dioxide (SO_2) by active sampling (1-hour sampling period per monitoring event) in accordance with Indonesian Standard Method SNI 19-7119.7-2005;
- Ozone (O_3) by active sampling (1-hour sampling period per monitoring event) in accordance with Indonesian Standard Method SNI 19-7119.8-2005;
- Total non-methane hydrocarbons (TNMHC) by active sampling (30-minute sampling period) in accordance with Indonesian Standard Method SNI 19-7119.13-2005; and
- Lead (Pb) by active sampling (1-hour average) in accordance with Indonesian Standard Method SNI 19-7119.4-2005.

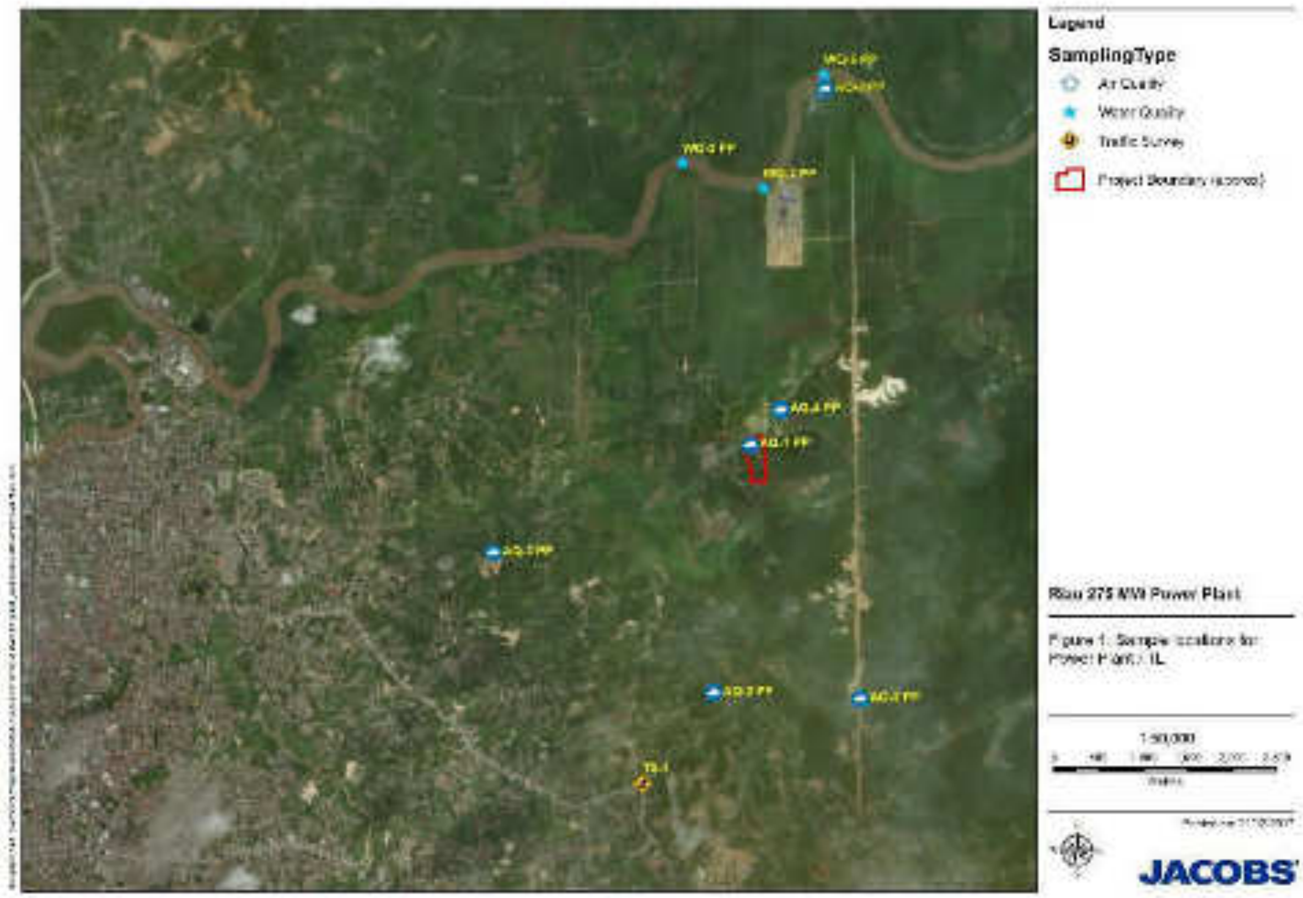

Figure 2.3 : Baseline Sampling Locations for Riau CCPP Power Plant

A summary of the baseline ambient air quality monitoring events, including number of monitoring sites and number of samples collected per site, is provided in Table 2.2 below. Summaries of the monitoring results for the dry and wet season are provided respectively in Table 2.3 and Table 2.4 below.

Table 2.2 Summary of Ambient Air Monitoring Events

Contaminant	Number of monitoring sites	Total number of samples
Dry Season (July-August 2017)		
SO_2, O_3, NO_2, TSP, Pb, HC, CO	10	10
TSP, PM_{10}, $PM_{2.5}$	2	8
Passive NO_2	4	8
Wet Season – Power Plant Sites (January-February 2018)		
SO_2, O_3, NO_2, TSP, Pb, HC, CO	3	3
PM_{10}, $PM_{2.5}$	3	6
Wet Season – Pipeline Sites (January-February 2018)		
SO_2, O_3, NO_2, TSP, Pb, HC, CO, PM_{10}, $PM_{2.5}$	2	4
Passive NO_2	4	4

Table 2.3 : Baseline Ambient Air Monitoring Results, July 2017 (dry season)

Contaminant	Range of Measured Concentrations (µg/m^3)						Overall Average (µg/m^3)	Indonesian Air Quality Standard (µg/m^3)	WHO Air Quality Guidelines (µg/m^3)
	AQ-1	AQ-2	AQ-3	AQ-4	AQ-5	AQ-6			
SO_2 (1-hr avg)	<34	<34	<34	<34	<34	<34	<34	*900*	*500*
O_3 (1-hr avg)	<30	<30	<30	<30	<30	<30	<30	*235*	*n/a*
NO_2 (1-hr avg)	<17	<17	<17	<17	<17	<17	<17	*400*	*200*
NO_2 (14 day average)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	*n/a*	*n/a*
CO (1-hr avg)	0	1200	0	0	0	0	200	*30000*	*n/a*
TNMHC (30-minute avg)	1.0	1.0	0.7	1.6	1.6	1.3	1.2	*160*	*n/a*
TSP (1-hr avg)	49	92	54	6	55-317 (avg 136)	36-141 (avg 69)	95	*230*	*n/a*
PM_{10} (24-hr avg)	n/a	n/a	n/a	n/a	20-66 (avg 45)	9-42 (avg 25)	38	*150*	*50*
$PM_{2.5}$ (24-hr avg)	n/a	n/a	n/a	n/a	11-31 (avg 21)	<2-22 (avg 11)	*16*	*65*	*25*
Pb (1-hr avg)	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	*2*	*n/a*

Note: < refers to the detection limit of the sampling method

Table 2.4 : Baseline Ambient Air Monitoring Results, January-February 2018 (wet season)

Contaminant	Range of Measured Concentrations (µg/m^3)						Overall Average (µg/m^3)	Indonesian Air Quality Standard (µg/m^3)	WHO Air Quality Guidelines (µg/m^3)
	AQ-1	AQ-2	AQ-3	AQ-4	AQ-5	AQ-6			
NO_2 (1-hr avg)	<17	<17	<17	<17	n/a	<17	*<17*	*400*	*200*
PM_{10} (24-hr avg)	n/a	n/a	n/a	n/a	10-53	13-43	30	*150*	*50*
$PM_{2.5}$ (24-hr avg)	n/a	n/a	n/a	n/a	5-20	17-23	*16*	*65*	*25*

Note: < refers to the detection limit of the sampling method

The ambient monitoring undertaken shows that the ambient air concentrations measured are influenced to some degree by human activity, with concentrations being above what would be typically observed in a rural area. Generally ambient air quality in the project area is good, with ambient air concentrations of contaminants being consistently below the national and international guidelines.

With the exception of particulate matter, the air quality at the sites was determined to be of good quality, with SO_2, NO_2, CO and ozone ambient air concentrations being relatively low, and well below the Indonesian Ambient Air Standards and the World Health Organisation (WHO) Ambient Air Guidelines. PM_{10} concentrations are higher and at times exceeding the WHO 24-hour guideline value of 50 µg/m^3 for PM_{10} and 25 µg/m^3 for $PM_{2.5}$, though are consistently below the Indonesian ambient air standards. It is likely that the occasionally high TSP measurements are a result of the monitors being placed in locations of cleared and unsealed land where dust can be easily mobilised by wind or vehicular traffic. This is demonstrated in the photograph of air quality sampling site AQ-5, shown as Figure 2.4, which had the highest TSP reading of 317 µg/m^3 as a 24-hour average. Measurements of particulate matter taken elsewhere in the area were generally lower, and likely to be more representative of actual conditions during the plant operation. However, the dusty nature of the disturbed soil does indicate the need for good practice dust management procedures during the construction phase of the Project.

Figure 2.4 : Air Quality Sampling Location AQ-5

Passive sampling for NO_2 was also undertaken at four of the baseline monitoring sites (AQ-1, AQ-2, AQ-3 and AQ-4). Passive samplers were deployed for a 14-day sampling duration at each site for three months over the dry season and for six weeks over the wet season. As with the manual sampling, concentrations of NO_2 at each of the sites were also determined to be below the method detection limit (equivalent to an ambient air concentration of around 0.01 µg/m^3).

Ambient Air Quality Monitoring Along the Gas Pipeline Route

Ambient air monitoring data has also been collected along the gas pipeline route, at four locations. A map of these locations is provided as, and the dry and wet season baseline results are provided in Table 2.5 below. Since sampling was undertaken a section of the gas pipeline route has changed and this is also shown in Figure 2.5 below. Monitoring results along the pipeline route were similar to those in the main Project area, with all contaminants measured below Indonesian Ambient Air Standards and WHO Ambient Air Guidelines.

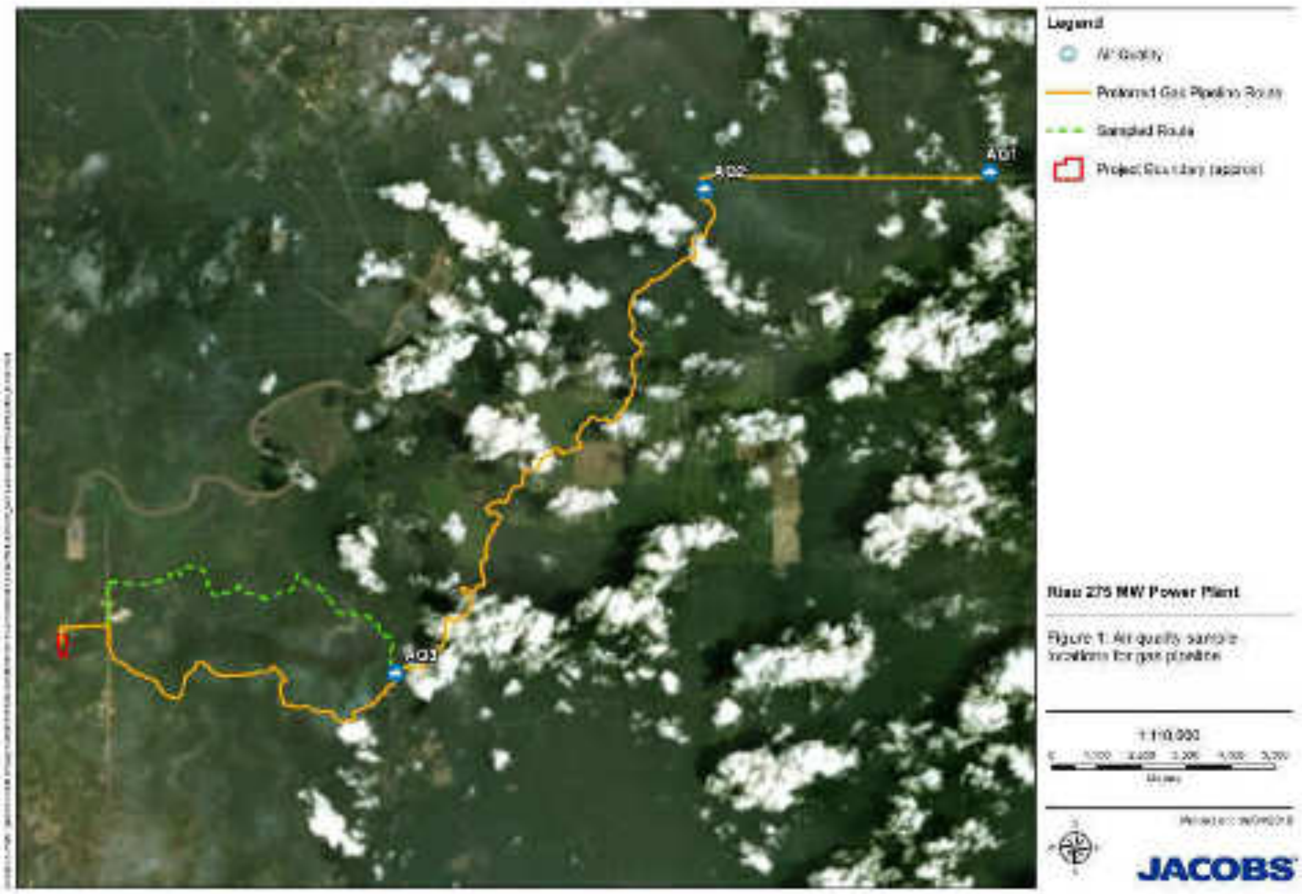

Figure 2.5 : Baseline Sampling Locations for Riau CCPP Gas Pipeline Route

Table 2.5 : Baseline Ambient Air Monitoring Results along Gas Pipeline Route, January-February 2018 (wet season)

Contaminant	Measured Concentrations (µg/m³)			Overall Average (µg/m³)	Indonesian Air Quality Standard (µg/m³)	WHO Air Quality Guidelines (µg/m³)
	AQ-1	AQ-2	AQ-3			
SO_2 (1-hr avg)	<33	<33	<33	<33	*900*	*500*
O_3 (1-hr avg)	<34	<34	69	<46	*235*	*n/a*
NO_2 (1-hr avg)	<17	<17	<17	<17	*400*	*200*
CO (1-hr avg)	<114	<114	<114	<114	*30000*	*n/a*
TNMHC (30-minute avg)	<1.6	<1.6	<1.6	<1.6	*160*	*n/a*
TSP (1-hr avg)	88	81	71	80	*230*	*n/a*
PM_{10} (24-hr avg)	12-34	56	26-38	26	*150*	*50*
$PM_{2.5}$ (24-hr avg)	10-23	24	14-21	*16*	*65*	*25*
Pb (1-hr avg)	<0.06	<0.06	<0.06	<0.06	*2*	*n/a*

Pekanbaru City Continuous Ambient Monitoring

To supplement the manual and passive ambient air sampling undertaken for the Project, Jacobs has sourced continuous ambient air monitoring data from the city of Pekanbaru, which maintains an ambient monitoring station approximately 9 km west of the Project. This data is reproduced in Table 2.6.

A photograph of the Pekanbaru monitoring site is shown as Figure 2.6, with Figure 2.7 showing the location of this station (labelled as PEF2) in relation to the Project. Data collected at this site consists of half-hourly measurements of NO, NO_2, O_3, SO_2 and PM_{10}, measured from 2011 to 2015. This data provides a good indication of existing ambient air quality in the Pekanbaru airshed, including any short-term and seasonal variations that could be expected to occur at the power plant site.

It is expected that contaminant concentrations at the urban Pekanbaru City monitoring location would be higher than that in the Project area, due to higher levels of traffic in the City as compared to the Project site which will result in elevated levels of NO_X. This assumption is supported by the baseline monitoring undertaken as part of the air quality assessment described above, which measured lower concentrations of contaminants in the Project area compared to those measured in Pekanbaru.

Figure 2.6 : Photograph of PEF-2 Ambient Air Monitoring Site in Pekanbaru

Figure 2.7 : Location Map of PEF-2 Ambient Monitoring Site in Pekanbaru in relation to the Project

Table 2.6 : Summary of Ambient Monitoring Data Collected at Pekanbaru, 2011 - 2015

Statistic	NO_2 (µg/m³)		Ozone (µg/m³)	PM_{10} (µg/m³)	SO_2 (µg/m³)	
	1-hour avg	24-hour avg	1-hr avg	24-hr avg	1-hour avg	24-hour avg
average	10		59	48	67	
median	6.8	6.9	45	25	59	61
70th	14	12	88	37	84	85
95th	30	24	166	174	176	153
99th	45	30	233	424	259	254
99.9th	115	46	312	562	341	305
Indonesian Air Quality Standards	400	150	235	150	900	364
WHO Ambient Air Guidelines	200	n/a	n/a	50	n/a	20

The continuous monitoring data in Pekanbaru indicates that the ambient air quality is relatively good with respect to NO_2. The concentrations measured over the 2011-2015 period are generally (excluding outliers) less than 25% of the Indonesian 1-hour average ambient air standard of 400 ug/m³, and less than 15% of the 24-hour average standard of 150 µg/m³. Concentrations of PM_{10} and SO_2 are significantly higher than those observed in the Project area during the baseline air quality monitoring. This is in part due to the more urban nature of the Pekanbaru site, which includes discharges from traffic (including road dust and fuel combustion) and domestic fires etc. It may also be attributed to the longer, continuous nature of the monitoring which is able to capture high pollution events such as that caused by regional-scale agricultural burning and forest fires.

Analysis of PM_{10} concentrations measured during the 2011-2015 period, as shown in Figure 2.8 below, shows the concentrations to be highly variable over the course of a year, with significantly elevated concentrations occurring during the June to October dry season when open agricultural burning and forest fires are common throughout the region. These sources contribute to a regional haze which is not attributable to individual industrial sources. The 2015 fire season has been noted[1] as being the worst year for haze on record in Pekanbaru, resulting in widespread mobilisation of the population to combat brush fires. Since then government intervention has greatly reduced the incidence of these fires, and the regional haze problem has been less of a problem.

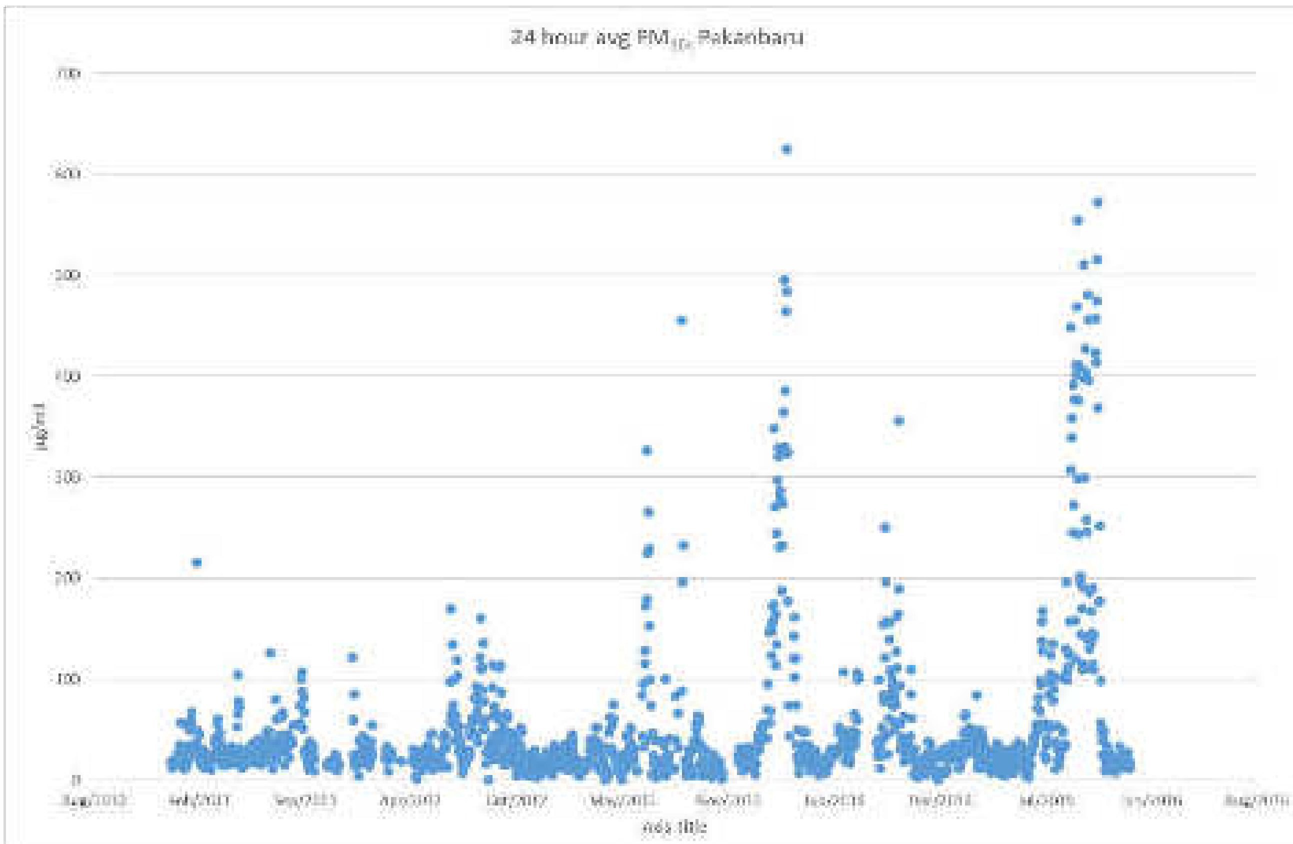

Figure 2.8 : 24-hour Average PM_{10} Concentrations as Measured at Pekanbaru, 2011-2015

Elevated concentrations of SO_2 are assumed to be the result of elevated sulphur content of fuels used for transportation and other industrial sources burning fuels containing sulphur in the area where the continuous ambient air monitoring was undertaken. Given the low level of traffic in the Project area, the concentrations of SO_2 are also expected to be much lower.

[1] Various media publications

3. Impact Assessment Methodology

3.1 Introduction

The impact assessment methodology applies to the assessment of potential environmental impacts arising from the Project. The impact assessment methodology has been developed in accordance with good industry practice and the potential impacts have been identified in the context of the Project's Area of Influence (AoI), in accordance with ADB Environmental Safeguards and IFC Performance Standard 1 (Assessment and Management of Environmental and Social Risks and Impacts).

3.2 Spatial and Temporal Scope

The AoI constitutes the spatial extent of the ESIA. The AoI encompasses all areas directly and indirectly affected by Project components, which are primarily contained within the power plant site (for construction effects) and in the wider area where air discharges from the Project's operation will have an effect. Operational impacts have been considered out to a 5 km distance beyond which the impacts of the discharges are considered to be at a much lower level.

The study period is a time limit that will be used in predicting and undertaking an impact evaluation as part of the impact assessment. The period is used as a basis to determine if there are any changes to the environmental baseline resulting from the Project activities. Operational effects have been assessed using dispersion model simulations over a two-year period which is expected to encompass all likely meteorological conditions for the area.

3.3 Baseline Environmental Conditions

Baseline data collection refers to the collection of background data in support of the environmental assessment. Ideally baseline data should be collected prior to development of a project, but often this is not possible. Baseline data collection can also occur throughout the life of a project as part of ongoing monitoring of environmental and social conditions.

World Bank (1999) guidance on identification of baseline data states that it '*…describes relevant physical, biological, and socioeconomic conditions, including any changes anticipated before the project commences. Also takes into account current and proposed development activities within the project area but not directly connected to the project. Data should be relevant to decisions about project location, design, operation, or mitigatory measures. The section indicates the accuracy, reliability, and sources of the data.*'

Baseline information used for this ESIA has utilised primary data collected through on-site surveys by Environmental and Social Specialists from Jacobs and their sub-consultants, NBC, in August 2017 and February 2018. Secondary data sources collected from desk-based studies and literature reviews have also been used, including ambient air monitoring data obtained from the city of Pekanbaru.

3.3.1 Adopted Background Concentrations

For the purpose of this assessment, existing baseline levels need to be estimated to determine the potential cumulative effects of contaminants discharged from the Project with existing levels in order to assess the potential for the Project to result in exceedances of the ambient air standards and guidelines. In order to provide an element of conservatism to the assessment, data from the Pekanbaru continuous ambient air monitoring station has been used, which has a statistically robust set of ambient air monitoring data. For 1-hour and 24-hour averages, the 70^{th} percentile contaminant concentrations measured at the Pekanbaru ambient air monitoring station over the five-year period 2011-2015 have been used. This is in accordance with the Victorian

EPA recommendations (Victoria EPA, 2001) which recommends adding the 70th percentile of 1-hour average monitoring to maximum dispersion modelling results. These values are summarised in Table 3.1, and are expected to be greater than what is observed in the Project area due to the difference in land use (i.e. urban versus rural), which is confirmed by the baseline data collected in the vicinity of the Project site.

As CO is not measured at the Pekanbaru monitoring site, the highest measured 1-hour average concentration measured in the July 2017 baseline monitoring associated with the Project has been used. Similarly, $PM_{2.5}$ concentrations are not measured at Pekanbaru, and a $PM_{2.5}$:PM_{10} ratio of 50% has been assumed; this is used by the WHO Ambient Air Guidelines.

Table 3.1 : Assumed Background Concentrations of Atmospheric Contaminants in Pekanbaru

Averaging period	Background concentration (µg/m^3)					Source
	NO_2	PM_{10}	$PM_{2.5}$*	SO_2	CO**	
1-hour	14	n/a	n/a	83	1200*	70th Percentile of 1-hour averages at Pekanbaru (2011-2015)
24-hour	12	37	19	83	n/a	70th Percentile of 1-hour averages at Pekanbaru (2011-2015)
Annual	10	48	24	66	n/a	Average of all measured concentrations (2011-2015)

**Background CO concentration adopted from highest measured 1-hour average during July 2017 baseline monitoring.

Discharges of NO_X to air are a mixture of NO and NO_2, with NO gradually becoming oxidised to NO_2 by way of chemical reactions in the atmosphere. O_3 is the primary oxidising chemical in the air, and so for the purpose of predicting the conversion of NO to NO_2, the dispersion model also requires an estimation of background O_3 concentrations. O_3 concentrations measured at Pekanbaru were used (assumed at the 70th percentile of 88 µg/m^3) for the purpose of estimating NO oxidation rates.

3.4 Aspects Identification

3.4.1 Construction Phase

The construction phase of the Project is scheduled to last from late early 2018 to the end of 2020. The following stages are envisaged.

- Site clearance, levelling and general preparation;
- Construction of access road;
- Gas pipeline construction;
- Power plant and switchyard construction, including construction of water pipelines (to and from site);
- Transmission line construction; and
- Commissioning.

The construction stage includes the development of an access road which will be approximately 500 m long and run from the main road to the north of the Site. The access road will be a permanently sealed two-lane 8 m wide road. A road from the temporary jetty to the Project site may also be widened.

Construction dust arising from the dust generating activities and air emissions from construction vehicles and non-road machinery within the construction site boundary are the key concerns during construction of the Project.

3.4.2 Operational Phase

The key emission source associated with the operation of the Project is stack emissions from the combustion of natural gas during combined cycle and simple cycle operation. The main air pollutant of concern for a gas-fired combined cycle power plant is nitrogen dioxide (NO_2 while emissions of sulphur dioxide (SO_2 and particulate matter (PM) including respirable suspended particulates (PM_{10}) are likely to be minimal provided that the combustion process is optimised and efficient.

3.5 Impact Assessment

The impact assessment predicts and assesses the Project's likely positive and negative impacts, in quantitative terms to the extent possible. For each of the environmental aspects listed above, the assessment determined the sensitivity of the receiving environment and identifies impacts and assesses the magnitude and overall significance of environmental impacts. An ESIA will always contain a degree of subjectivity, as it is based on the value judgment of various specialists and ESIA practitioners. The evaluation of significance is thus contingent upon values, professional judgement, and dependent upon the environmental context. Ultimately, impact significance involves a process of determining the acceptability of a predicted impact.

3.5.1 Defining Impact

There are a number of ways that impacts may be described and quantified. An impact is essentially any change to a resource or receptor brought about by the presence of the proposed project component, project discharge or by the execution of a proposed project related activity. The assessment of the significance of impacts and determination of residual impacts takes account of any inherent mitigation measures incorporated into the Project by the nature of its design.

In broad terms, impact significance can be characterised as the product of the degree of change predicted (the magnitude of impact) and the value of the receptor/resource that is subjected to that change (sensitivity of receptor). For each impact the likely magnitude of the impact and the sensitivity of the receptor are defined. Generic criteria for the definition of magnitude and sensitivity are summarised below.

3.5.2 Direct vs Indirect Impacts

A direct impact, or first order impact, is any change to the environment, whether adverse or beneficial, wholly or partially, resulting directly from an environmental aspect related to the project. An indirect impact may affect an environmental, social or economic component through a second order impact resulting from a direct impact. For example, removal of vegetation may lead to increased soil erosion (direct impact) which causes an indirect impact on aquatic ecosystems through sedimentation (indirect impact).

3.5.3 Magnitude Criteria

The assessment of impact magnitude is undertaken by categorising identified impacts of the Project as beneficial or adverse. Then impacts are categorised as ‘major’, ‘moderate’, ‘minor’ or ‘negligible’ based on consideration of parameters such as:

- Duration of the impact – ranging from ‘well into operation’ to ‘temporary with no detectable impact’.
- Spatial extent of the impact – for instance, within the site boundary, within district, regionally, nationally, and internationally.
- Reversibility – ranging from ‘permanent thus requiring significant intervention to return to baseline’ to ‘no change’.
- Likelihood – ranging from ‘occurring regularly under typical conditions’ to ‘unlikely to occur’.

- Compliance with legal standards and established professional criteria – ranging from 'substantially exceeds national standards or international guidance' to 'meets the standards' (i.e. impacts are not predicted to exceed the relevant standards) presents generic criteria for determining impact magnitude (for adverse impacts). Each detailed assessment will define impact magnitude in relation to its environmental or social aspect.
- Any other impact characteristics of relevance.

Table 3.2 below presents generic criteria for determining impact magnitude (for adverse impacts). Each detailed assessment will define impact magnitude in relation to its environmental or social aspect.

Table 3.2 : General criteria for determining impact magnitude

Category	Description
Major	Fundamental change to the specific conditions assessed resulting in long term or permanent change, typically widespread in nature and requiring significant intervention to return to baseline; would violate national standards or Good International Industry Practice (GIIP) without mitigation.
Moderate	Detectable change to the specific conditions assessed resulting in non-fundamental temporary or permanent change.
Minor	Detectable but small change to the specific conditions assessed.
Negligible	No perceptible change to the specific conditions assessed.

3.5.4 Sensitivity Criteria

Sensitivity is specific to each aspect and the environmental resource or population affected, with criteria developed from baseline information. Using the baseline information, the sensitivity of the receptor is determined factoring in proximity, number exposed, vulnerability and the presence of receptors on site or the surrounding area. Generic criteria for determining sensitivity of receptors are outlined in Table 3.3 below. Each detailed assessment will define sensitivity in relation to its environmental or social aspect.

Table 3.3 : General criteria for determining impact sensitivity

Category	Description
High	Receptor (human, physical or biological) with little or no capacity to absorb proposed changes
Medium	Receptor with little capacity to absorb proposed changes
Low	Receptor with some capacity to absorb proposed changes
Negligible	Receptor with good capacity to absorb proposed changes

3.5.5 Impact Evaluation

The determination of impact significance involves making a judgment about the importance of project impacts. This is typically done at two levels:

- The significance of project impacts factoring in the mitigation inherently within the design of the project; and
- The significance of project impacts following the implementation of additional mitigation measures.

The impacts are evaluated taking into account the interaction between the magnitude and sensitivity criteria as presented in the impact evaluation matrix in Table 3.4 below.

Table 3.4 : Impact matrix

		Magnitude			
		Major	**Moderate**	**Minor**	**Negligible**
Sensitivity	**High**	Major	Major	Moderate	Negligible
	Medium	Major	Moderate	Minor	Negligible
	Low	Moderate	Minor	Negligible	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible

The objective of the ESIA is to identify the likely significant impacts on the environment and people of the project. In this impact assessment, impacts determined to be ‘moderate’ or ‘major’ are deemed significant. Consequently, impacts determined to be ‘minor’ or ‘negligible’ are not significant.

3.6 Assessment Criteria

Ambient air quality standards and guidelines have been developed with the primary aim to provide a basis for protecting public health from the adverse effects of air pollution and for eliminating, or reducing to a minimum, those pollutants in air that are known or likely to be hazardous to human health and wellbeing. The ambient air quality standards and guidelines provide values for evaluating the potential impact of contaminants that are commonly discharged from industrial sources.

The Indonesian Ministry of the Environment and Forestry has legislated National Ambient Air Standards that are used as one set of the evaluation criteria in determining the level of impact of the proposed power station emissions to air. The World Bank Group Environmental Health and Safety General Guidelines (WBG, 2007) and the EHS Guidelines for New Thermal Power Plants (WBG, 2008) also provide ambient air guidelines and emission limits based on those recommended by the WHO. The national and international ambient air guidelines and emission limits along with the principle of the development meeting Good International Industrial Practice (GIIP) are used to assess the potential environmental impacts on air quality from the proposed power station.

The following section sets out the emission standards and ambient air standards and guidelines applicable to this air dispersion modelling assessment.

3.6.1 Indonesian Standards

3.6.1.1 Emission Standards

For the combustion of fossil fuels, the main air quality parameters of concern are NO_X, SO_2 and PM_{10}. The proposed power plant will meet the Indonesian limit values, stipulated in Environmental Regulation No. 21 of 2008, regarding Threshold Limit of Stationary Sources. Table 3.5 sets out the emission threshold limit values for gas fired power plants.

Table 3.5 : Emission Threshold Limits for Stationary Gas-Fired Power Plants

No.	Parameter	Maximum (mg/Nm^3)
1	Sulphur Dioxide	150
2	Nitrogen Oxides as NO_2	400
3	Total Particulate	50
4	Opacity	n/a

No.	Parameter	Maximum (mg/Nm^3)

Notes:

1. The volume of gas measured in the standard state (25°C and a pressure of 1 atmosphere).

2. All parameters corrected to 3% Oxygen for gas fuel in a dry state except for opacity

3. The implementation of quality standards for 95% of emissions during normal operation time of 3 (three) months.

3.6.1.2 Ambient Air Quality Standards

The Indonesian government has promulgated the Indonesia Air Quality Standards - Government Regulation No. 41 of 1999 regarding air pollution control. This regulation sets out the ambient air quality standards for Indonesia which all developments must meet. The ambient air quality standards relevant to this assessment are presented in Table 3.6.

Table 3.6 : Indonesia Ambient Air Quality Standards, 25°C, 1 Atmosphere

Parameter	Exposure Period	Threshold Limit (25°C)
SO_2 (Sulphur dioxide)	1 hour	900 µg/Nm^3
	24 hours	365 µg/Nm^3
	1 year	60 µg/Nm^3
NO_2 (Nitrogen dioxide)	1 hour	400 µg/Nm^3
	24 hours	150 µg/Nm^3
	1 year	100 µg/Nm^3
PM_{10} (Particulate Matter <10µm)	24 hours	150 µg/Nm^3
$PM_{2.5}$ (Particulate Matter <2.5µm)*	24 hours	65 µg/Nm^3
CO (Carbon monoxide)	1 hour	30,000 µg/Nm^3
	24 hours	10,000 µg/Nm^3
O_3 (Oxidant)	1 hour	235 µg/Nm^3
	1 year	50 µg/Nm^3
HC (Hydrocarbon)	3 hours	160 µg/Nm^3
Pb (Lead)	24 hours	2 µg/Nm^3
	1 year	1 µg/Nm^3
Dust fall	30 days	10 tonnes/km^2/month (for residential area)
		20 tonnes/km^2/month (for industrial area)

It should be noted that the local environmental agency (Badan Pengelolaan Lingkungan Hidup Daerah or BPLHD), through the AMDAL approval process, can also set stricter ambient air quality standards.

3.6.2 WHO Ambient Air Quality Guidelines

The WHO has published recommended ambient air quality guidelines for a range of pollutants found in ambient air which have the potential to adversely affect human health (WHO, 2006). These guidelines are often adopted by countries outright or are modified to reflect the countries' national requirements as legislated national ambient air quality standards. In 2005 the WHO updated their published ambient air quality guidelines and this has resulted in a significant reduction in the ambient air quality guidelines recommended for particulate matter (PM_{10}

and $PM_{2.5}$) and sulphur dioxide. Interim targets have been provided by the WHO in recognition of the need for a staged approach to achieving the recommended guidelines. The updated guidelines and interim targets are presented in Table 3.7. The WHO ambient air quality guidelines are also contained in the World Bank Group Environmental, Health and Safety General Guidelines (WBG, 2007).

The WHO ambient air quality guidelines need to be considered in assessing the impacts of the emissions from the proposed power plant in respect to demonstrating that GIIP is being achieved, and that the more stringent WHO guidelines are being achieved when compared to the Indonesian Ambient Air Standards.

Table 3.7 : Relevant WHO Ambient Air Quality Guidelines, 0°C, 1 Atmosphere

Parameter	Exposure Period	Threshold Limit
Sulphur Dioxide (SO_2)	10 minutes	500 µg/Nm^3 not to be exceeded over an averaging period of 10 minutes
	1 hour	No guideline
	24 hours	125 µg/Nm^3 (Interim target 1) 50 µg/Nm^3 (Interim target 2) 20 µg/Nm^3 (guideline)
Nitrogen Dioxide (NO_2)	1 hour	200 µg/Nm^3
	24 hours	No guideline
	1 year	40 µg/Nm^3
Particulate matter less than 10 microns (PM_{10})	24 hour	150 µg/Nm^3 (Interim target 1) 100 µg/Nm^3 (Interim target 2) 75 µg/Nm^3 (Interim target 3) 50 µg/Nm^3 (guideline)
	annual	70 µg/Nm^3 (Interim target 1) 50 µg/Nm^3 (Interim target 2) 30 µg/Nm^3 (Interim target 3) 20 µg/Nm^3 (guideline)
Particulate matter less than 2.5 microns ($PM_{2.5}$)	24 hour	75 µg/Nm^3 (Interim target 1) 50 µg/Nm^3 (Interim target 2) 37.5 µg/Nm^3 (Interim target 3) 25 µg/Nm^3 (guideline)
	annual	35 µg/Nm^3 (Interim target 1) 25 µg/Nm^3 (Interim target 2) 15 µg/Nm^3 (Interim target 3) 10 µg/Nm^3 (guideline)
Ozone (O_3)	8 hour	100 µg/Nm^3

The WHO has no ambient air guideline values for 1-hour average SO_2 and 24-hour average NO_2. New Zealand (NZ) ambient air guidelines (MfE, 2002) have been used to provide an international benchmark to assess modelling predictions for these averaging periods in this report. The NZ ambient air guideline for SO_2 is 350 µg/Nm^3 as a 1-hour average and for SO_2 is 100 µg/Nm^3 as a 24-hour average.

3.6.3 IFC Emission Guidelines

The general approach of the WBG EHS General Guidelines is to prevent or minimise impacts from power station developments so that:

- *"Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines, or other internationally recognized sources;*
- *Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this Guideline suggests 25 percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed." (WBG, 2007)*

The EHS Guidelines for Thermal Power Plants emission limits distinguish between degraded (i.e. polluted) and non-degraded airsheds. However, for gas combustion the emission limits are the same for both degraded airsheds (DAs) and non-degraded airsheds (NDAs). The IFC emission limits for combustion turbines are presented in Table 3.8. The proposed Riau CCPP will meet the IFC Emission Guidelines for NO_X of 51 mg/m^3.

Table 3.8 : IFC Emission Guidelines for Combustion Turbines (mg/Nm^3)

Combustion Technology/Fuel	Particulate Matter (PM)		Sulphur Dioxide (SO_2)		Nitrogen Oxides (NOx)	Dry Gas, Excess O_2 Content (%)
	NDA	DA	NDA	DA	NDA/DA	
Natural Gas (all turbine types of Unit > 50MWth)	N/A	N/A	N/A	N/A	51 (25 ppm)	15%

Ambient air monitoring data collected in the area, as discussed in Section 2 of this report, indicates that the airshed is non-degraded with respect to particulate matter, SO_2 and NO_2 when compared to Indonesian Ambient Air Standards. Discharges from natural gas-fired power plants are primarily of concern in regard to NO_2. SO_2 and PM_{10} are discharged for the Riau CCPP at much lower levels, and are expected to have negligible impacts on the surrounding air quality.

4. Air Quality Assessment Methodology

4.1 Construction Phase

The air quality impacts during construction of the Project have been assessed in a qualitative manner following WBG EHS Guidelines and based on available information.

The production of dust from construction works such as the formation of roads and preparation of lay-down and building sites is inevitable. Modelling for dust is generally not considered appropriate for assessing construction impacts, as emission rates vary depending on a combination of the construction activity being undertaken and the meteorological conditions, which cannot be reliably predicted. For this assessment, *Guidance on the Assessment of Dust from Demolition and Construction, Version 1.1* developed by the Institute of Air Quality Management (IAQM) (2014) has been referenced.

Activities on Site and along the gas pipeline route have been divided into four types to reflect their different potential impacts. These are:

- Demolition;
- Earthworks;
- Construction; and
- Trackout.

Of these four types of activities, only earthworks, construction and trackout are relevant to the Project as very limited demolition may be required for the gas pipeline.

The IAQM method uses a five step process for assessing dust impacts from construction activities:

Step 1. Screening based on distance to nearest receptor. No further assessment is required if there are no receptors within a certain distance of the works;

Step 2. Assess the risk of dust effects from activities using:

- the scale and nature of the works, which determines the potential magnitude of dust emissions; and
- the sensitivity of the area.

Step 3. Determine site specific mitigation for remaining activities with greater than negligible effects.

Step 4. Assess significance of remaining activities after mitigation has been considered.

Step 5. Reporting.

The Step 1 screening criteria provided by the IAQM guidance suggests screening out assessment of impacts from activities where sensitive ‘human receptors’ will be more than 350 m from the boundary of the site, 50 m of the route used by construction vehicles, or up to 500 m from the Site entrance. Sensitive ‘ecological receptors’ can be screened out if they are greater than 50 m from the boundary of the site, 50 m of the route used by construction vehicles, or 500 m from the site entrance.

The Step 2 assessment determines the Dust Emission Magnitude for each of four dust generating activities; demolition, earthworks, construction, and track out. The classes are; Large, Medium, or Small, with suggested definitions for each category. The lists of suggested definitions for earthworks and construction activities are presented in Appendix A.

The class of activity is then considered in relation to the distance of the nearest receptor and a risk category determined through an assessment matrix for each of three categories:

- Sensitivity to dust soiling effects;
- Sensitivity of people to health effects from PM_{10}; and,
- Sensitivity of ecological effects.

A copy of each matrix for earthworks, construction, and track out is presented in Appendix A.

4.2 Operational Phase

Stack emissions of the power plant have been identified as key source of air pollution during operation of the Project. The Project consists of two sets of gas turbine generating unit, two sets of heat recovery steam generator (HRSG) and one steam turbine generating unit with associated auxiliary equipment. The cooling towers associated with the Project will also discharge particulate matter to air, though at very low levels. The Project will be designed to operate continuously throughout the year. The Black Start Diesel Generators will supply black power in case of a station black out and emergency power for the safe shutdown of the power plant in the event of the loss of mains supply. The Project site boundary is shown in Figure 1.1.

During combined cycle operation, the heat of exhaust gas will be admitted to the HRSG where superheated steam will be produced which will then drive the steam turbine to generate additional electrical power. Use of the HSRG will not result in additional contaminants to the air discharges.

4.2.1 Model Selection

A two stage modelling approach was taken, first using the TAPM prognostic meteorological model to provide meteorological data for the modelling period. The AERMOD dispersion model (Version 14134) was then used to predict the ground level concentrations of the pollutants discharged from the proposed site.

4.2.2 TAPM Settings

As discussed in Section 2, meteorological data collected at the Pekanbaru continuous ambient air monitoring site was determined to be influenced by nearby buildings, and so was not considered to be representative of actual surface winds in the wider area. The prognostic meteorological model TAPM has therefore been used to develop a meteorological dataset for use with the dispersion model. TAPM was developed by the CSIRO in Australia and predicts all meteorological parameters based on large-scale synoptic information, in this case for the Indonesian region. TAPM consists of two main components: a meteorological component and a pollution dispersion component. For this modelling exercise the meteorological component was used to produce upper air and surface meteorological data for use with AERMOD dispersion model.

In order to produce the meteorological data set, TAPM was configured as per CSIRO recommendations (Edwards et al, 2004) which primarily follow that used by Hibberd *et al* (2003), with:

- Four nested meteorological grids with a grid spacing of 30, 10, 3 and 1 km;
- Default vegetation, topography and soil types as supplied in the South Asia TAPM databases;
- Grid centre at 0° 32.5’ N, 101° 31’ E, with a UTM grid centre of 780581E, 59726N;
- Deep soil moisture used throughout the year was 0.15;
- 25 vertical levels;
- Prognostic turbulence scheme and hydrostatic approximation; and
- Model run for 2015 and 2016.

The AERMOD meteorological data file was extracted at a pseudo-meteorological station of the modelling domain located at the location of the proposed power plant. Two meteorological datasets – one surface air data file (**.sfc) and one upper air data file (**.pfl) were extracted from a pseudo-met station of the modelling grid located at the proposed Java 1 site for use with the AERMOD dispersion model. A windrose of the surface meteorological data is provided as Figure 4.1.

It is noted that Gaussian-plume models such as AERMOD over-predict when winds less than 0.5 m/s are used. For this reason, a minimum wind speed of 0.5 m/s has been applied to the wind speeds predicted by TAPM for use with Gaussian-plume models.

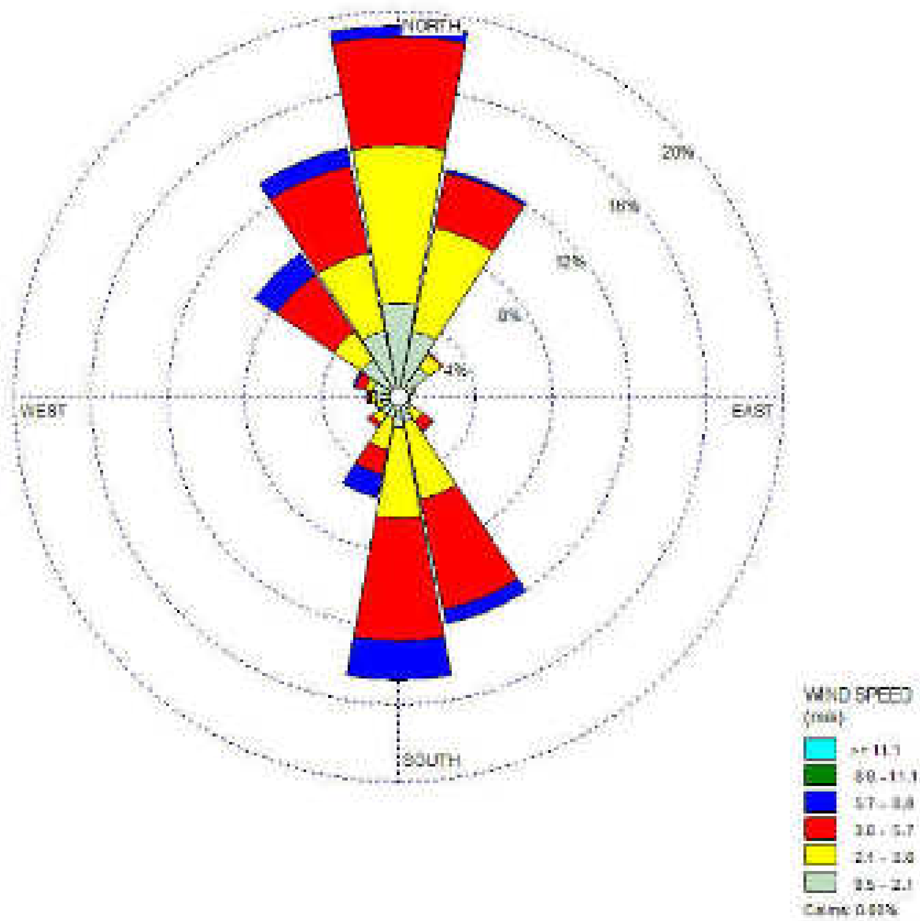

Figure 4.1 : Windrose of Modelled Meteorological Data at the Proposed CCGT Site

4.2.3 Modelling Scenarios

Modelling was conducted for the following scenarios.

- Emissions of combustion gases and particulate matter from the proposed 275 MW Riau CCPP; and
- Emissions of combustion gases and particulate matter from the proposed power plant in addition to the existing Tenayan CFPP.

Both scenarios were modelled assuming continuous operation at maximum continuous rating for the years 2015-2016.

4.2.4 Receptor Grid and Sensitive Receptors

The AERMOD model was run with a 10 km x 10 km (100 km^2) digital terrain file with 50 m grid spacing. The AERMAP module of AERMOD was run to calculate the ground elevations and representative terrain height scale for all receptors, stacks and buildings in the model from digital terrain elevation data.

4.2.5 Model Input Parameters

The input parameters used for this atmospheric dispersion modelling are summarised below. The key model assumptions to note are:

- All modelled emissions, either time-of-hour dependent or constant with time, are modelled over a one-year period;
- The Universal Trans Mercator (UTM_47N) projection was used for mapping contours;
- Meteorological data set for 2015-2016 was developed using the TAPM prognostic meteorological model to be representative of the existing meteorological conditions;
- Building downwash effects were assumed to be irrelevant for the existing and proposed power plant with the exception of the Steam Turbine Building, as per the GIIP; and
- Discharge rates for each power plant were modelled at maximum continuous rating, 7 days a week, 52 weeks a year.

4.2.6 Chimney Height and Building Downwash Effects

WBG Environmental, Health and Safety (EHS) General Guidelines recommends that the chimney height for all point source emissions, whether significant or not, be designed according to GIIP. The GIIP is based on United States 40 CFR, part 51.100 (ii), which used the following technical document, "Guideline for Determination of Good Engineering Practice Chimney Height (Technical Support Document for the Chimney Height Regulations)", EPA 450/4-80-023R, June 1985.

The Good Engineering Practice (GEP) Chimney Height is determined using the following equations

$$H_G = H + 1.5L$$

where:

HG = GEP chimney height measured from the ground level elevation at the base of the chimney

H = Height of nearby structure(s) above the base of the chimney

L = Lesser dimension, height (h) or width (w), of nearby structure(s)

“Nearby structure(s)” = Structures within/touching a radius of 5L.

A chimney located downwind, within the influence zone (the lesser of the structure’s width or height five times – 5L) of structure(s) that meets the GEP stack height will effectively place the chimney’s emissions outside the building wake height effects. However, if a building is within the influence zone and the calculation shows that is higher than the effective stack height, then its influence in terms of building downwash effects needs to be determined in the dispersion modelling undertaken.

AERMOD contains the US EPA's Building Profile Input Program (BPIP). The BPIP processor computes the maximum GEP chimney height and maximum Wake Effect Heights (WEHs) for all combinations of tiers, chimneys and wind directions. Dispersion modelling then uses the WEHs to compute the plume downwash down wind of the chimney. The GEP calculation was undertaken for all buildings and structure within a radius of 5 x L (5 x stack height of 45 m). Only the Steam Turbine Building was found to be of a size that it could potentially result in building downwash effects on the discharged plume. This building (25 m high, and 24 m wide) and has therefore been included in the AERMOD dispersion modelling with BPIP processor switched on.

It should be noted that while GEP heights represent the stack height required to avoid building downwash effects, the GEP heights are maximums under US Federal Law and are not necessarily required where the contaminant emission rates are sufficiently low as to have acceptable environmental effects. For the case of gas-fired power plants, contaminant emission rates are generally considered to be sufficiently low that higher stacks are not required. Table 4.1 provides the results of a survey of gas-fired power plants in Australia and New Zealand that confirms this practice. Most power plants surveyed have stacks less than 50 metres in height, and some as low as 15 metres in height, well below the height expected for conformance with the GEP maximum stack height.

Table 4.1 : Survey of Stack Heights for Gas Fired Power Plants in Australia and New Zealand

Site	Location	Power rating (MWe)	Stack height (m)
Jeeralang Power Station (7x OCGTs)	Morwell, Victoria, Australia	460 (combined)	32
McKee Power Plant (2 x OCGT)	New Plymouth, NZ	100	14.5
Genesis Unit 5 CCGT	Huntly, NZ	400	50
Genesis Unit 6 OCGT	Huntly, NZ	51	50
Mortlake (2x OCGTs)	Victoria, Australia	550 (combined)	45
Snowy Hydro Laverton North (2 x OCGTs)	Laverton, Victoria	320 (combined)	30
Snowy Hydro Valley Power (2 x OCGTs)	Traralgon, Victoria	300 (combined)	16.3
Snowy Hydro Colongra Power Station (4 x OCGTs)	Colongra, New South Wales	600 (combined)	35

4.2.7 Stack Discharge Parameters

A number of sources have been identified as potentially discharging pollutants to the atmosphere. They include two point sources corresponding to the locations of the CCPP stacks as shown in design drawings. Locations of stacks at the existing Tenayan CFPP obtained from aerial imagery. Contaminant discharge rates have been derived from design criteria where these were available (i.e. for NO_X and SO_2 for the Riau CCPP). US EPA AP-42 emission factors were used to estimate emission rates for PM_{10} and CO from the Riau CCPP[2] and for all contaminants from the Tenayan CFPP[3].

Table 4.1 presents the physical parameters of the discharge sources as used in the dispersion model. All PM_{10} has been assumed to be $PM_{2.5}$.

[2] USEPA, Compilation of Air Pollutant Emission Factors AP-42: Chapter 3.1 Stationary Gas Turbines, Fifth Edition, Volume 1: Stationary Point and Area Sources, 2000.
[3] USEPA, Compilation of Air Pollutant Emission Factors AP-42: Chapter 1.1 Bituminous and Subbituminous Coal Combustion, Fifth Edition, Volume 1: Stationary Point and Area Sources, 1998.

Table 4.2 : Source Characteristics and Discharge Rates Used in Dispersion Model

Source ID	Stack Height (m)	Stack Diameter (m)	Efflux Velocity (m/s)	Exit Temperature (°C)	Discharge Rate (g/s)			
					NO_X	PM_{10}	SO_2	CO
Riau CCPP (Stack 1)	45	3.8	20	82	12.1* (51 mg/Nm^3)	1.56 (6.6 mg/Nm^3)	0.47* (2 mg/Nm^3)	1.95 (8.2 mg/N/m^3)
Riau CCPP (Stack 2)	45	3.8	20	82	12.1* (51 mg/Nm^3)	1.56 (6.6 mg/Nm^3)	0.47* (2 mg/Nm^3)	1.95 (8.2 mg/Nm^3)
Tenayan CFPP	150	5	10	120	70	11.2	1283	3.1

Note: *guaranteed emission rates

4.2.8 Cooling Tower Emissions

Cooling tower PM_{10} emission rates were calculated from the evaporative loss of the towers as supplied by the EPC Contractor. The dimensions of the cooling towers are provided in Table 4.3

Table 4.3 : Cooling tower condition details

Parameter	Value
Exhaust temperature	35.8°C
Exhaust flow	3,800 kg/s
Volumetric flow rate	3,500 m^3/s
Exhaust velocity	10.4 m/s
Geometry of cooling tower	73 m long x 18 m wide x 10.1 m high (top deck)
Discharge height	13 m
Drift	Less than 1 kg/s
Total dissolved solids	100 mg/L
Particulate Matter discharge rate	0.1 g/s

4.2.9 Emergency Grid Failure

The CCPP will have an emergency black start facility, comprising 4 x 1.2 MWe containerised diesel generator sets (DGs). This facility is required by the Power Purchase Agreement (PPA) and will enable the plant to start independently and reenergise the grid without any external source of power in the unlikely event of a PLN grid failure or black-out. The failure could be local to Riau or affect the whole of the Sumatra Grid.

During a normal start, power to start the GTs is imported from the grid via the generator step-up transformer. When there is a grid failure (or a “black-out” or “black grid”), no power is available from the grid and so, without black start capability, the plant would not be able to start until the grid is energised by some other power station. With the black start facility, the plant will be able to start on its own and help restore power to consumers.

When there is a black-out, power stations disconnect from the grid as there is no actual demand. In order to re-energise the grid, stations with black-start capability must be able to start without any power from the grid. Typically, the power is provided by diesel generators. At the Riau plant, four 1.2 MWe DGs will be used for this purpose.

Under a black start scenario, the DGs would provide the power to start one of the gas turbines. The DGs will run for, perhaps, an hour or so while the plant is being readied for the start. Then, one GT would be started and synchronised to the DG sets forming an "island" grid. Then, the generator of the gas turbine set would take over the supply of the auxiliary loads and the DG sets can be shut down. The GT would run at low load in parallel with the DGT sets for approximately 30 minutes.

It is anticipated that this scenario would occur no more than once per year. In addition, each DG unit would be subject to a monthly test run to ensure they are functioning properly for a period of 15 to 30 minutes. The units would be fired up separately when conducting the monthly test runs. The units in total will run for around 24 hours a year.

Each diesel generator set will be installed in a steel container with its own chimney stack. Table 4.3 presents the estimated emission parameters of the BSDGs using the US EPA AP-42 emission factors[4].

Due to the infrequent nature of the running of the BSDGs in an emergency situation and the short duration for which these units will operate for, these units have not been included in the dispersion modelling conducted. The impacts of emissions to air from the BSDGs will be negligible.

Table 4.4 : Estimated Black Start Diesel Generator Emissions per Unit

Parameter	Unit	Value
Stack height	m	5
Stack diameter	m	0.2
Exit velocity	m/s	30
Fuel consumption	kg/hr	327
Volume flow rate	m^3/s	5
Exit temperature	K	673
Power Output	MWe	1.2
Thermal Input	MWth	4.1
NOx emission rate	g/s	5.6
PM emission rate	g/s	0.17
CO emission rate	g/s	1.48
SO_2 emission rate (0.5% sulphur content of fuel)	g/s	0.9
SO_2 emission rate (0.3% sulphur content of fuel)	g/s	0.5

Note: US EPA AP-42 emission factors for large units have been used to generate emission rates

4.2.10 Conversion of NO to NO_2

Emission factors and modelling outputs for NO_X are typically reported in terms of NO_X as NO_2. This approach presents predicted concentrations of the principal oxides of nitrogen ($NO + NO_2$) based on the assumption that all nitric oxide in the plume fully oxidises to nitrogen dioxide. In reality, only a portion of the NO_X emitted from the combustion sources is NO_2, with typically less than 5% to 10% of the total NO_X discharge consisting of NO_2, and additional NO_2 being generated by oxidation of NO in the plume as it disperses downwind.

[4] . USEPA, Compilation of Air Pollutant Emission Factors AP-42: Chapter 1.3 Fuel Oil Combustion, Fifth Edition, Volume 1: Stationary Point and Area Sources, September 1998.

The US EPA (Appendix W to Code of Federal Regulations 40 Part 51, 2017) recommends a three tiered approach to converting NO to NO_X, as follows:

- Tier 1: Assume total conversion of NO to NO_2.
- Tier 2: Assume 80% conversion of NO to NO_2 for 1-hour averages, and 75% conversion for annual average concentrations.
- Tier 3: Undertake detailed conversion methodology on a case by case basis. Conversion methodologies include the Plume Volume Molar Ratio Method (PVMRM) or Ozone Limiting Method (OLM).

Methods of modelling conversion of NO to NO_2 can be complex, and are therefore not normally undertaken if more conservative assumptions can be used that show adverse effects of pollutants are likely to be avoided. Given the size of the proposed power plant, a Tier 3 approach using the PVMRM has been followed.

The Plume Volume Molar Ratio Method (PVMRM) calculates the ratio of ozone moles to NOx moles in an effluent plume segment volume at downwind distance receptor locations (Hanrahan, 1999). This molar ratio is multiplied by the NOx concentrations estimated by AERMOD to calculate the NO_2 concentrations in the plume. The PVMRM includes a method to simulate multiple NO_X sources by accounting for how the plumes merge and combine. Similar to the Ozone Limiting Method (OLM), the PVMRM does not account for the gradual entrainment and mixing of ambient O_3 in the plume, and fresh ozone is assumed to be uniformly mixed across the plume cross section.

The main characteristic that affects NO_2 conversion using the PVMRM is background O_3 concentrations. A background concentration of 88 µg/m^3 has been assumed, which is the measured 1-hour average concentration at the 70th percentile as measured at the PEF-2 ambient air monitoring site in Pekanbaru. An in-stack ratio of NO_2:NO_X has been assumed to be 0.1, or 10% NO_2.

4.2.11 Use of 99.9 Percentile Levels for Evaluations

The use of percentiles when analysing dispersion modelling predictions for 1-hour averages, subject to certain criteria, is a statistical method widely accepted and used. For example, the Ministry for the Environment's (New Zealand) *Good Practice Guide for Atmospheric Dispersion Modelling* (2004) recommends (Section 6) for the purpose of comparing modelling results to evaluation criteria, that the 99.9th percentile value of the predicted ground level of the highest maximum ground level concentration likely to occur is used (MfE, 2004). The use of percentiles is linked to the inherent uncertainty (accuracy) of modelling predictions even when input data is appropriate. It has been found generally that short-term (for example, 1-hour average) modelling predictions at the 99.9th percentile more closely approximate empirical data than do peak predictions. The use of percentiles for analysing dispersion modelling data (and monitoring data) becomes increasingly less relevant as averaging times increase and as a result the highest maximum ground level concentrations should be used (for example, 24-hour averages).

Percentile limits should only be applied when there is a large amount of data. Consequently, the use of percentiles is particularly relevant to dispersion modelling outputs where, for example, the predicted hourly averages for 12 months (8,760 hours) or more of meteorological data are available for interpretation. This approach has been used in evaluating the 1-hour average results from the dispersion modelling undertaken.

In presenting and assessing the results of air dispersion modelling of the CCGT discharges, Jacobs has used the 99.9th percentile predictions to assess short term (1-hour average) concentrations against the ambient air standards and guidelines, which is accepted as international good practice. Examples of jurisdictions where this approach is accepted include:

1) Victorian EPA State Environment Protection Policy (Ambient Air Quality), which states: "The 99.9th percentile is selected because this avoids the possibility of setting expensive emission controls based on a

single extreme set of meteorological conditions”. Reference: https://www.epa.vic.gov.au/~/media/Publications/1551.pdf

2) New South Wales EPA - Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (2016), which requires incremental impacts from a pollutant source be reported for an averaging period of 1-hour as the 99.9th percentile for Level 2 impact assessments (i.e. for refined dispersion modelling technique using site-specific input data). Reference: https://www.epa.nsw.gov.au/~/media/EPA/Corporate%20Site/resources/epa/approved-methods-for-modelling-and-assessment-of-air-pollutants-in-NSW-160666.ashx

3) NZ MfE Good Practice Guide for Dispersion Modelling (2004) - Recommends use of 99.9th percentile model predictions for 1-hour averages. Reference: http://www.mfe.govt.nz/sites/default/files/atmospheric-dispersion-modelling-jun04.pdf

4) Alberta Air Quality Modelling Guidelines - Recommends use of 99.9th percentile model predictions for 1-hour averages. Reference: http://aep.alberta.ca/air/air-quality-modelling/documents/AirQualityModelGuideline-Oct1-2013.pdf

US EPA[5] and UK DEFRA[6] practice also allows use of modelling predictions at the percentile level for 1-hour averages for comparison with ambient air quality standards. The USEPA recommends the 98th percentile model predictions for NO_2, and the UK DEFRA recommends using model predictions at the 99.8th percentile for comparison against the national Air Quality Objectives for NO_2 as a one-hour average.

The 100th percentile model 1-hour average predictions have been presented for comparison purposes rather than for assessment against the relevant evaluation criteria.

4.3 Cumulative Impacts

The assessment of cumulative impacts will identify where particular resources or receptors would experience significant adverse or beneficial impacts as a result of a combination of projects (inter-project cumulative impacts). In order to determine the full combined impact of the development, potential impacts during construction and operational phases have been assessed where relevant.

There are no relevant cumulative impacts that need to be considered for the construction phase of the Project. The main existing industrial discharge in the Project area is the Tenayan CFPP located to the north of the Project. Cumulative effects of the operational phase of the Project with the Tenayan CFPP have been assessed by dispersion modelling both sources.

[5] https://www.epa.gov/sites/production/files/2015-07/documents/appwno2_2.pdf
[6] https://laqm.defra.gov.uk/technical-guidance/

5. Assessment of Potential Impacts

5.1 Construction Phase

5.1.1 Dust

The construction phase of the project will involve land preparation including site clearance, backfilling and land drainage followed by construction of the power plant and associated gas pipeline and transmission line. Potential dust discharges will be associated principally with the site clearance and levelling activities, which will involve movement of earth.

Power Plant

The site area for the power plant and switchyard will need to be cleared of vegetation and any debris prior to levelling. Site clearance works will include felling, trimming, and cutting trees, and disposing of vegetation and debris off-site. Voids and water ponds will be dried and filled with suitable material.

Topsoil will be stripped from the surface. Excavated topsoil will be transported to and stockpiled in designated topsoil storage areas. Prior to being filled, any sub-grade surfaces will be freed of standing water and unsatisfactory soil materials will be removed. All unnecessary excavated materials will be transported and deposited off-site at an approved facility.

The site will then be levelled. Ideally, the cut and fill will be balanced, to minimise the need to import or export material from the site area. Based on the site topography, preliminary estimates show that if the site elevation is set at 28 m, then the cut and fill / backfilling volumes will be reasonably well balanced at approximately 165,000 m^3 each.

Notwithstanding this, it is likely that approximately 45,000 m^3 of soil will need to be disposed of offsite. At 20 m^3 per truck, this will require 2,250 truck movements over approximately 3 months. Access roads will be used to convey soil and other material for offsite disposal.

Due to the volume of earth movement required (165,000 m^3 of cut and fill), the dust emission magnitude of earthworks activities which may be associated with the power plant would be classified as “Large”, following the IAQM assessment definition in Appendix A:

> *‘Total site area <10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active and any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes;’*

The dust emission magnitude of construction activities, which includes on site concrete batching, associated with the power plant would be classified as “Medium”, following the IAQM assessment definition:

> *‘Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), on site concrete batching;’*

The dust emission magnitude of trackout activities associated with the power plant, which includes a range of 50-60 heavy vehicles per day, would fall under the “Large” classification following the IAQM assessment definition:

> *‘Large: >50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m’*

While the potential magnitude of dust emissions are classified as “Medium” to “Large”, based on the nature or scale of the power plant construction activities, a survey of aerial imagery and review of baseline site assessment information indicates that there are no residential or other sensitive receptors within 350 m of the construction works associated with the power plant site.

Pipeline

Construction of the gas pipeline involves clearing of vegetation and grading of the immediate area, transporting the pipe sections to the relevant area, digging and preparation of trenches, backfilling the trenches using the excavated material and compaction of trench material.

It is understood that the open gas pipeline trenches will be a maximum of 500 m at any one time and will be no more than 2 m deep by 1 m wide. The time that each section of trench is excavated and open is likely to be for around one week therefore gas pipeline construction activities are expected to be limited in terms of spatial extent and therefore in terms of the potential exposure period to dust. On this basis the dust emission magnitude of the pipeline earthworks activities is expected to fall into the ‘Small’ classification, following the IAQM assessment definition in Appendix A.

Based on the variety of construction equipment required for the pipeline excavators (bulldozers, dump trucks, cranes, welding machines and water pumps), the dust emission magnitude of the pipeline trackout activities has been conservatively assigned to the ‘Medium’ classification, following the IAQM assessment definition in Appendix A.

The construction of the gas pipeline will also occur through largely uninhabited areas, with the land use consisting primarily of palm oil plantations. There are a few residential properties which are located within 350 m of the pipeline route and therefore within a distance to be impacted by construction dust. Due to the nature of the works area (i.e. a maximum of 500 m of open trench at any one time), with reference to the IAQM assessment definitions in Appendix A, there are:

- approximately 1-10 highly sensitive receptors anticipated to be within 50 m of the pipeline construction activities, on a worst-case basis; and
- located in an area with an annual mean PM_{10} above 32 $\mu g/m^3$ (background PM_{10} has been understood to be 48 $\mu g/m^3$ as in Table 3.1).

This would therefore classify the sensitivity of the area to dust soiling effects on people and property as ‘Low’, and the sensitivity of the area to human health impacts as ‘Medium’ with reference to the IAQM definitions in Appendix A.

Summary

Table 5.1 summarises the dust emission magnitude of the Project construction phase of the power plant and pipeline, determined with reference to the IAQM guidance. With reference to the magnitude criteria for the ESIA in Table 3.2, this would be categorised as ‘Moderate’ to ‘Major’ magnitude of impact for the power plant, and ‘Minor’ to ‘Moderate’ for the pipeline.

Table 5.1 : Construction Dust Emission Magnitude

Activity	Dust Emission Magnitude	
	As per IAQM (2014) Guidance	ESIA Classification
Power Plant		
Earthworks	Large	Major

Activity	Dust Emission Magnitude	
	As per IAQM (2014) Guidance	ESIA Classification
Construction	Medium	Moderate
Trackout	Large	Major
Gas Pipeline		
Earthworks	Small	Minor
Construction	N/A	N/A
Trackout	Medium	Moderate

The impact assessment results using the dust emission magnitude classification, and the sensitivity of the area is presented in Table 5.22.

Given the absence of sensitive receptors within 350 m of the power plant, in combination with the relatively short duration of the construction period it is considered that there will be a 'Negligible' impact from the power plant construction.

As the magnitude classification of dust emissions from the pipeline construction activities is 'Small' to 'Medium', when this is considered with the 'Low' sensitivity to dust soiling, and 'Medium' sensitivity to human health, a 'Low' risk of impact from dust emissions is concluded, with reference to the IAQM assessment definitions in Appendix A. This translates to a 'Minor' impact as per the ESIA impact matrix in Table 3.4.

Table 5.2 : Risk of Dust Impacts and Significance

Activity	Impact Classification	Significant
Power Plant		
Earthworks	Negligible	Not significant
Construction	Negligible	Not significant
Trackout	Negligible	Not significant
Pipeline		
Earthworks	Minor	Not significant
Construction	N/A	N/A
Trackout	Minor	Not significant

The objective of the ESIA is to identify the likely significant impacts on the environment and people of the project. In this impact assessment, impacts determined to be 'moderate' or 'major' are deemed significant. Consequently, impacts determined to be 'minor' or 'negligible' are not significant. On this basis, the construction dust effects of the power plant and gas pipeline are considered to be not significant.

5.1.2 Combustion Gases

Ambient air monitoring undertaken during the baseline monitoring described in Section 2.1.3 indicate that overall air quality in the Project area is good with respect to combustion gases, although there is the potential for cumulative impacts of SO_2 and particulate matter. However, combustion emissions associated with construction activities at the power plant will be more than 350 m from the main residential areas and emissions from the main source will occur over a relatively short duration. For the gas pipeline the exhaust emissions from construction vehicles will not be discernible from those vehicles operating on the existing road which the gas pipeline will be buried in. As such, it is considered that the potential impact on people living and working in the surrounding area from construction phase combustion gas emissions will be ‘Negligible’.

5.2 Operational Phase

5.2.1 Assessing the Impacts of Discharges to Air from Operation of the Project

Atmospheric dispersion modelling was undertaken to predict the likely impact emissions from the power station on air quality of the surrounding area and to assess the potential impacts on the environment. The results of the modelling are evaluated in the following sections.

Atmospheric dispersion modelling was used to predict the highest one-hour (99.9th percentile) and 24-hour and annual average maximum ground level concentrations (MGLCs) for NO_2 and SO_2, 24-hour and annual average MGLCs for PM_{10}, and 1-hour averages for CO. The modelling assumes that the CCPP plant was operating simultaneously on a continuous basis over the course of the 2-year modelling period. The modelling also included discharges of PM_{10} from the cooling towers associated with the CCPP.

Relevant isopleth diagrams are presented in the following sections. The location of the highest concentration predicted by the modelling is indicated by an arrow on each isopleth diagram.

5.3 Proposed CCPP Plant Model Results

The highest maximum ground level concentrations (MGLCs) predicted by the AERMOD dispersion model for the proposed power plant are presented in Table 5.3 below. The relevant international air quality standards and guidelines are provided for comparison. Maximum predicted concentrations including the existing background concentrations as derived from the Pekanbaru monitoring data are also provided. As discussed previously the background data is obtained in a more urban environment than the Project area, where ambient air concentrations are likely to be higher. Using this data to represent existing baseline conditions for the assessment of the effects of discharges from the proposed CCPP plant will therefore provide a conservative assessment.

Table 5.3 : Highest MGLCs Proposed Power Plant at for Comparison with International and Indonesian Guidelines

Pollutant and Averaging Period	Highest Predicted MGLCs (µg/m^3)		International Guidelines (µg/m^3)	Indonesian Ambient Air Standard (µg/m^3)
	Excluding Background	Including Background		
CO (1-hour highest)	15	1215	30,000 (NZ)	30,000
CO (1-hour highest 99.9th percentile)	11	1211		
CO (24-hour)	2.5	602.5	10,000 (WHO)	10,000
NO_2 (1-hour highest (100th percentile))	86	101	200 (WHO)	400
NO_2 (1-hour highest 99.9th percentile)	43	57		
NO_2 (as NO_2, 24-hour average)	12.8	24.8	100 (NZ)	150

Pollutant and Averaging Period	Highest Predicted MGLCs (µg/m³)		International Guidelines (µg/m³)	Indonesian Ambient Air Standard (µg/m³)
	Excluding Background	Including Background		
NO_2 (as NO_2, annual average)	3.4	13.4	40 (WHO)	100
PM_{10} (24-hour average)	2	39	150 (WHO Interim target 1); 100 (WHO Interim target 2); 75 (WHO Interim target 3); 50 (WHO)	150
PM_{10} (annual average)	0.6	48.6	70 (WHO Interim target 1); 50 (WHO Interim target 2); 30 (WHO Interim target 3); 20 (WHO)	n/a
$PM_{2.5}$ (24-hour average)	2	21	75 (WHO Interim target 1); 50(WHO Interim target 2); 37.5 (WHO Interim target 3); 25 (WHO)	65
$PM_{2.5}$ (annual average)	0.6	24.6	35 (WHO Interim target 1); 25 (WHO Interim target 2); 15 (WHO Interim target 3); 10 (WHO)	n/a
SO_2 (1-hour highest)	3.7	86.7	350 (NZ)	900
SO_2 (1-hour highest 99.9th percentile)	2.7	85.7		
SO_2 (24-hour average)	0.6	83.6	125 (WHO Interim target 1); 50 (WHO Interim target 2): 20	365
SO_2 (annual average)	0.2	66.2	10 – 30 (NZ)	60

Isopleth diagrams of predicted NO_2 from the Project are provided as Figure 5.1 (1-hour averages, 100th percentile), Figure 5.2 (1-hour averages, 99.9th percentile), Figure 5.3 (24-hour averages) and Figure 5.4 (annual averages) below.

As discussed previously in Section 4.2.11, modelling predictions for short term (1-hour) averages are best assessed at the 99.9th percentile to remove outliers resulting from unusual meteorological conditions. The highest 1-hour average concentrations of contaminants presented in Table 5.3 are provided for reference, and should be considered as being as absolute worst case for contaminant concentrations.

The highest predicted MGLC of NO_2 as a 1-hour average (99.9th percentile) from the Project is 41.4 µg/m³, which is approximately 21% of the WHO guideline, and 18% of the Indonesian Standard value. This concentration is predicted to occur very close to the proposed power plant, just beyond the western boundary of the plant. If the assumed background value of 14 µg/m³ is added, the WHO and Indonesian guidelines and standards for NO_2 are still met. The highest predicted concentrations occur at the site boundary, and decrease with distance from the source. The modelling predicts that even for the 100th percentile case, the plant will comply with the WBG EHS Guidelines requirement of being less than 25% of the Indonesian ambient air standard for NO_2 of 400 µg/m^3 as a one-hour average.

Predicted MGLCs of NO_2 as 24-hour averages are similarly well below the Indonesian and international guidelines and standards, being less than 13% of the 100 µg/m^3 International Guideline value, and 9% of the 150 µg/m^3 Indonesian Standard. The highest predicted 24-hour average MGLCs are shown to occur approximately 1.5 km to the southwest of the power plant site boundary. As the airshed is shown to be relatively non-degraded with respect to NO_2, with the assumed background concentration assumed as being 12 µg/m^3, both the International Guideline and Indonesian Standard values are predicted to be complied with.

Predicted MGLCs of NO_2 as annual averages (including background) is well below the 40 µg/m^3 WHO Guideline, and the 100 µg/m^3 Indonesian Standard.

The airshed in Pekanbaru has been shown to be degraded with respect to particulate matter and SO_2, with exceedances being observed at the Pekanbaru monitoring station. This is primarily due to the large scale agricultural burning and forest fires (for PM_{10}) and the use of high sulphur fuel for transport (for SO_2). These sources of air pollution are expected to decrease in the coming years as government regulations limit the spread of fires for agricultural land clearing, and the implementation of lower sulphur content of fuels. Regardless, the incremental increase in ambient concentrations of CO, PM_{10} and SO_2 resulting from the Project's air discharges, which include both stack and cooling tower discharges, are predicted to be at a very low level as shown in Table 5.33 above, with respect to the ambient air guidelines. Considering the low emission rates of these contaminants, the incremental effect on the airshed may be assumed to be minor and will not significantly contribute to further airshed degradation.

Emissions of particulate matter from the cooling towers were shown to have a small contribution to overall particulate matter concentrations, with the maximum predicted concentrations resulting from the cooling towers in isolation being less than 0.2 µg/m^3 as a 24-hour average. The maximum concentrations occur at the site boundary, and quickly disperse to negligible levels with distance from the site. The cooling tower discharges are therefore expected to have a negligible impact on the surrounding environment.

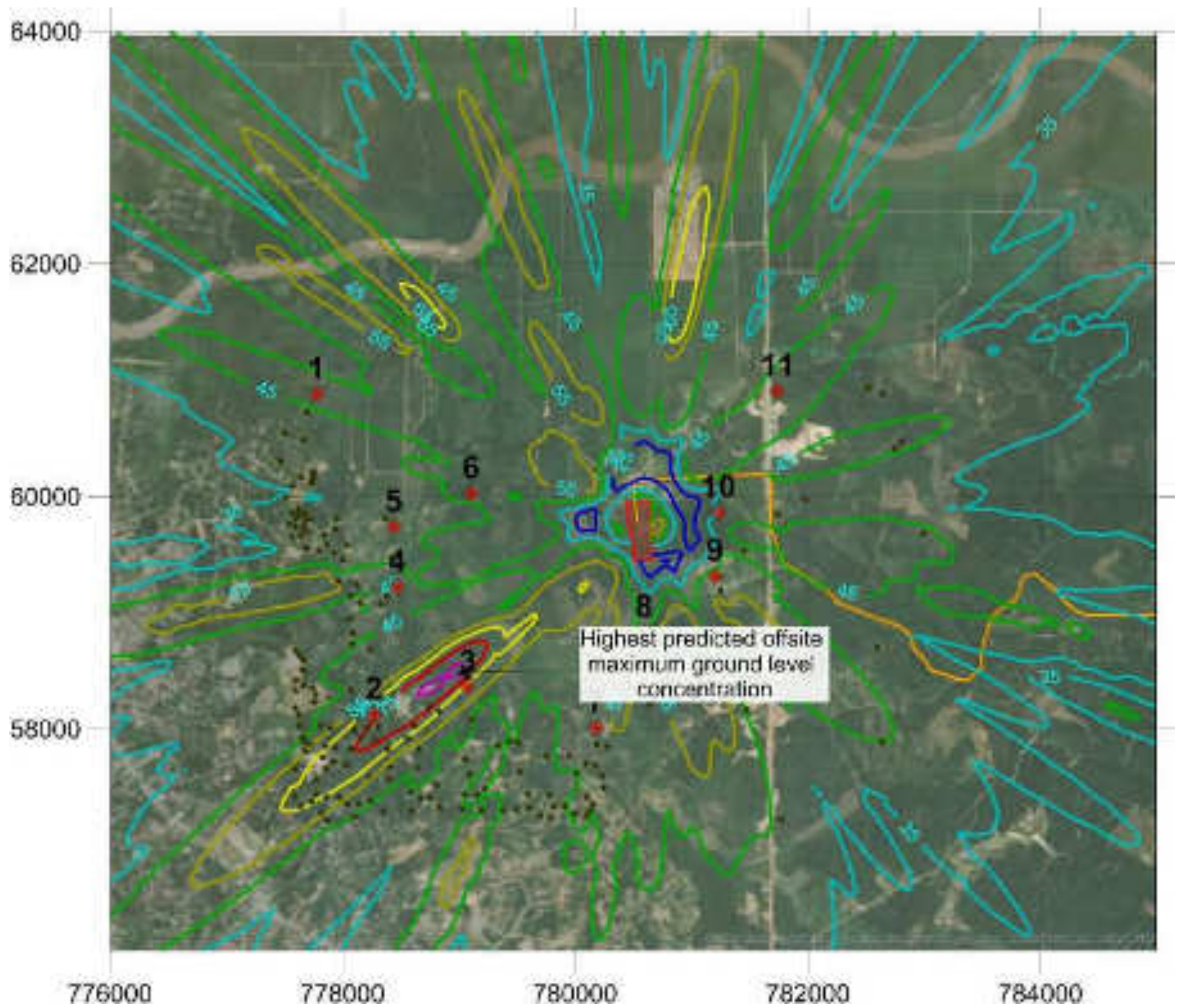

Figure 5.1 : Highest Predicted Maximum Ground Level Concentrations (1-hour average, 100th percentile) of NO_2 (µg/m³) from discharges from the proposed power plant (excluding background)

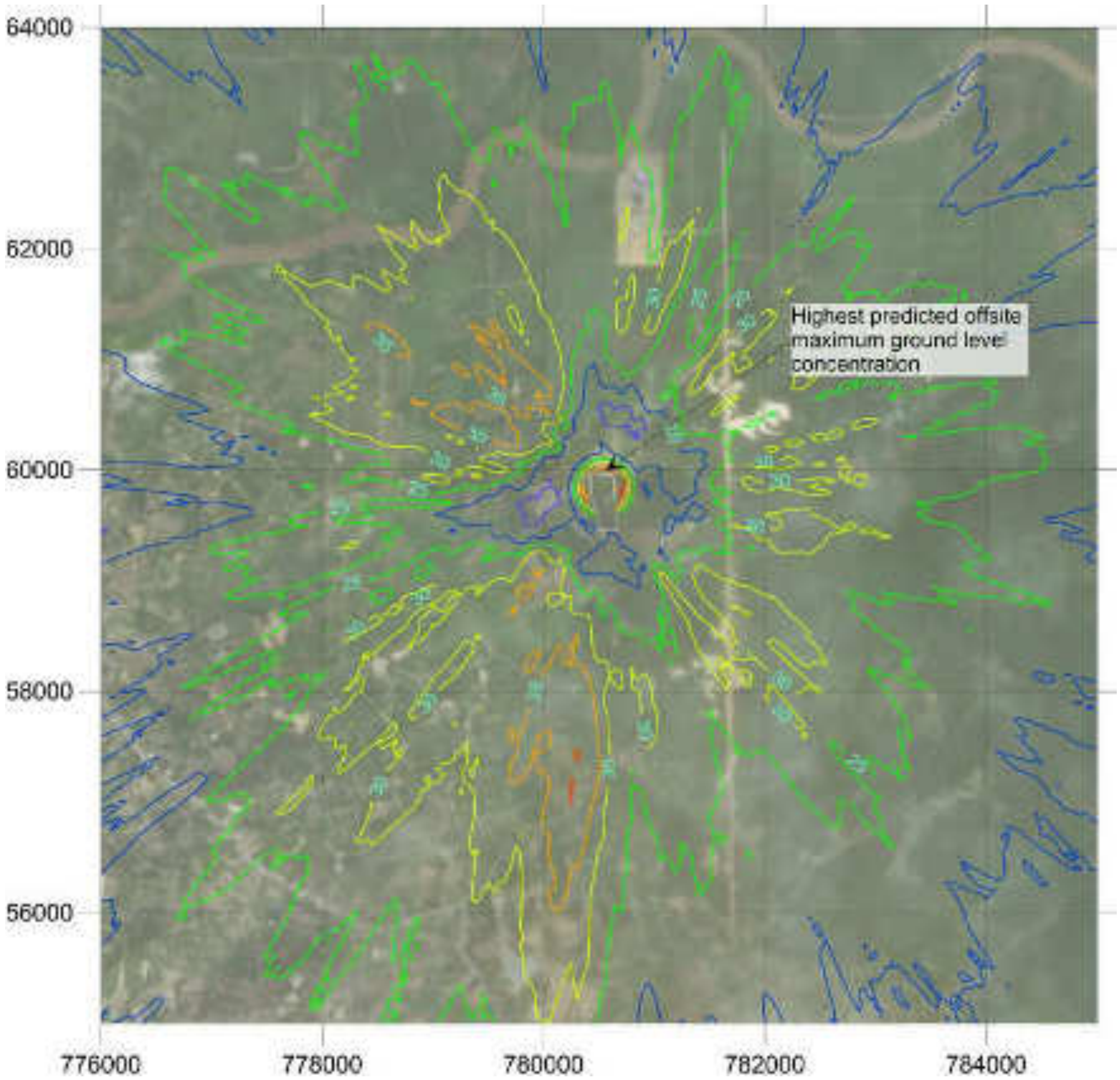

Figure 5.2 : Highest Predicted Maximum Ground Level Concentrations (1-hour average, 99.9th percentile) of NO_2 ($\mu g/m^3$) from discharges from the proposed power plant (excluding background)

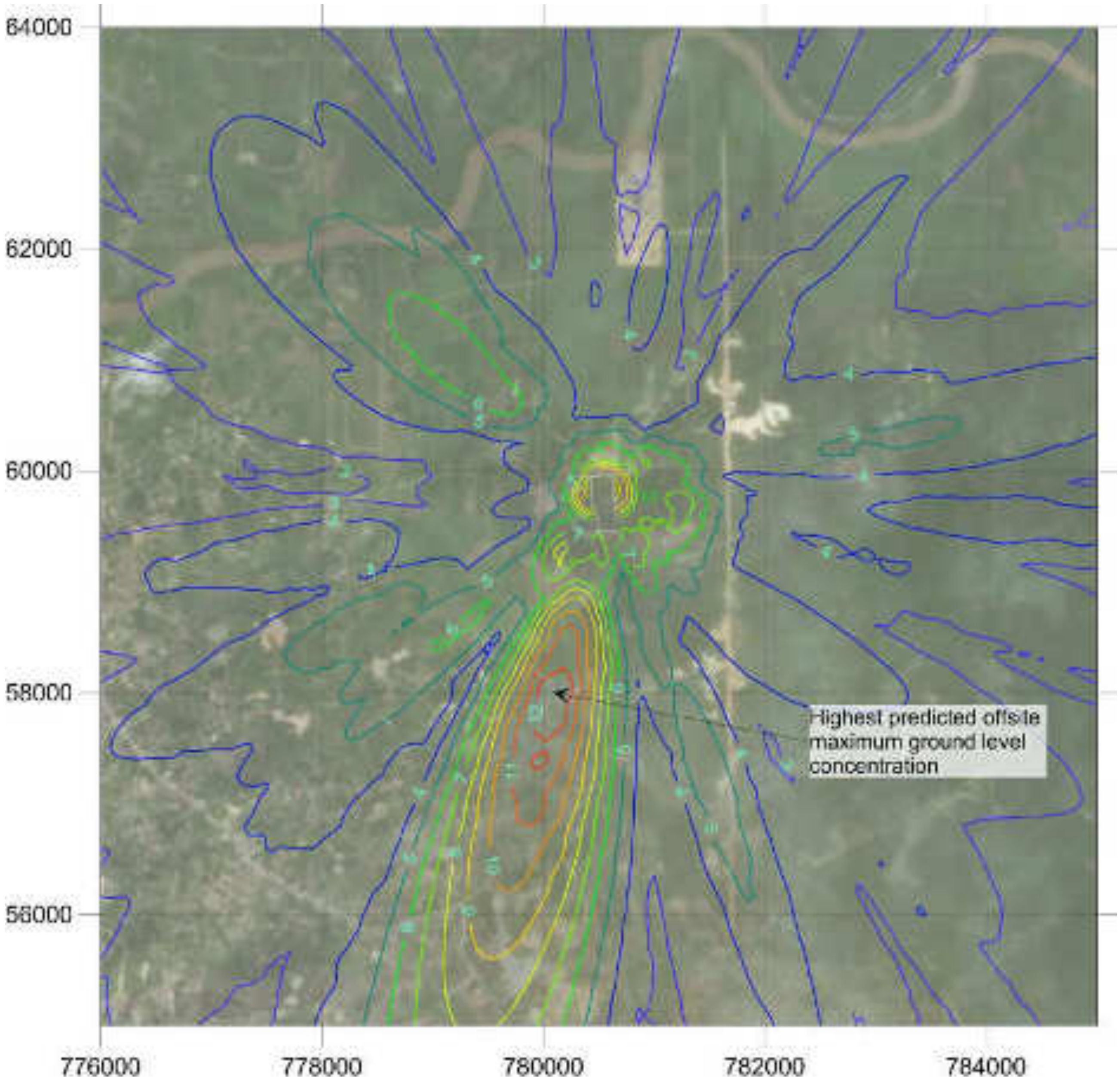

Figure 5.3 : Highest Predicted Maximum Ground Level Concentrations (24-hour average) of NO_2 ($\mu g/m^3$) from discharges from the proposed power plant (excluding background)

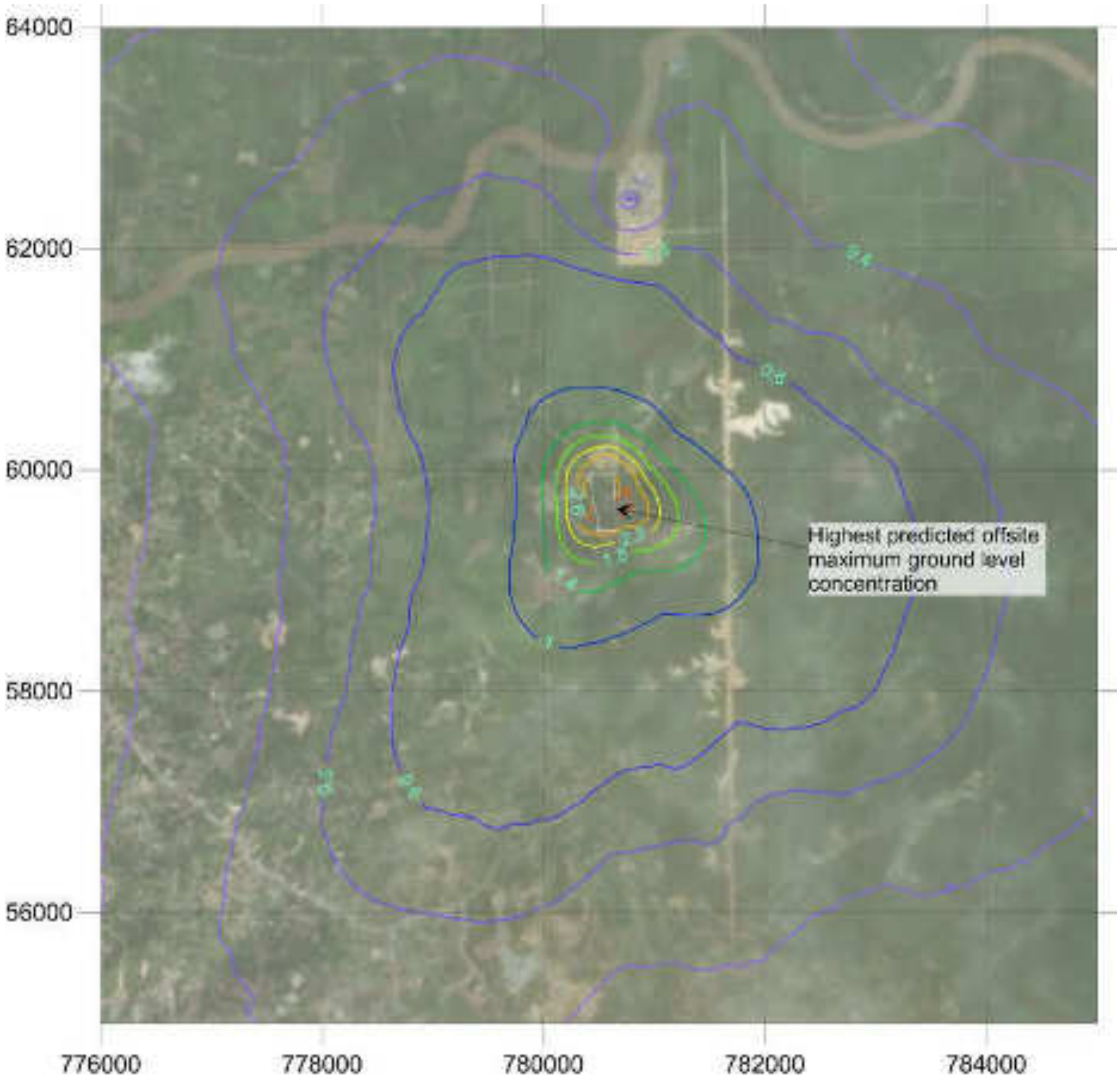

Figure 5.4 : Highest Predicted Maximum Ground Level Concentrations (annual average) of NO_2 ($\mu g/m^3$) from discharges from the proposed power plant (excluding background)

5.3.1 Black Start Emergency Situation

Due to the infrequent nature of the running of the BSDGs in an emergency situation and the short duration for which these units will operate impact of emissions to air on the surrounding air quality will be negligible.

5.4 Cumulative Impacts

The highest MGLCs predicted by the AERMOD dispersion model for the combined Riau CCPP and Tenayan CFPP are presented in Table 5.44 below.

The relevant international air quality standards and guidelines are provided for comparison. Maximum concentrations including existing background concentrations are also provided. As previously discussed, the background concentrations are adopted from monitoring undertaken in Pekanbaru, and are expected to be higher than what would be observed in the Project area. It is also noted that the existing Tenayan CFPP has been included in the modelling assessment, which will account for discharges that may not be observed (or would be observed at a lower level) at the Pekanbaru ambient air monitoring station.

Table 5.4: Highest MGLCs from Cumulative Discharges (Proposed Riau CCPP and Existing Tenayan CFPP), for Comparison with International and Indonesian Guidelines

Pollutant and Averaging Period	Highest Predicted MGLCs (µg/m³)		International Guidelines (µg/m³)	Indonesian Ambient Air Standards (µg/m³)
	Excluding Background	Including Background		
CO (1-hour highest)	15	15	30,000 (NZ)	30,000
CO (1-hour highest 99.9th percentile)	11	1211		
CO (24-hour)	2.8	603	10,000 (WHO)	10,000
NO_2 (1-hour highest (100th percentile))	110	124	200 (WHO)	400
NO_2 (1-hour highest 99.9th percentile)	53	67		
NO_2 (as NO_2, 24-hour average)	15.7	27.7	100 (NZ)	150
NO_2 (as NO_2, annual average)	110	124	40 (WHO)	100
PM_{10} (24-hour average)	2.7	39.7	150 (WHO Interim target 1); 100 (WHO Interim target 2); 75 (WHO Interim target 3); 50 (WHO)	150
PM_{10} (annual average)	0.8	48.8	70 (WHO Interim target 1); 50 (WHO Interim target 2); 30 (WHO Interim target 3); 20 (WHO)	n/a
$PM_{2.5}$ (24-hour average)	2.7	21.7	75 (WHO Interim target 1); 50(WHO Interim target 2); 37.5 (WHO Interim target 3); 25 (WHO)	65
$PM_{2.5}$ (annual average)	0.8	24.8	35 (WHO Interim target 1); 25 (WHO Interim target 2); 15 (WHO Interim target 3); 10 (WHO)	n/a
SO_2 (1-hour highest)	185	268	350 (NZ)	900
SO_2 (1-hour highest 99.9th percentile)	142	225		

Pollutant and Averaging Period	Highest Predicted MGLCs (µg/m³)		International Guidelines (µg/m³)	Indonesian Ambient Air Standards (µg/m³)
	Excluding Background	Including Background		
SO_2 (24-hour average)	29	112	125 (WHO Interim target 1); 50 (WHO Interim target 2); 20	365
SO_2 (annual average)	6.4	72.4	10 – 30 (NZ)	60

Isopleth diagrams showing the highest predicted concentrations of NO_2 resulting from the combined discharges from the Project and the existing Tenayan CFPP are provided as Figure 5.5 (1-hour averages, 100th percentile) Figure 5.6 (1-hour averages, 99.9th percentile), Figure 5.7 (24-hour averages), and Figure 5.8 (annual averages) below. The highest predicted MGLC of NO_2 as a 1-hour average (100thpercentile) from the cumulative discharges is 110 µg/m^3. The highest predicted MGLC of NO_2 as a 1-hour average (99.9 percentile) from the cumulative discharges is 53 µg/m^3 (67 µg/m^3 including the assumed background NO_2 concentration), which is well below the WHO one-hour average guideline value of 200 µg/m^3, and the Indonesian Standard of 400 µg/m^3. The highest predicted concentrations occur at the site boundary of the Project. There is little overlap in the plumes in NO_2 concentrations between the Project and the existing Tenayan CFPP. This is likely due to the distance between the two power plants as well as the differences in emission heights of the two sources.

Predicted MGLCs of NO_2 as 24-hour averages are similarly well below the 100 µg/m^3 International guideline value, and the 150 µg/m^3 Indonesian Standard. The highest predicted MGLCs are shown to occur approximately 1.5 km to the south-west of the Project site.

Predicted MGLCs of NO_2 as annual averages (including background) are also low, being less than 40% of the 40 µg/m^3 WHO Guideline, but are less than 15% of the 100 µg/m^3 Indonesian Standard.

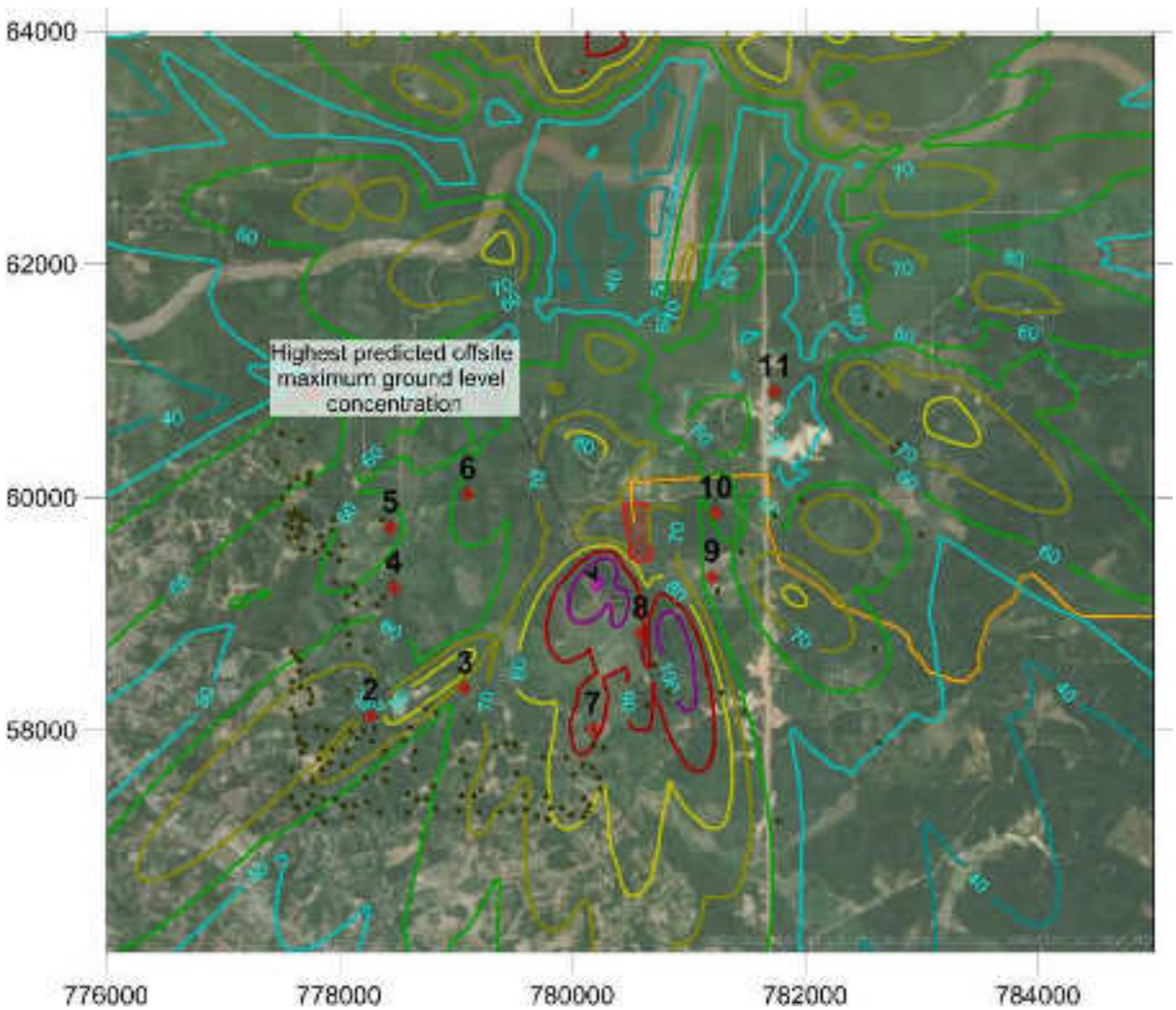

Figure 5.5 : Highest Predicted Maximum Ground Level Concentrations (1-hour average, 100th percentile) of NO_2 ($\mu g/m^3$) from discharges from the proposed power plant and the Tenayan CFPP (excluding background)

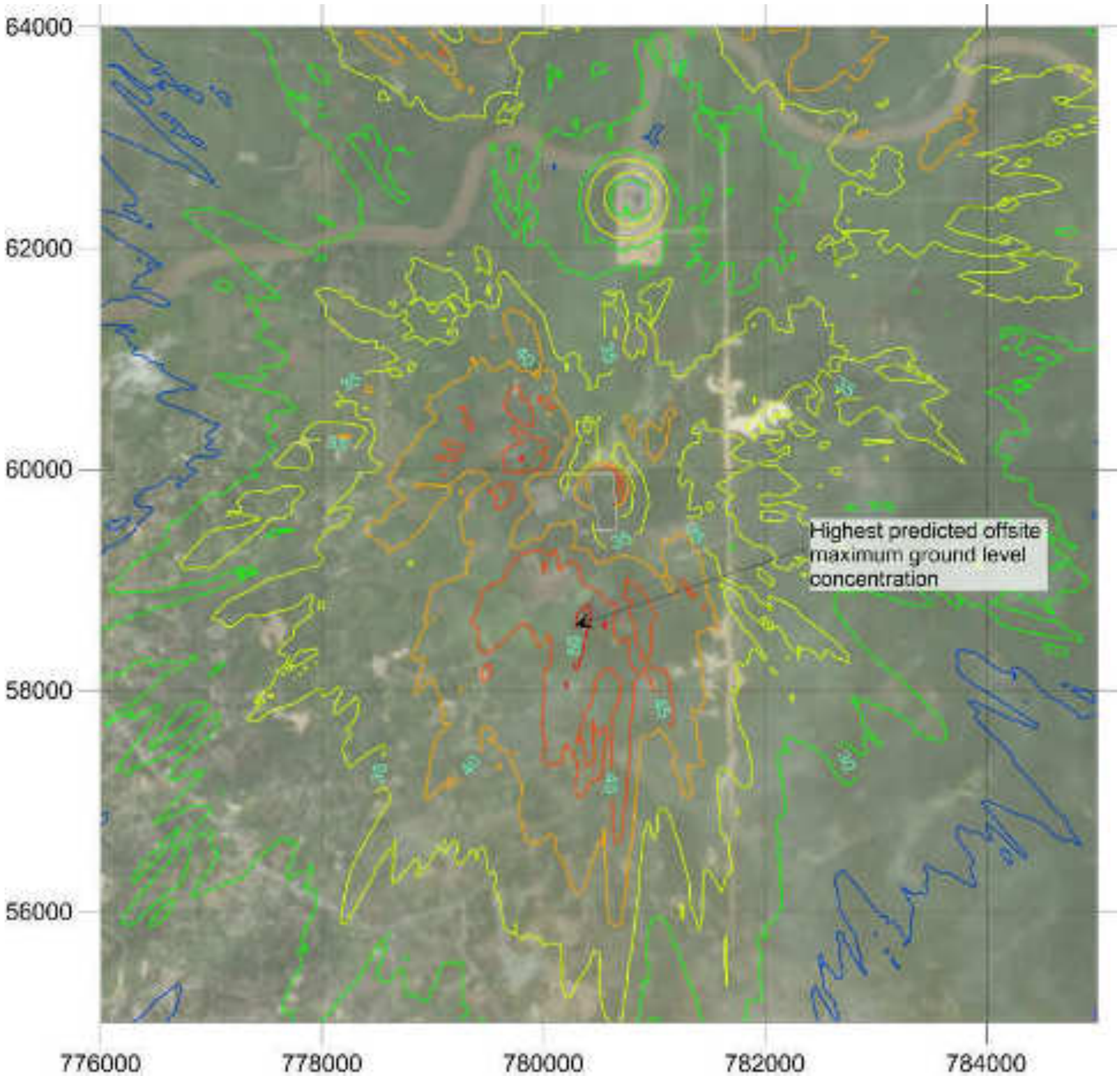

Figure 5.6 : Highest Predicted Maximum Ground Level Concentrations (1-hour average, 99.9th percentile) of NO_2 ($\mu g/m^3$) from discharges from the existing and proposed power complexes (excluding background)

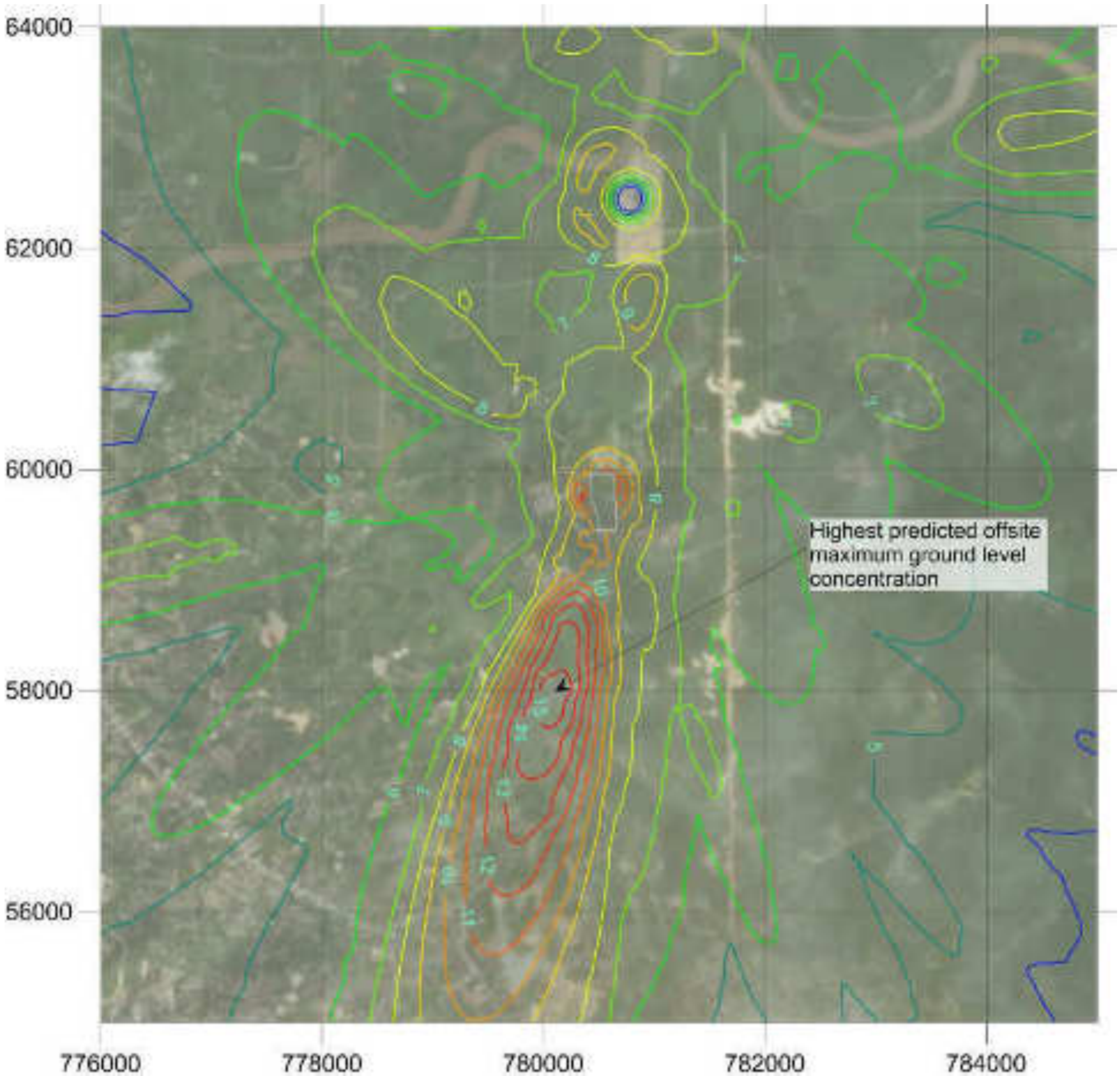

Figure 5.7 : Highest Predicted Maximum Ground Level Concentrations (24-hour average) of NO_2 (µg/m³) from discharges from the existing and proposed power complexes (excluding background)

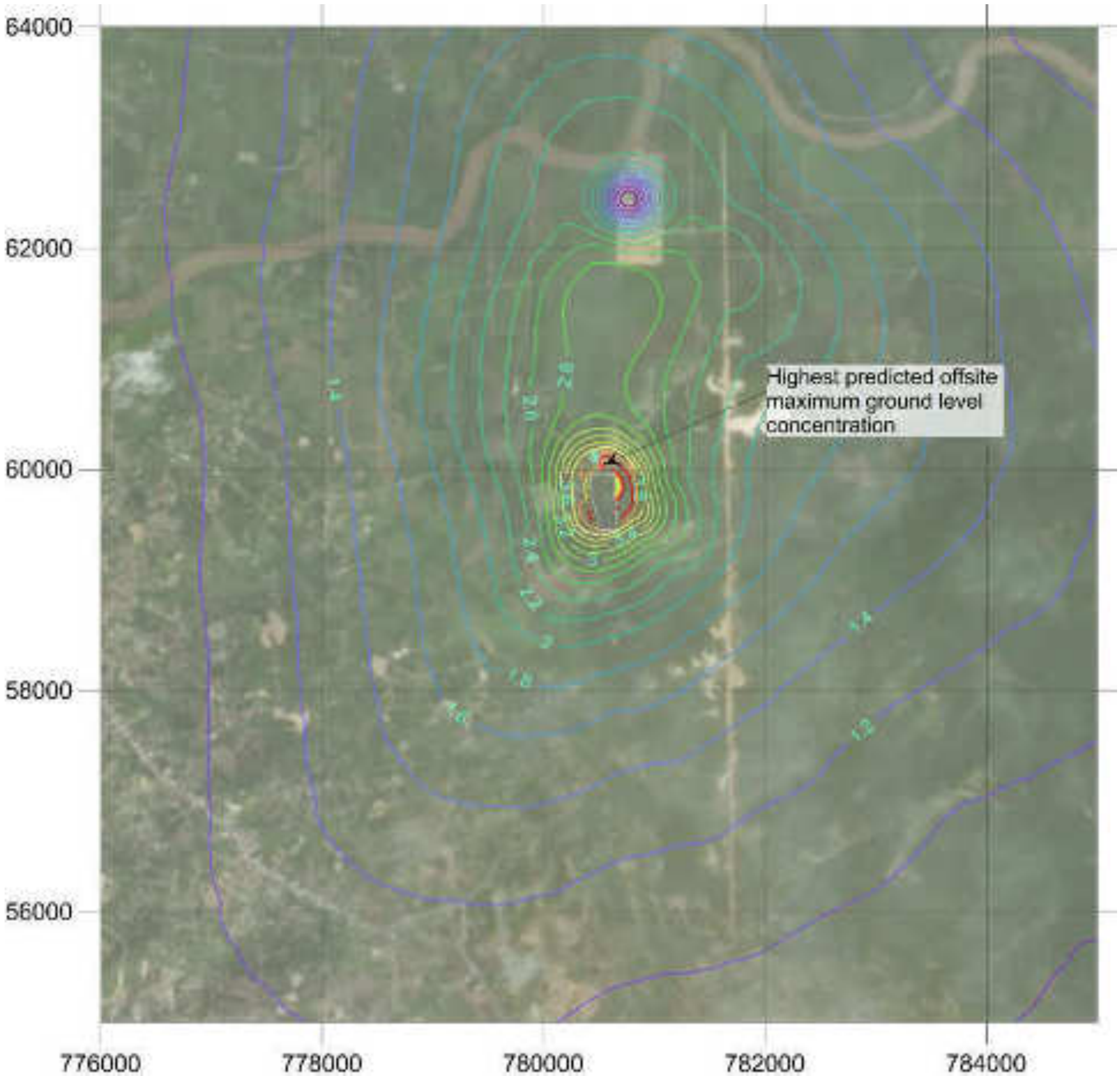

Figure 5.8 : Highest Predicted Maximum Ground Level Concentrations (annual average) of NO_2 ($\mu g/m^3$) from discharges from the existing and proposed power complexes (excluding background)

The Tenayan CFPP discharges contaminants to air at a greater rate than the Project due to the nature of coal-fired power plants, and consequently the model predictions are higher for the cumulative assessment. It is noted that the existing background concentrations as measured at both Pekanbaru and at the baseline monitoring sites would include the Tenayan CFPP discharges, and so adding the background concentrations to the model predictions could be seen as 'double counting'.

Regardless, the incremental increase in ambient concentrations of CO, PM_{10} and SO_2 resulting from the combined Tenayan CFPP and the Project's air discharges are well below the ambient air guidelines. It is also noted that the very low discharge rates of these contaminants from the Project mean that the contribution to the ambient concentrations in the region are relatively minor and will not result in significant increases in ambient air concentrations.

Based on the above assessment, the impact magnitude as per the matrix provided in Table 3.2 of the operation of the Project is expected to be 'Moderate', in that there will be a permanent and detectable change to the contaminant concentrations (principally NO_X) in the surrounding environment.

The sensitivity of the receiving environment, as per the matrix provided in Table 3.3, is considered to be 'Low', in that the dispersion modelling assessment indicates that the surrounding area has some capacity to absorb the change to the increase in the air contaminants without resulting in significant degradation of air quality.

The impact significance on air quality from the operation of the Project (i.e. an activity with a 'Moderate' impact upon a 'Low' sensitivity receiving environment) as therefore assessed as being 'Minor' as determined by the matrix provided in Table 3.4.

5.5 Model Predictions at Sensitive Receptors

5.5.1 Sensitive Receptor Selection

Sensitive receptors are defined as locations where people are more susceptible to the adverse effects of exposure to environmental contaminants. Sensitive receptors include, but are not limited to, hospitals, schools, day-care facilities, elderly housing and convalescent facilities. Sensitive receptors within the Project area were selected using aerial imagery to observe potential residential structures. Of these residences 11 were selected torepresent the receiving environment. These locations are indicated in Table 5.5below. A map showing the locations of the sensitive receptors is provided as Figure 5.9. The map also provides the indication of the highest 24-hour MGLCs and highest 1-hour average 99.9th %-ile GLCs predicted in the dispersion modelling assessment.

Table 5.5 : Location of Selected Sensitive Receptors and Highest Predicted MGLCs

ID	Distance from Riau CCPP	UTM X	UTM Y
1	3.0 km West	777775	60881
2	2.8 km Southwest	778269	58130
3	2.0 km Southwest	779077	58363
4	2.1 km West	778470	59225
5	2.1 km West	778439	59743
6	1.4 km West	779104	60029
7	1.8 km Southwest	780180	58016
8	0.9 km South	780590	58835
9	0.8 km Southeast	781200	59319
10	0.7 km East	781230	59867
11	1.7 km Northeast	781738	60907

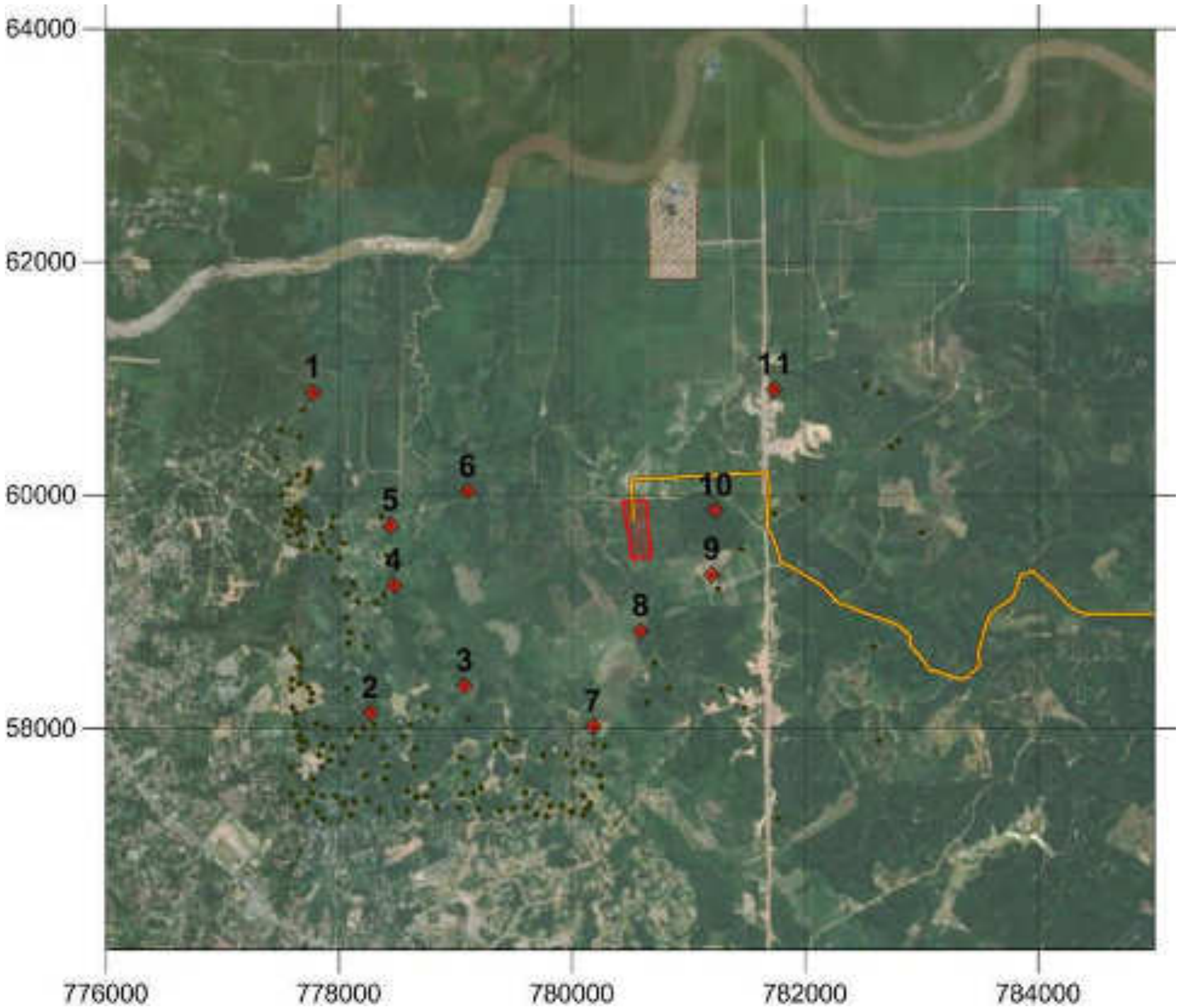

Figure 5.9 : Discrete Receptors in Residential Areas nearby to the Riau CCPP Site

5.5.2 Predicted MGLC Concentrations at Sensitive Receptors

The dispersion modelling predictions for the selected sensitive receptors are provided in the following tables for NO_2 (Table 5.6), SO_2 (Table 5.7), and PM_{10} (Table 5.8), and CO (Table 5.9). Model predictions for both the proposed Riau CCPP plant operating by itself, and cumulatively for the combined CCPP plant and the Tenayan coal-fired power plant, are provided for all relevant averaging periods in the Tables.

The sensitive receptors, which were selected to represent the residential areas most likely to experience adverse effects from the power plant discharges, are predicted to have much lower concentrations than the maximum predicted concentrations, and are in all cases well below the relative ambient air standards and guidelines.

Table 5.6 : Highest Predicted MGLCs of NO_2 at Selected Sensitive Receptors (excluding background)

Receptor ID	NO_2 MGLCs (µg/m^3)							
	1-hour average (highest 100th %-ile)		1-hour average (99.9th %-ile)		24-hour average		Annual average	
	Riau CCPP	Both plants	Riau CCPP	Both plants	Riau CCPP	Both plants	Riau CCPP	Both plants
1	53	67	28	37	3.8	6.2	0.5	1.4
2	69	69	29	43	4.9	7.2	0.5	1.5
3	61	69	32	31	5.8	6.9	0.7	2.1
4	45	66	27	38	4.3	6.0	0.5	1.5
5	41	53	24	34	2.8	5.5	0.5	1.5
6	47	76	30	32	3.1	6.8	0.7	2.0
7	50	72	40	39	12.5	6.8	0.9	2.3
8	40	70	22	36	5.4	8.1	1.3	2.8
9	49	79	23	35	6.2	8.6	1.6	3.0
10	35	57	18	33	6.4	7.0	1.6	2.9
11	52	66	31	33	4.3	6.7	0.6	1.9
Overall Highest Predicted MGLCs	***86***	***110***	***43***	***53***	***12.8***	***15.7***	***3.4***	***4.6***

Table 5.7 : Highest Predicted MGLCs of SO_2 at Selected Sensitive Receptors (excluding background)[1]

Receptor ID	SO_2 MGLCs (µg/m^3)							
	1-hour average (highest 100th %-ile)		1-hour average (99.9th %-ile)		24-hour average		Annual average	
	Riau CCPP	Riau CCPP	Riau CCPP	Both plants	Riau CCPP	Both plants	Riau CCPP	Both plants
1	1.5	880	0.9	35	0.1	7.4	0.01	1.2
2	1.4	723	1.0	37	0.2	6.0	0.01	1.1
3	1.5	837	1.1	38	0.3	7.7	0.02	1.3
4	1.8	1034	1.4	50	0.4	9.3	0.03	1.8
5	2.0	935	1.6	56	0.5	8.5	0.03	1.8
6	1.5	759	0.9	36	0.2	6.6	0.02	1.3
7	1.3	728	0.9	36	0.2	6.3	0.02	1.1
8	1.6	636	1.0	32	0.1	5.4	0.02	1.1
9	1.4	709	1.1	36	0.3	6.9	0.02	1.2
10	1.6	816	1.1	36	0.2	8.6	0.02	1.2
11	1.6	1031	1.1	41	0.2	7.5	0.02	1.2
Overall Highest Predicted MGLCs	***3.7***	***1853***	***2.7***	***142***	***0.6***	***29***	***0.2***	***6.4***

Table 5.8 : Highest Predicted MGLCs of PM_{10} at Selected Sensitive Receptors (excluding background)

Receptor ID	PM_{10} MGLCs (µg/m^3)			
	24-hour average		Annual average	
	Riau CCPP	Both plants	Riau CCPP	Both plants
1	0.5	0.9	0.04	0.15
2	0.5	0.7	0.04	0.14
3	1.1	1.4	0.07	0.19
4	1.4	1.9	0.11	0.26
5	1.8	2.3	0.11	0.27
6	0.5	0.9	0.06	0.17
7	0.6	0.8	0.05	0.15
8	0.4	0.8	0.06	0.16
9	0.9	1.2	0.06	0.17
10	0.8	1.3	0.06	0.16
11	0.5	0.8	0.06	0.16
Overall Highest Predicted MGLCs	***2.1***	***2.7***	***0.64***	***0.88***

Table 5.9 : Highest Predicted MGLCs of CO at Selected Sensitive Receptors (excluding background)

Receptor ID	CO MGLCs (µg/m^3)					
	1-hour average (highest)		1-hour average (highest)		8-hour average	
	Riau CCPP	Riau CCPP	Riau CCPP	Both plants	Riau CCPP	Both plants
1	6.4	6.4	3.9	3.9	1.6	1.8
2	6.0	6.0	4.0	4.0	1.9	1.9
3	5.9	5.9	4.5	4.7	3.8	3.9
4	7.3	7.6	5.1	6.0	5.1	5.2
5	8.3	8.3	5.1	6.1	6.3	6.5
6	6.1	6.1	3.8	3.8	1.6	1.7
7	5.5	5.5	3.7	3.7	1.8	1.8
8	6.6	6.6	4.2	4.2	1.3	1.4
9	5.5	5.5	4.2	4.3	3.2	3.3
10	4.9	4.9	3.9	4.0	2.7	2.8
11	6.4	6.4	4.7	4.7	1.9	1.9
Overall Highest Predicted MGLCs	***15.5***	***15.5***	***9.7***	***9.8***	***7.3***	***7.6***

6. Mitigation and Monitoring

6.1 Construction Phase

6.1.1 Mitigation

Although the unmitigated impacts of nuisance dust are not considered to be significant in the wider context of the Project, there could be individual residences within closer proximity to construction sites, as well as local use of near-by farming areas. The Project will apply good working practices to minimise potential impacts through mitigation techniques such as:

- Water spraying of or covering all exposed areas and stockpiles;
- Covering or enclosed storage of aggregates (including topsoil and sand) where practical;
- Minimizing the size of exposed areas and material stockpiles and the periods of their existence;
- Covering the construction materials transported by trucks or vehicles to prevent dust emissions;
- Limiting dust generation activities in high winds or specific wind directions, if required;
- Cleaning wheels and the lower body parts of trucks at all exits of the construction site;
- Cleaning the entire construction work sites at least once per week; and,
- Maintaining and checking the construction equipment regularly.

6.1.1 Monitoring

As part of good working practice the construction manager for the construction phase of the Project will complete routine checks on dust generation from construction activities, and confirm that dust suppression and appropriate storage is being used where required. In addition, a mechanism for complaints regarding dust will be available to locals, and due regard given to any issues raised.

6.2 Operational Phase

6.2.1 Mitigation

Mitigation of discharges from the operational phase of the project has occurred in the Project design stage, and includes high efficiency burners and low design concentration of contaminants from natural gas combustion. Drift eliminators on the cooling towers also limit particulate matter discharges from the site.

As discussed in 4.2 and 4.3, the predicted maximum contribution of air pollutants to the airshed resulting from the operation of the Project is low, at less than 25% of the relevant air quality standards for all contaminants. Since the Project is located in a non-degraded airshed with respect to the main contaminant discharged (NO_2), and the maximum Project contribution is predicted to be less than 25% of the relevant air quality standards, the cumulative impact significance is also considered minor during the operation of the Project. No additional mitigation measure associated with the operation of the Project is therefore required.

6.2.2 Monitoring

The Project will include an environmental monitoring programme, which will include a Continuous Emissions Monitoring System (CEMS) for continuous monitoring of gases discharged from both stacks, including measurements of oxygen, carbon dioxide, nitrogen oxides and temperature. The CEMS unit will calibrated annually by stack testing conducted in accordance with good international practice for stack testing.

It is recommended that ambient air monitoring for NO_2 is undertaken in the area surrounding the power plant at two locations, with sampling carried out using passive and manual methods on a monthly basis. Alternatively, a permanent continuous ambient air monitoring unit for NO_2 which utilises electro chemical cell non-reference method could be installed at one location where the highest concentration of NO_2 as a 24-hour average is predicted to occur, subject to land acquisition and security arrangements.

7. Assessment of Residual Impacts

7.1 Construction Phase

The assessment indicates that the air quality associated with the construction will be controlled to minor; no adverse air quality impact during construction phase will be anticipated provided all recommended air mitigation measures will be implemented.

7.2 Operational Phase

The potential air quality impacts arising from the Project during the operational phase have been predicted to be small relative to the relevant WHO Ambient Air Quality Guidelines as recommended in the IFC Guidelines. Incremental impacts in the degraded air shed should therefore be minimised by NO_X emissions being less than 25% of the WHO guideline, and will be significantly less than this at the nearest residential areas. Incremental impacts of other contaminants, including SO_2 and particulate matter, are significantly lower than those of NO_2. The significance of impact during the operation phase of the Project is therefore considered minor.

8. References

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Appendix A. Assessment Criteria

The assessment criteria below have been summarised from the *Guidance on the Assessment of Dust from Demolition and Construction* developed by the Institute of Air Quality Management (IAQM) (2014).

A.1 Dust Emission Magnitude

Earthworks

Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling the site and landscaping. Every site is different in terms of timing (seasonality), geology, topography and duration and therefore professional judgement must be applied when classifying the earthworks' activities.

The following are examples of the potential dust emission classes (note that not all the criteria need to be met for a particular class); other criteria may be used if justified in the assessment:

- Large: Total site area >10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry to due small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8m in height, total material moved >100,000 tonne;
- Medium: Total site area 2,500m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m – 8 m in height, total material moved 20,000 tonne – 100,000 tonne; and
- Small: Total site area <2,500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <10,000 tonne, earthworks during wetter months.

Construction

The key issues when determining the potential dust emission class during the construction phase include the size of the building(s)/infrastructure, method of construction, construction materials, and duration of build. Every site is different in terms of timing (seasonality), building type, duration, scale (volume and height) and therefore professional judgement must be applied when classifying the construction activities into one of the 3 magnitude classes.

The following are examples of the potential dust emission classes (note that not all the criteria need to be met for a particular class); other criteria may be used if justified in the assessment:

Large: Total building volume >100,000m^3, piling, on site concrete batching; sandblasting

Medium: Total building volume 25,000m^3 – 100,000m^3, potentially dusty construction material (e.g. concrete), piling, on site concrete batching; and

Small: Total building volume <25,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

Trackout

Factors which determine the dust emission magnitude are vehicle size, vehicle speed, vehicle numbers, geology and duration. As with all other potential sources, professional judgement must be applied when classifying trackout into one of the dust emission magnitude categories.

Example definitions for trackout are:

Large: >50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m;

Medium: 10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m; and

Small: 3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length.

These numbers are for vehicles that leave the site after moving over unpaved ground, where they will accumulate mud and dirt that can be tracked out onto the public highway.

A.2 Area Sensitivity

The dust emission magnitudes for both earthworks and construction activities should then be used in the matrix in Table A1 to determine the earthworks risk category for dust soiling effects with no mitigation applied. Similarly, the dust emission classes should be used in the matrix provided in Table A2 to assess risk to human health, and Table A3 for assessing ecological risk.

Table A1: Sensitivity of the area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

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Table A2: Sensitivity of the area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m^3	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m^3	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table A3: Sensitivity of the area to Ecological Impacts

Receptor Sensitivity	Distance from Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

A.3 Risk of Dust Impacts

The dust emission magnitude determined for construction and earthworks activities (i.e. small, medium or large) should be combined with the sensitivity of the area determined by the matrices in Tables A1, A2 and A3) to determine the risk of impacts with no mitigation applied. The matrix in Table A4 provides a method of assigning the level of risk for each activity. This should be used to determining the level of mitigation that must be applied. For those cases where the risk category is ‘Negligible’, no mitigation measures beyond those required by legislation will be required.

Table A4: Risk of Dust Impacts

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Appendix I. Technical Report – Noise Impact Assessment

Riau 275 MW Gas Combine Cycle Power Plant IPP - ESIA

Medco Ratch Power Riau

Technical Report – Noise Assessment

AM039100-400-GN-RPT-1009 | V5

July 2018

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Riau 275 MW Gas Combine Cycle Power Plant IPP - ESIA

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Contents

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Acronyms

AMDAL	Analisis Mengenai Dampak Lingkungan
ADB	Asian Development Bank
CEMP	Construction Environmental Management Plan
CEMS	Continuous Environmental Monitoring Station
CCPP	Combined cycle power plant
CFPS	Coal fired power plant
CPI	Corrugated plate interceptor
EHS	Environmental, Health and Safety
EPFI	Equator Principle Financial Institution
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
GT	Gas turbine
H&SP	Health and Safety Plant
ha	Hectare
HHV	High Heating Value
HP	High pressure
HRSG	Heat recovery steam generator
IP	Intermediate pressure
km	Kilometres
m	Metres
aMSL	Above mean sea level
MRPR	Medco Ratch Power Riau
MW	Megawatt
NO_x	Oxides of Nitrogen
OHL	Overhead Line
OPGW	Optical Ground Wire
PPA	Power Purchase Agreement
RoW	Right of way
SAP	Survey Action Plan
SEP	Stakeholder Engagement Plan
ST	Steam turbine
T	Tonnes

1. Introduction

1.1 Purpose

This Technical Report provides an assessment of the noise impacts associated with the construction and operation of the Riau 275 MW Combined Cycle Gas Fired Power Plant IPP Project (Riau 275MW CCPP). The project consists of a 275 MW combined cycle power plant and ancillary facilities, a 40 km long 12-inch gas pipeline, and a switchyard and 150 kV transmission line - collectively comprising the “Project”.

This report provides a brief description of the location and environmental setting, followed by key details of the proposed design in respect to construction and operation of the Project. This report is one of several technical reports prepared for the Environmental and Social Impacts Assessment (ESIA) and other permitting work associated with the Project. It is based on preliminary engineering work, including the EPC Contractor’s (Lotte E&C) preliminary design of the power plant.

1.2 Background

The Riau 275 MW CCPP will be a new, greenfield power station. The Project Sponsors (being PT Medco Power Indonesia (MEDCO) and Ratchaburi Electricity Generating Holding PCL (RATCH), have formed PT Medco Ratch Power Riau (MRPR) to build, own and operate the plant under the terms of the Power Purchase Agreement (PPA) which has been agreed with PLN.

The key components of the Project include a 275 MW combined cycle power plant (CCPP), a 40 km long gas supply pipeline which will bring fuel to the site, a 150 kV switchyard, and an approximately 750 m long transmission line to connect the power plant to the PLN grid. Once constructed, ownership of the switchyard and transmission line collectively known as the Special Facilities will be transferred to PLN. At the end of the 20-year term of the PPA, PLN will take ownership of the power plant and gas supply pipeline.

The Project will be located approximately 10 km due east of Pekanbaru City, approximately three km south of the Siak River. The power plant and switchyard well be comfortably accommodated inside the 9 ha of land being procured by MRPR. The power plant is a 2 x 1 combined cycle plant, designed to deliver up to 275 MW over the 20-year term of the PPA. It will burn gas fuel only. It will consist of:

- 2 x GE 6F.03 gas turbine (GT) generator sets;
- 2 x supplementary fired heat recovery steam generators (HRSGs);
- 1 x steam turbine (ST) generator set;
- A wet mechanical draft cooling tower;
- Gas reception area; and
- All normal balance of plant systems.

In addition, there will be:

- A 150 kV switchyard at the plant, with an approximately 750 m double-phi connection to intercept the Tenayan – Pasir Putih 150 kV transmission line;
- A 40 km gas pipeline running from the gas connection point at an offtake location known as SV1401 on the main Grissik-Duri gas pipeline; and
- Water supply and discharge pipelines to and from the Siak River.

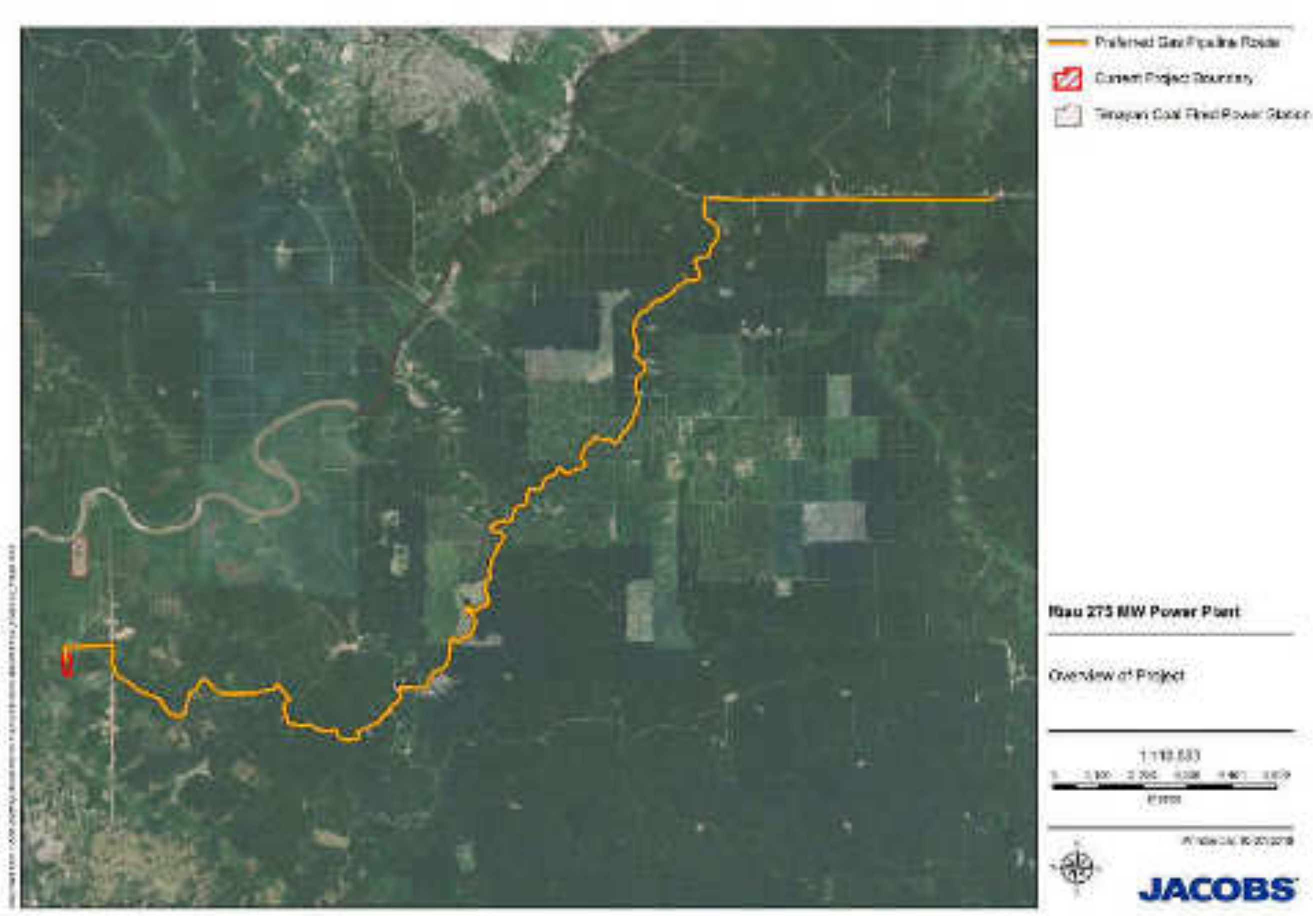


Figure 1.1 : Outline of Project Area

1.3 Purpose

The purpose of this report is to provide an assessment of the noise impacts for the operation and construction of the Project.

The objectives of this study were to:

1) Establish operational and construction noise criteria for environmental noise emissions at potentially noise affected sensitive receivers surrounding the site;
2) Determine all acoustically significant plant required for the construction of the Project and to predict noise at the nearest potentially affected noise sensitive receivers within the vicinity of the works;
3) From results of the noise predictions, assess noise levels from proposed construction relative to the noise criteria at the nearest potentially affected receivers;
4) Determine all acoustically significant plant required during the operation of the project and to predict noise at the nearest potentially affected noise sensitive receivers within the vicinity of the power station;
5) From results of the noise predictions, assess noise levels from proposed site operations relative to the noise criteria at the nearest potentially affected receivers; and
6) Recommend construction and operational noise impact mitigation and management measures if required.

Specific acoustic terminology is used within this report. An explanation of common terms is included in Appendix A.

2. Baseline Existing Environment

The current land uses at the proposed power plant site are predominantly palm oil plantations and low density rural residential properties. The photograph in Figure 2.1 provides an indication of the terrain and topography immediately surrounding the site and in Figure 2.1: View of proposed CCPP site an indication of typical rural residential development south-east of the proposal.

Figure 2.1 : View of Proposed CCPP Site

Figure 2.2 : View Towards Existing Tenayan CFPP Over Rural Residential Area

Further afield, the eastern outskirts of Pekanbaru City are located approximately 3 to 4 km towards the west and south.

2.1 Acoustic Character of Surrounding Area

Noise levels were measured at locations representative of the nearest built up areas over several days during September and October 2017. The ambient noise levels were recorded continuously for a one-hour period during representative time intervals and comments against identifiable noise influences were noted during the noise survey. Typically, the noise sources in the area were as follows:

Day time – residential areas

- Noise from traffic activity
- Residential noise (children, talking, televisions, radios)
- Birds
- Dogs.

Night time – residential areas

- Noise from traffic activity
- Dominant noise from crickets and other nocturnal insects
- Generators
- Crickets
- Occasional birds.

Monitoring locations are presented visually in Figure 2.3 and the results of monitoring are provided in Table 2.2.

2.1.1 Noise catchment areas

The area surrounding the proposed Riau CCPP has been divided into Noise Catchment Areas (NCAs). These areas have been presented in Table 2.1 and graphically in Figure 2.3 and have been defined according to the likely noise environment in the area.

Table 2.1 : Description of NCAs

Noise Catchment Area	Description
NCA 1	The immediate vicinity of the Riau CCPP
NCA 2	Semi-rural receivers on the eastern outskirts of Pekanbaru
NCA 3	Suburban receivers in eastern Pekanbaru
NCA 4	Palm oil plantations
NCA 5	Township near the intersection of Jl Baru Bakal and Jl Pemda
NCA 6	Properties along Jl Ferry Pinang Sebatang

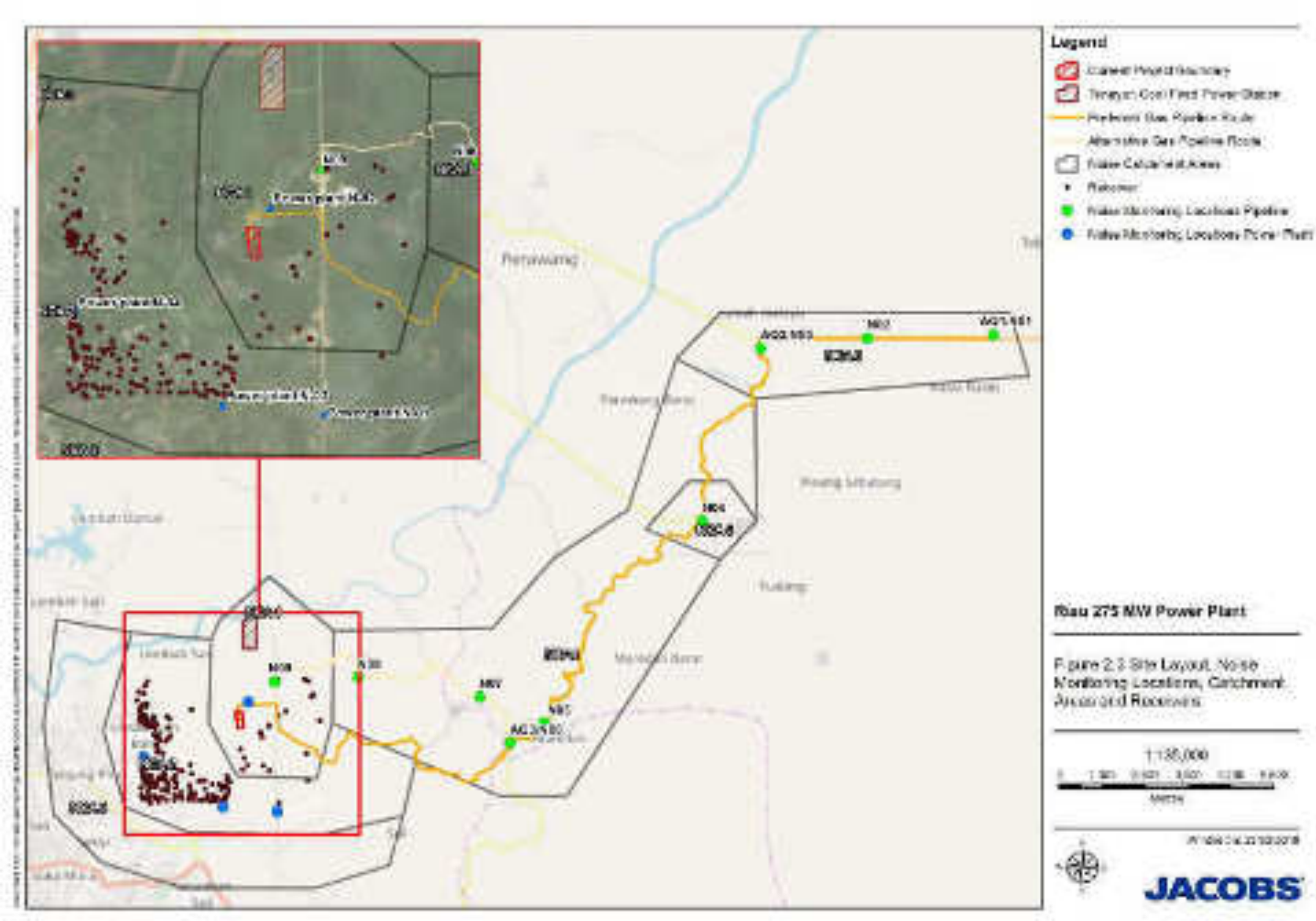


Figure 2.3 : Site Layout, Noise Monitoring Locations and Catchment Areas

2.1.2 Monitoring results

The results of monitoring at each location are summarised in Table 2.2. Noise monitoring was carried out at each site during periods where noise impacts may be experienced. For the pipeline route, noise impacts may be associated with daytime construction work only, while at for receivers potentially affected by power station noise, results are presented for each time interval of the 24-hour monitoring period and for the overall Ls (Daytime), Lm (Night time) and Lsm (24 hour) periods.

At the four locations (PS01, PS02, PS03 and PS04) around the power station, attended monitoring was undertaken in intervals covering continuous 48-hour periods. The monitoring was completed at different dates for each of the four locations, though all of the monitoring was undertaken in the second half of 2017.

Table 2.2 : Noise Monitoring Results

Study area	Location	NCA	Monitored noise level (L_{Aeq} period)							Overall noise level			World Bank Parameters	
			L1	L2	L3	L4	L5	L6	L7	Ls	Lm	Lsm	Day	Night
			6am-9am	9am-11am	2pm-5pm	5pm-10pm	10pm-12am	12am-3am	3am-6am				(7:00 to 22:00)	(22:00 to 7:00)
Pipeline	PL01	6	-	57	-	-	-	-	-	-	-	-	-	-
	PL 02	6	-	62	-	-	-	-	-	-	-	-	-	-
	PL03	6	-	71	-	-	-	-	-	-	-	-	-	-

Study area	Location	NCA	Monitored noise level (L_{Aeq} period)							Overall noise level			World Bank Parameters	
			L1	L2	L3	L4	L5	L6	L7	Ls	Lm	Lsm	Day	Night
			6am-9am	9am-11am	2pm-5pm	5pm-10pm	10pm-12am	12am-3am	3am-6am				(7:00 to 22:00)	(22:00 to 7:00)
	PL 04	5	-	67	-	-	-	-	-	-	-	-	-	-
	PL 05	4	-	72*	-	-	-	-	-	-	-	-	-	-
	PL06	4	-	62	-	-	-	-	-	-	-	-	-	-
	PL 07	4	-	53	-	-	-	-	-	-	-	-	-	-
	PL 08	4	-	37	-	-	-	-	-	-	-	-	-	-
	PL 09	1	-	45	-	-	-	-	-	-	-	-	-	-
Power station	PS 01	2	61	50	58	49	52	47	44	56	49	55	54	55
	PS 02	1	61	53	62	57	59	62	61	59	61*	59	60	59
	PS 03	2	58	57	60	62	59	56	51	59	56	58	58	58
	PS 04	2	54	57	56	43	46	41	46	53	45	51	49	51

** These results appear to be unrealistically high and may indicate interference from a localised noise source.*

Audio recording at proposed power plant sites indicated that existing background noise levels were influenced by birds, local traffic and residential noise (including diesel generators) during daytime and evening hours and crickets during night time hours. Background noise levels along the pipeline route are controlled by the proximity of the monitoring site to local roads and the local density of residential properties.

World Bank (WBG) EHS noise guidelines are discussed in Section 3.2.2, however in summary they outline recommended goals for noise levels measured outside a dwelling. For residential properties, these noise levels are described as 55 dB(A) during daytime hours and 45 dB(A) during the night.

Review of the monitoring results shown in Table 2.2 shows that this noise level is currently exceeded during daytime hours at receivers PL01 – PL06 and PS02 / PS03. Night time noise monitoring was carried out at the four sites potentially impacted by operational noise. This testing showed that existing noise levels during night time hours are currently exceeded at all four locations.

2.2 Topography

The local topography and terrain is important in the consideration of noise propagation to other locations adjacent to the site. In the area of interest around the proposed power plant, the land is generally flat, with regular, low rolling hills.

The terrain is typically thickly vegetated with palm oil plantations and interspersed with small dirt roads. Over these large distances, acoustic absorption through these plantations may be significant and land usage has been accounted for in the modelling of noise impacts for the proposal.

2.3 Meteorology

The air quality assessment (Jacobs, 2018) has identified meteorological conditions typically associated with the proposed location of the Project. The prevailing weather patterns affect how noise propagates from the source to the receiver locations and provide potential for noise enhancing conditions to be present. Similarly, local weather conditions can also reduce noise impacts where wind directions are generally directed from receiver to the source (i.e. sound propagation towards sensitive receivers is hindered).

Wind is generally light, but the area is subject to monsoonal weather with high winds during the wet months. The predominant wind direction varies throughout the year, with southerly winds occurring primarily during the dry season and northerly winds during the rainy season. The average wind speed is less than 3 m/s.

The wind rose shown in Figure 2.4 has been generated from data collected at an ambient air monitoring site in Pekanbaru for 2010 to 2015. The data shows monitoring station is influenced by local buildings and terrain, with the general area affected by winds predominantly from the north-western and north-eastern sectors, and from the south-southeast. Calm conditions, which are a wind speed of less than 0.5m/s, are predicted to occur for 26.8% of the time and the average wind speed for the data period is 0.54 m/s. The very low wind speeds as well as the absence of winds from the north suggest that that winds at this location are measured at a low height above ground level, and are affected by local structures, trees, etc. Given the very low wind speeds observed, we consider the wind data to not be representative of meteorological conditions in the wider area which the Project is located.

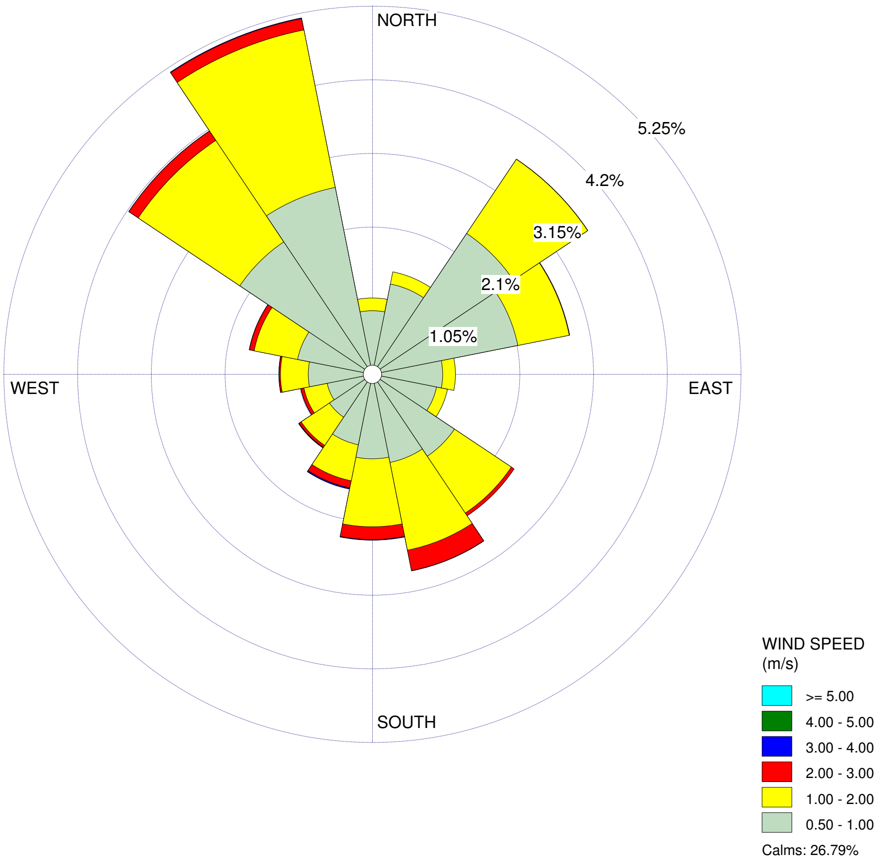
As such the operational noise assessment has considered absolute worst case noise transmission, rather than typical indicative conditions. Under the modelled scenarios, wind has been assumed to be blowing at 2 m/s from each source to each receiver.

WIND ROSE PLOT:

Pekanbaru Windrose 2010-2015

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 31/12/2010 - 00:00 **End Date: 31/12/2015 - 23:00**	MODELER:	
	CALM WINDS: **26.79%**	TOTAL COUNT: **27267 hrs.**	
	AVG. WIND SPEED: **0.54 m/s**	DATE: **29/01/2018**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Figure 2.4 : Windrose of Data Collected at Pekanbaru (Years 2010 – 2015)

3. Standards and Guidelines

3.1 Overview

Noise limits provide a benchmark for assessing the potential for noise emissions from the power plant to impact on nearby residential locations. The noise limits applicable to this type of development are determined by the approval authorities for the Project. In this instance the Indonesian Ministry of Environment has a local approval role, referencing Indonesian environmental ambient noise standards as part of the AMDAL process. Other parties to the project include financing bodies such as the Asian Development Bank and International Finance Corporation (IFC), which also have noise criteria to be considered as part of the governance process.

An assessment of the power plant noise emissions is made using available information and compared to the most stringent of the proposed noise standards and guidelines for the daytime and night time periods. Because the power plant is expected to run 24 hours per day, consideration of the night time noise levels will be the limiting case for the majority of the considered criteria.

Where the noise limits indicate the potential for an exceedance of these goals, mitigation measures should be considered to reduce the predicted noise levels to acceptable values wherever possible.

3.2 Construction and Operational Noise Limits

3.2.1 Indonesian Standards

The State Minister of Environment Decree No 48 identifies noise limits relevant to the project in Subsection 4.2 as follows:

*"**4.2 Minimum Noise Threshold** - Decision of Environmental Minister No KEP-48/MENLH/11/96 establish standard noise levels for specific areas shown in Table 3.1. The standard level of noise is based on an A weighted equivalent noise level, L_{Aeq} over a 1 hour period."*

Table 3.1 presents the relevant Indonesian noise criteria for the project, which has in turn been reproduced from Table 1 of *KEP-48/MENLH/11/96*.

Table 3.1 : Indonesian SME Noise Limits for the Project

<table>
<tr><th colspan="3">Appropriation Region - environmental Activities</th><th>Noise level
dB(A)</th></tr>
<tr><td rowspan="11">a.</td><td colspan="3">Appropriation Region</td></tr>
<tr><td>1</td><td>Housing and Settlements</td><td>55</td></tr>
<tr><td>2</td><td>Trade and Services</td><td>70</td></tr>
<tr><td>3</td><td>Office and Commerce</td><td>65</td></tr>
<tr><td>4</td><td>Green open space</td><td>50</td></tr>
<tr><td>5</td><td>Industry</td><td>70</td></tr>
<tr><td>6</td><td>Government and Public Facilities</td><td>60</td></tr>
<tr><td>7</td><td>Recreation</td><td>70</td></tr>
<tr><td rowspan="3">8</td><td colspan="2">Special:</td></tr>
<tr><td>Seaports</td><td>70</td></tr>
<tr><td>Cultural heritage</td><td>60</td></tr>
<tr><td>b.</td><td colspan="3">Environmental Activities</td></tr>
</table>

Appropriation Region - environmental Activities			Noise level dB(A)
	1	Hospital or the like	55
	2	Schools or the like	55
	3	Places of worship or the like	55

The relevant criterion for residential noise sensitive receivers (housing and settlement) is taken to be an L_{Aeq} (1 hour) 55 dB(A). As there is no distinction for different times of the day, this criterion would be applicable for both the day and night time periods.

Other locations for consideration include industrial sites, which have an $L_{Aeq\ 1\ hour}$ 70 dB(A) criterion for both day and night. Typically, the 70 dB(A) noise limit is applied at the boundary of the facility under assessment.

School, hospitals and places of worship have the same limits as the residential criterion and it is expected that these values represent predicted external noise levels.

3.2.2 World Bank Criteria

3.2.3 WBG EHS Guidelines

The WBG recommends noise limits for residential locations in accordance with its EHS Guidelines. These guidelines have been adopted from Guidelines for Community Noise, World Health Organization, 1999 and are values for noise levels measured outside a dwelling. The noise level guidelines from the IFC have been reproduced in Table 3.2 :

Table 3.2 : IFC Noise Guidelines for Noise Sensitive Locations

Receptor	Day 07:00-22:00	Night-time 22:00-07:00
	$L_{Aeq1\ hr}$	$L_{Aeq1\ hr}$
Residential, Institutional Educational	55 dB(A)	45 dB(A)
Industrial, Commercial	70 dB(A)	70 dB(A)

The guidelines state:

"Noise impacts should not exceed the levels presented in Table 3.2 or result in a maximum increase in background levels of 3 dB at the nearest receptor location – off site"

The additional criteria of background plus 3 dB(A) is referred to as a maximum increase in noise levels and is only to be adopted where the guideline levels in the table are already exceeded.

Table 3.3 : World Bank Noise Guidelines for Power Stations

NCA (Residential, Institutional Educational receptors)	Initial noise limits dB(A)		Existing dB(A)*		Final noise limits dB(A)	
	Daytime 07:00-22:00	Night-time 22:00-07:00	Daytime 07:00-22:00	Night-time 22:00-07:00	Daytime 07:00-22:00	Night-time 22:00-07:00
	$L_{Aeq1\ hr}$	$L_{Aeq1\ hr}$	$L_{Aeq\ period}$	$L_{Aeq\ period}$	$L_{Aeq1\ hr}$	$L_{Aeq1\ hr}$
1****	55	45	59	61**	62	45
2			53	45	56	48
3***			53	45	56	48
4****			53	-	56	45

NCA (Residential, Institutional Educational receptors)	Initial noise limits dB(A)		Existing dB(A)*		Final noise limits dB(A)	
	Daytime 07:00-22:00	Night-time 22:00-07:00	Daytime 07:00-22:00	Night-time 22:00-07:00	Daytime 07:00-22:00	Night-time 22:00-07:00
	$L_{Aeq1\ hr}$	$L_{Aeq1\ hr}$	$L_{Aeq\ period}$	$L_{Aeq\ period}$	$L_{Aeq1\ hr}$	$L_{Aeq1\ hr}$
5			67	-	70	45
6			62	-	65	45

** A representative single monitoring result has been selected from each NCA*

*** As outlined in Section 0, this noise result is unrealistically high. As such the WBG EHS L_{Aeq} criterion of 55dB(A) has been applied.*

**** It is noted that noise monitoring was not conducted in NCA 3, and as such the noise levels from nearby NCA 2 have been applied. In reality this is a conservative approach as NCA 2 assesses semi-rural receivers on the eastern outskirts of Pekanbaru, whereas NCA 3 is located in the noisier suburban areas.*

***** Representative median values have been selected where multiple measurements have been obtained in these NCAs.*

Given that noise monitoring was not conducted during night time hours in NCAs 4, 5 and 6, the WBG EHS noise guidelines have been applied during these periods. In NCAs 1, 2 and 3 the existing noise level is greater than the guidelines and as such the alternative 'background plus 3 dB(A)' criterion has been applied at these locations.

Given that power plant noise is generally steady in nature, showing little variation throughout the day and night time period, the lowest noise criterion (night time) at each location will be applied.

These limits will be used to assess the acceptability of both construction and operation of the Project as set out in the ESMP.

4. Impact Assessment Methodology

4.1 Introduction

The impact assessment methodology has been developed in accordance with good industry practice and the potential impacts have been identified in the context of the Project's Area of Influence (AoI), in accordance with ADB Environmental Safeguards and IFC Performance Standard 1 (Assessment and Management of Environmental and Social Risks and Impacts).

4.2 Modelling Methodology

Noise modelling for the project utilised the SoundPLAN modelling software implementing the CONCAWE method of calculation.

Calculations have been provided for both neutral and unfavourable weather conditions. The following meteorological conditions are accounted for in the modelling:

- Neutral meteorological conditions: zero wind speed, 'D class' Pasquill category; and
- Adverse meteorological conditions: 2 m/s wind speed with the wind blowing from source to receiver, 'F class' Pasquill category

As well as consideration of meteorological conditions, the standard also considers the following acoustic elements:

- Source directivity and size;
- Geometrical spreading;
- Air absorption;
- Ground absorption;
- Reflections; and
- Screening from terrain and major structures

4.2.1 Modelling parameters and scenarios

Noise contours for the site were generated based on the following modelling parameters:

- Receiver height above ground of 1.5 m;
- Ground absorption = 0.75 (soft surface);
- Contour grid size of 20 m; and
- Reflection order of 3.

Modelling was conducted for the following operational scenarios:

- 24 hour emissions from Riau CCPP; and
- 24 hour emissions from both Riau CCPP and Tenayan CFPP (cumulative impact).

4.2.2 Meteorological influences

Given the that the wind measurements at Pekanbaru (refer Section 2.3) have been influenced by buildings and local topography, typical meteorological conditions have not been assessed, instead the operational noise assessment has considered absolute worst case noise transmission. Under the modelled scenarios, wind has been assumed to be blowing at 2 m/s from each source to each receiver. Predictions have been provided for these adverse and neutral meteorological conditions.

Where the dominant wind direction is from receiver to the noise source, noise levels will be lower than the levels predicted in this assessment.

4.2.3 Magnitude Criteria

The assessment of impact magnitude is undertaken by categorising identified impacts of the Project as beneficial or adverse. Then impacts are categorised as 'major', 'moderate', 'minor' or 'negligible' based on consideration of parameters such as:

- Duration of the impact – ranging from 'well into operation' to 'temporary with no detectable impact'.
- Spatial extent of the impact – for instance, within the site boundary, within district, regionally, nationally, and internationally.
- Reversibility – ranging from 'permanent thus requiring significant intervention to return to baseline' to 'no change'.
- Likelihood – ranging from 'occurring regularly under typical conditions' to 'unlikely to occur'.
- Compliance with legal standards and established professional criteria – ranging from 'substantially exceeds national standards or international guidance' to 'meets the standards' (i.e. impacts are not predicted to exceed the relevant standards) presents generic criteria for determining impact magnitude (for adverse impacts). Each detailed assessment will define impact magnitude in relation to its environmental or social aspect.
- Any other impact characteristics of relevance.

Table 4.1 below presents generic criteria for determining impact magnitude (for adverse impacts). Each detailed assessment will define impact magnitude in relation to its environmental or social aspect.

Table 4.1 : General Criteria for Determining Impact Magnitude

Category	Description
Major	Fundamental change to the specific conditions assessed resulting in long term or permanent change, typically widespread in nature and requiring significant intervention to return to baseline; would violate national standards or Good International Industry Practice (GIIP) without mitigation.
Moderate	Detectable change to the specific conditions assessed resulting in non-fundamental temporary or permanent change.
Minor	Detectable but small change to the specific conditions assessed.
Negligible	No perceptible change to the specific conditions assessed.

4.2.4 Sensitivity Criteria

Sensitivity is specific to each aspect and the environmental resource or population affected, with criteria developed from baseline information. Using the baseline information, the sensitivity of the receptor is determined factoring in proximity, number exposed, vulnerability and the presence of receptors on site or the surrounding area. Generic criteria for determining sensitivity of receptors are outlined in Table 4.2 below. Each detailed assessment will define sensitivity in relation to its environmental or social aspect.

Table 4.2 : General Criteria for Determining Impact Sensitivity

Category	Description
High	Receptor (human, physical or biological) with little or no capacity to absorb proposed changes
Medium	Receptor with little capacity to absorb proposed changes
Low	Receptor with some capacity to absorb proposed changes
Negligible	Receptor with good capacity to absorb proposed changes

4.2.5 Impact Evaluation

The determination of impact significance involves making a judgment about the importance of project impacts. This is typically done at two levels:

- The significance of project impacts factoring in the mitigation inherently within the design of the project; and
- The significance of project impacts following the implementation of additional mitigation measures.

The impacts are evaluated taking into account the interaction between the magnitude and sensitivity criteria as presented in the impact evaluation matrix in Table 4.3 below.

Table 4.3 : Impact Matrix

		Magnitude			
		Major	**Moderate**	**Minor**	**Negligible**
Sensitivity	**High**	Major	Major	Moderate	Negligible
	Medium	Major	Moderate	Minor	Negligible
	Low	Moderate	Minor	Negligible	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible

The objective of the ESIA is to identify the likely significant impacts on the environment and people of the project. In this impact assessment, impacts determined to be ‘moderate’ or ‘major’ are deemed significant. Consequently, impacts determined to be ‘minor’ or ‘negligible’ are not significant.

4.3 Construction Noise Impacts

A summary of construction scenarios has been reproduced here to inform the prediction of noise levels from these activities.

Noise impacts during construction of the CCPP have been modelled using CONCAWE noise prediction method. Modelling inputs are similar to those used in the operational noise model.

4.3.1 Construction scenarios and impacts

The estimated construction period for the power plant, pipelines and power transmission lines is about 24 months with six months for commissioning. During this time there would be earthworks and building activities on the site as well as truck movements to and from the work areas. The truck movements adjacent to the residential areas are expected to provide the greatest degree of impact on the nearby residences with other site work mostly being completed over 600 m from the local communities.

The construction phase of the Project is scheduled to last from September 2018 to September 2020. The construction of the CCPP will be carried out in the following phases:

- Clearing and earthworks;
- Foundations and drainage works;
- Erection of buildings and plant; and
- Installation of equipment.

Construction activities also include the construction of the gas pipeline and the transmission line.

It is understood that night time construction activities will rarely be required at the site. Where night time construction work is necessary, it shall be managed so that noise does not cause annoyance to neighbours unless it:

- is associated with an emergency; or
- is carried out with the prior written approval of the relevant authorities, or
- does not cause existing ambient noise levels to be exceeded.

Table 4.4 outlines a preliminary construction schedule and staging and associated equipment noise levels.

Table 4.4 : Preliminary Construction Staging and Equipment

Task	Equipment	Number	SWL
Clearing and earthworks	Dozer 40T - 50T (D8-D9)	2	114
	Excavator 40T - 50T	2	116
	Dump truck 40T - 50T	6	122
	Site generator	4	107
	Vibratory roller 10T - 20T	1	110
	TOTAL		**124**
Foundations and drainage	Concrete truck and pump	4	112
	Hand tools	12	116
	Concrete saw	1	114
	Bored piling rig	1	108
	Dump truck 40T - 50T	6	122
	Franna / truck mounted crane	4	105
	Mobile / truck mounted cranes 100T - 200T	2	102
	Hydraulic driver	1	115
	Vibratory roller 10T - 20T	1	110
	Excavator 40T - 50T	2	116
	Front end loader	1	116
	TOTAL		**126**
Erection of buildings and plant	Mobile / truck mounted cranes 100T - 200T	4	105
	Franna / truck mounted crane	6	107
	Hand tools	12	116
	Vibratory roller 10T - 20T	2	113
	Wacker packer		107
	Concrete truck and pump	2	99
	Dump truck 40T - 50T	3	119
	TOTAL		**122**
Installation of equipment	Mobile / truck mounted cranes 100T - 200T	1	99
	Franna / truck mounted crane	4	105
	Hand tools	12	116
	Concrete saw	1	114
	Vibratory roller 10T - 20T	2	113
	TOTAL		**119**

Task	Equipment	Number	SWL
Transmission line - Installation	Hand tools	6	110
	TOTAL		**110**
Gas pipeline - Installation	Franna / truck mounted crane	1	99
	Backhoe	2	97
	Hand tools	6	112
	Diesel generator (for lights – night time only)	2	105
	TOTAL		**114**

4.3.2 Riau CCPP Construction Noise Impacts

Construction noise contour maps for each of the four phases of construction of the CCPP above are presented in Appendix B. As displayed, noise levels are well below the site criteria outlined in Section 3.2 at the nearest, most affected receiver during all four assessment scenarios. Noise levels are expected to comply with these criteria even where works are conducted during night time hours. Given this, it was concluded that noise impacts during construction at the CCPP site are not expected, although measures to limit noise during these works have still been included below in Section 5.

Potential noise impacts associated with the construction of the power station have been evaluated as negligible, taking into account the negligible magnitude and negligible sensitivity of the predicted impacts.

4.4 Transmission Line Construction Noise Impacts

Owing to the linear nature of construction activities associated with construction of the transmission line, noise impacts will be temporal with the magnitude of noise levels varying as distances between receivers and the active work area changes. It is understood that construction of the towers will be largely manual, and require handtools, a truck mounted crane to deliver equipment and a concrete truck for footings.

Construction activities will be focused around each tower and are unlikely to generate noise impacts along other areas of the route.

The transmission line runs through NCA 1 only and is surrounded by very few isolated receivers. Compliance with the construction noise criteria is expected at distances of more than 100 m from each tower location. It should be noted that this assessment does not consider screening from terrain or structures and as such is a conservative estimate of construction noise.

Potential noise impacts associated with the construction of the power station have been evaluated as negligible, taking into account the minor magnitude and negligible sensitivity of the predicted impacts.

Section 5 provides measures to be incorporated into the environmental management plans to address potential noise issues during these works.

4.5 Gas pipeline Construction Noise Impacts

Owing to the linear nature of construction activities associated with construction of the gas pipeline, noise impacts will occur for an approximate two-week period with the magnitude of noise levels varying as distances between receivers and the active work area changes. It is understood that construction of pipeline will primarily be carried out with a truck mounted crane, single backhoe and hand tools.

The gas pipeline runs through NCAs 1, 4, 5 and 6 and passes several small villages and isolated rural residences. Construction of the gas pipeline is likely to be required during both day and night time periods.

During daytime hours, compliance with the construction noise criteria is expected at receivers located more than the following distances:

- NCA 1 150 metres
- NCA 4 300 metres
- NCA 5 60 metres
- NCA 6 110 metres

Where construction of the gas pipeline is carried out during night time hours, exceedances of the noise criteria may occur at all receivers located within than the following distances:

- NCA 1 1000 metres
- NCA 4 750 metres
- NCA 5 1000 metres
- NCA 6 1000 metres

It should be noted that this assessment does not consider screening from terrain or structures and as such is a conservative estimate of construction noise.

Where residential properties are located within the distances outlined above, exceedances of the identified project limits may occur. However, gas pipeline construction is linear in nature and any identified noise impacts will last for a short period of time. In consideration of this brief exposure period, construction noise impacts are not considered to be substantial.

During daytime work, potential noise impacts associated with the construction of the gas pipeline have been evaluated as minor, taking into account the moderate magnitude and negligible sensitivity of the predicted impacts.

However where pipeline construction is carried out during night time hours and within approximately 1km of a village, sensitivity may increase and noise impacts may be considered moderate.

4.6 Operational Noise Assessment

4.6.1 Supplied operational noise modelling data

The modelling data has been supplied by the contractor for the operational noise assessment process. Sound power levels (SWLs) are represented in the noise model to provide a three dimensional layout of the proposed power plant. The three dimensional noise model propagates these noise levels to a receiver location accounting for distance, air absorption, ground absorption, and screening effects.

The data in Table 4.5 summarises the significant noise sources that were accounted for in the modelling of operational noise impacts at the CCPP.

Table 4.5 : Significant CCPP Noise Emissions

Equipment	Status	Overall SWL dB(A)	Unit of measurement
GTG inlet			
Air inlet Filter Face	dB	85.0	per unit
Air Inlet Filter Transition	dB	99.0	per unit
Air Inlet Duct and Elbow	dB	105.0	per unit
Gas Turbine Package			
GT Enclosure	dB	101.0	per unit
Oil & Gas module enclosure	dB	99.0	per unit
GT Generator	dB	104.0	per unit

Equipment	Status	Overall SWL dB(A)	Unit of measurement
Vent Fans			
88TK	dB	91.0	per unit
88BN	dB	91.0	per unit
88BT (GT enclosure) casing	dB	90.0	per unit
88BT (GT enclosure) outlet	dB	90.0	per unit
88VG (load comp) casing	dB	92.0	per unit
88VG (load comp) outlet	dB	90.0	per unit
88VG (load comp) inlet	dB	90.0	per unit
88BL (lube oil enclosure) casing	dB	88.0	per unit
88BL (lube oil enclosure) inlet	dB	90.0	per unit
88VL (gas module enclosure) casing	dB	90.0	per unit
88VL (gas module enclosure) outlet	dB	90.0	per unit
Other Fans outlet	dB	90.0	per unit
Transition to HRSG			
GT Exhaust Diffuser Enclosure	dB	92.0	per unit
HRSG, with Duct Firing			
HRSG Inlet duct	dB	103.0	per unit
HRSG Body	dB	99.0	per unit
HRSG Stack & breaching	dB	94.0	per unit
Accessories (piping + valves + continuous vents)	dB	99.0	per unit
Stack Outlet (HRSG Stack Top) with duct firing	dB	104.0	per unit
BFPs	dB	90.0	per unit
Main cooling water pumps	dB	89.8	per unit
Closed cycle cooling water pumps, if outside	dB	85.0	per unit
Main Transformer	dB	83.0	per unit
Aux. Transformer	dB	71.0	per unit
Cooling Tower	dB	84.9	per unit
Steam turbine generator / condenser building			
ST Body	dB	108.0	per unit
HP/IP Steam Valve	dB	99.0	per unit
ST Generator	dB	106.0	per unit
Gas compressor enclosure	dB	85.0	per unit
Water treatment area	dB	<85.0	per unit
150kV substation	dB	50	per m2

A visual representation of the 3 dimensional model showing major operational noise sources in pink is provided below in Figure 4.1.

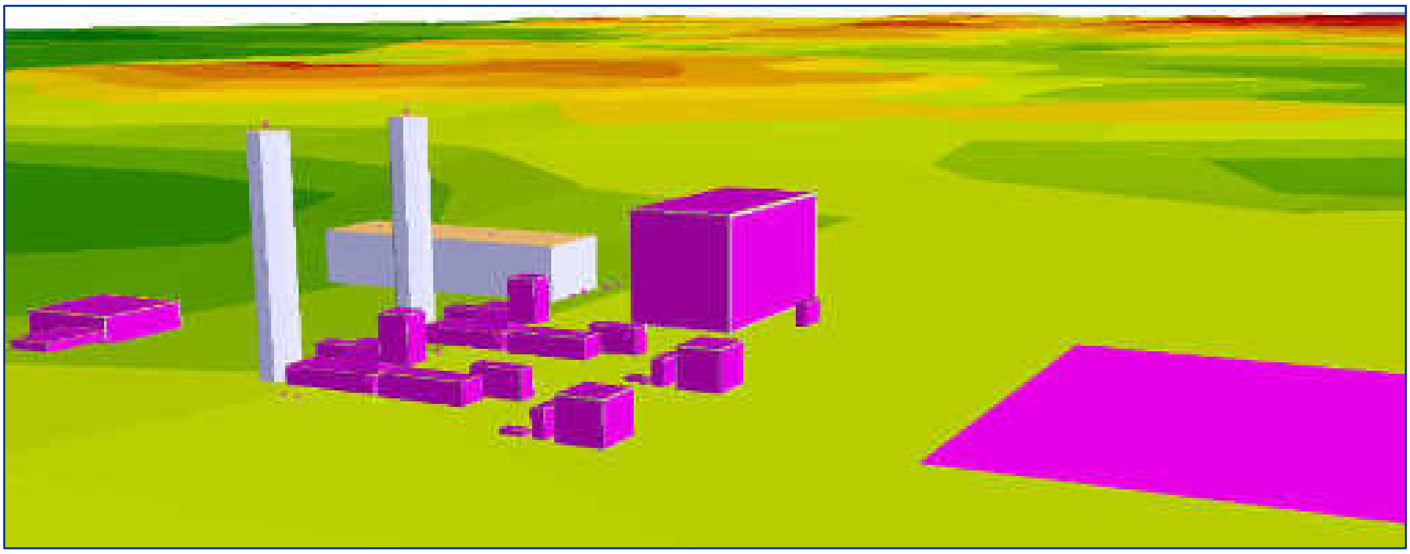


Figure 4.1 : Visual Representation of 3D Noise Model (Riau CCPP)

4.6.2 Riau CCPP impacts

4.6.3 Results of operational noise modelling

The power plant is assumed to have a constant noise emission however, in practice base load power levels are expected to decrease during the night time hours. This assessment has assumed the worst case scenario of the power station operating at full load, which may occur at any time.

Figure 4.2 and Figure 4.3 present predicted noise contours for the operational impacts from Riau CCPP alone under both neutral and adverse meteorological conditions.

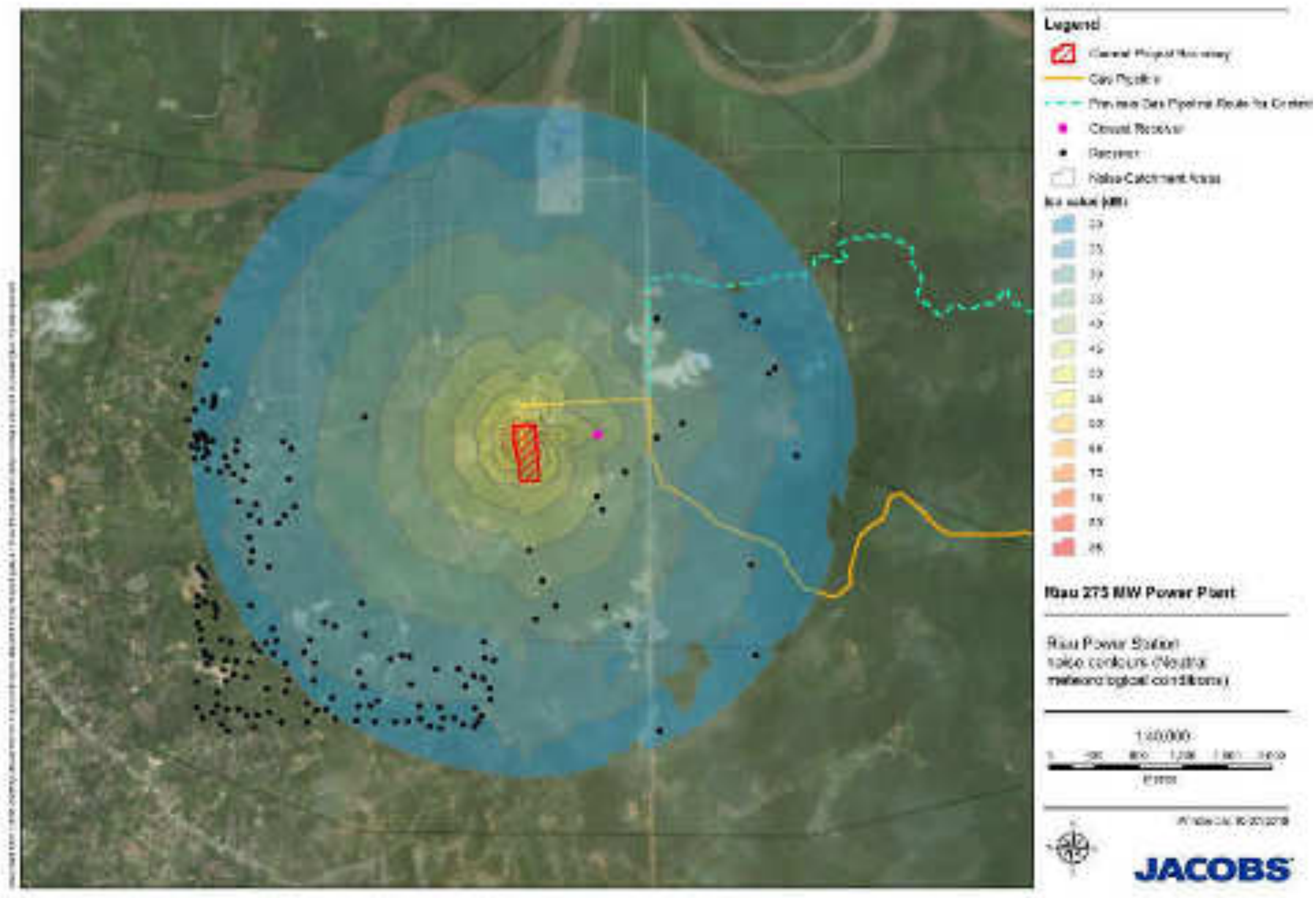


Figure 4.2 : Riau Power Station Noise Contours (Neutral Meteorological Conditions)

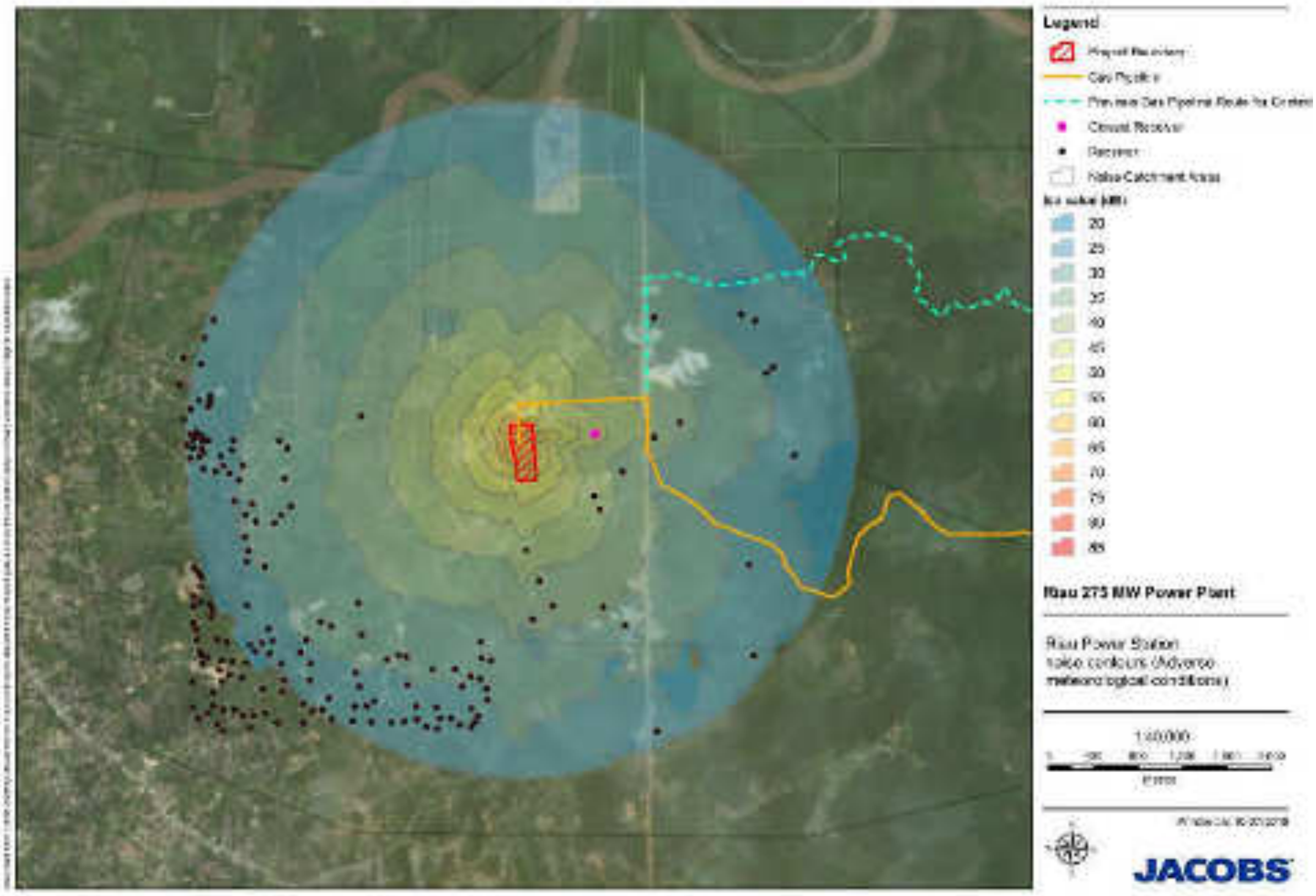


Figure 4.3 : Riau Power Station Noise Contours (Adverse Meteorological Conditions)

Under worst case, adverse weather conditions, the predicted noise levels from the plant alone at the nearest receivers (NCA 1 - sparse rural properties located to the east and north east) are expected to be below 40 dB(A) L_{Aeq}. For semi-rural properties located on the outskirts of Pekanbaru, noise levels are expected to be below 30 dB(A), while noise levels in all other NCAs are expected to be inaudible.

Under neutral meteorological conditions, noise levels are predicted to be approximately 5 dB(A) below these levels.

Noise levels are expected to remain within project criteria at all identified receiver locations under worst case meteorological conditions.

4.6.4 Cumulative impacts – Riau CCPP and Tenayan CFPP

Figure 4.4 and Figure 4.5 present the predicted noise contours for the operational impacts from the combined operation of both power stations.

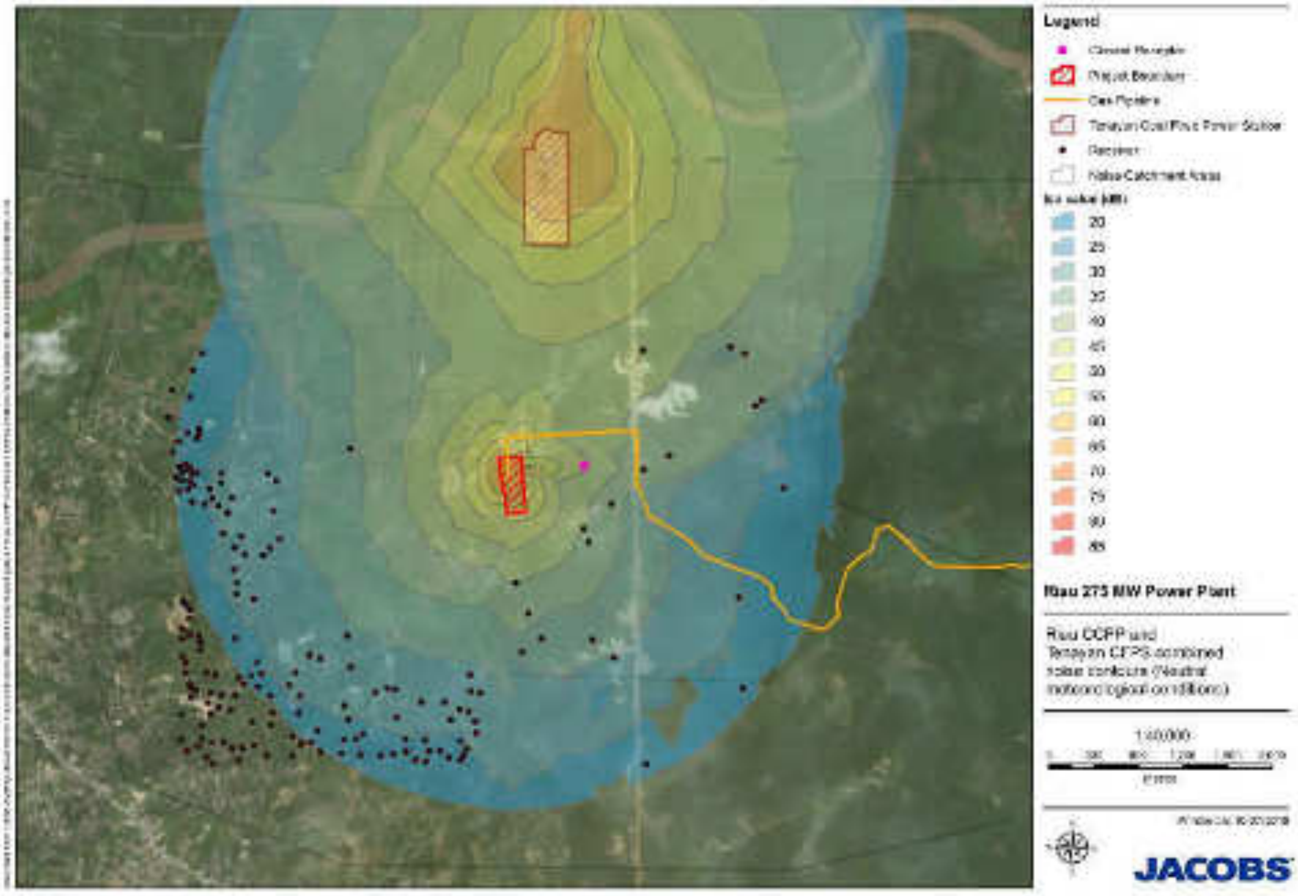


Figure 4.4 : Riau CCPP and Tenayan CFPP Combined Noise Contours (Neutral Meteorological Conditions)

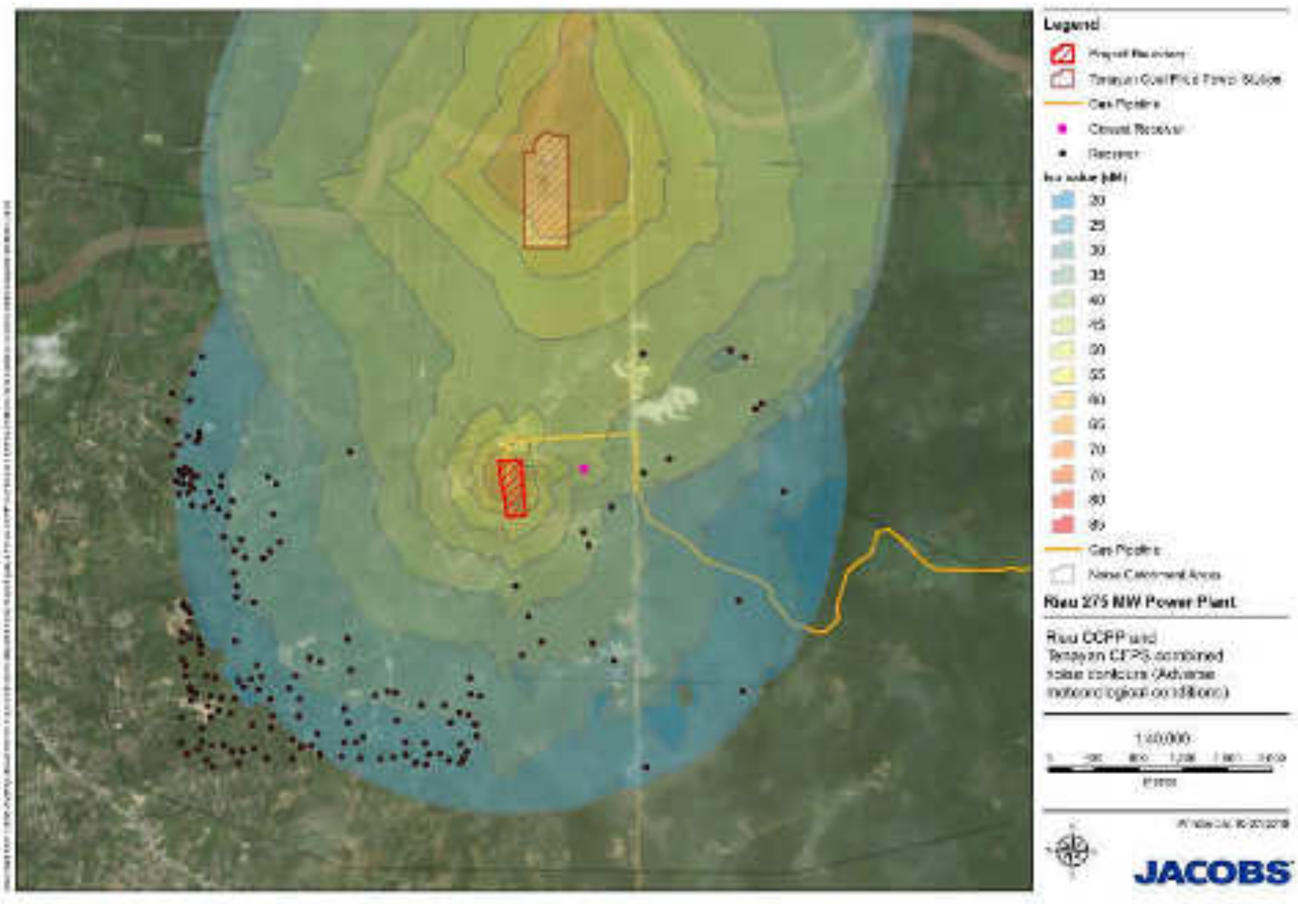


Figure 4.5 : Riau CCPP and Tenayan CFPP Combined Noise Contours (Adverse Meteorological Conditions)

The following SWL information was applied for the Tenayan CFPP in this cumulative assessment scenario:

- Cooling fans – 118.9 dB(A) per unit;
- Conveyers– 88 DB(A) per m per unit;
- Cooling water pumps – 83.9 dB(A) per unit;
- ESP – 97.8 dB(A) per unit;
- Oxidation air blowers – 115.8 dB(A) per unit;
- Recirculation pumps – 106.5 dB(A) per unit; and
- Boost up fan – 93 dB(A) per unit.

It can be seen that as most noise receivers are generally located south of the Riau CCPP, combined impacts are not substantially different to those from the Riau CCPP alone.

Under worst case, adverse weather conditions, the largest increases in noise under accumulative scenario are predicted for receivers located to the north east and north west of the Riau CCPP. In these areas cumulative noise levels are forecast to be up to 5 dB(A) above those of the Riau CCPP alone, however are predicted to remain below the project criteria at all receiver locations. No change to predicted noise levels is expected in other NCAs.

Predicted noise levels under neutral meteorological conditions are expected to be 5 dB(A) below those predicted above for NCA, while no change is predicted in other NCAs.

Cumulative noise impacts are expected to remain below the project criteria at all receiver properties under all meteorological conditions.

4.6.5 Gas pipeline impacts

Following construction, the gas pipeline is not expected to generate any operational noise.

4.6.6 Electricity transmission line impacts

Under most meteorological conditions, the electricity transmission line will also not generate any operational noise. However, during sustained periods of high winds, steady rainfall or high humidity, the transmission line may generate corona / arcing noise. This noise is caused by the breakdown of air into charged particles caused by the electrical field at the surface conductors.

Research has indicated that this noise source is typically in the order of 40 dB(A) at a distance of 50 m from the source (*Nyngan Solar Plant Noise Assessment, NGH Environmental, March 2013*).

The nearest identified receivers to the power line are located approximately 1 km to the west of the proposed route. At this distance, coronal noise would be inaudible.

4.6.7 Operational impact evaluation

Potential noise impacts associated with the construction of the power station have been evaluated as **negligible**, taking into account the negligible magnitude and negligible sensitivity of the predicted impacts.

5. Noise Mitigation

5.1 Construction Noise Mitigation

Table 5.1 presents safeguards and measures to manage potential noise impacts during construction. These measures should be considered prior to any construction activities being undertaken.

Table 5.1 : Noise Management Measures and Safeguards During Construction

Impact	Environmental safeguards
All sites	• Regularly train workers and contractors to use equipment in ways to minimise noise. • Ensure site managers periodically check the site and nearby residences for noise problems so that solutions can be quickly applied. Regularly inspect and maintain plant to avoid increased noise levels from rattling hatches, loose fittings etc. • Truck routes to and from the worksite should be contained to major roads where possible.
Riau CCPP	• Wherever possible, schedule noisy activities during standard hours of construction.
Transmission line	• Wherever possible, schedule noisy activities during standard hours of construction. • Use non-'beeper' reversing/movement alarms such as broadband (non-tonal) alarms or ambient noise sensing alarms.
Gas pipeline	• All residential properties and other key stakeholders such as schools and educational facilities should be notified prior to the commencement of noisy activity. • No night-time construction is permitted within 60 m of residential properties, villages, schools or mosques unless prior written approval is received from the village head. • Use non-'beeper' reversing/movement alarms such as broadband (non-tonal) alarms or ambient noise sensing alarms. • Schedule all noisy activities during standard hours of construction. • Turn off all vehicles, plant and equipment when not in use. • Ensure that all doors/hatches are shut during operation of plant and equipment. • Work compounds, parking areas, equipment and material stockpile sites will be positioned away from noise-sensitive locations. • Use of noise screens as appropriate.

5.2 Operational Noise Mitigation

Given the remote locations of the proposed Riau CCPP site, no operational noise impacts have been predicted. As such, noise mitigation is not considered necessary.

However, to promote best practice at the site and to ensure that noise impacts are maintained at or below the modelled levels, the following operational noise management measures are recommended:

- Where noise levels differ from those outlined in described above, remodelling should be conducted to confirm noise impacts;
- Noise levels modelled in this report should be confirmed prior during the commissioning of the plant;
- Operational equipment should be maintained and operated in the recommended manner in order to keep noise emissions to a minimum;
- Hatches on noisy plant and doors to noisy work areas should remain closed where possible; and
- It is recommended that all noise generating equipment is selected based in part on its acoustic rating where multiple choices exist.

5.3 Monitoring

5.3.1 Construction

Monitoring is not linked to the impact evaluation but is an important component of the ESIA. The following recommendations are made to inform the noise monitoring program:

- Noise monitoring should be conducted in response to noise complaints during the construction period. Monitoring shall be undertaken during typical work conditions and conducted at the location where the complaint was received (or at a similar representative location).
- Noise monitoring spot checks should also be conducted during gas pipeline construction, where the works pass in close proximity to residential properties (defined as within the buffer distances identified in Section 4.5).
- Where exceedances of the project construction noise goals are identified, noise control measures should be considered. If they are found to be inadequate, further noise management measures may be required. This could include changes to the implemented noise mitigation, construction methodology or scheduling.
- During commissioning of the power plant, noise monitoring should be conducted at representative and worst case residential locations to ensure that noise levels are below the World Bank General EHS Guidelines
- Where operational noise levels are found to exceed these levels, further noise mitigation may be required.
- Results of monitoring to be reported to MRPR in monthly Environmental and Social Performance Reports

5.3.2 Operation

During operations the following monitoring is recommended:

- Direct observation of machine maintenance should be made to ensure that any noise-creating faults are treated.
- Noise monitoring at the boundary of the power plant and nearest residential property carried out every six months in accordance with Indonesian standards (during day and night time periods).
- Compliance with operational noise criteria will be determined in accordance with the methodology outlined in State Minister of Environment Decree No 48 and Section 5.3.3 below.

5.3.3 Noise monitoring methodology

Environmental noise monitoring will be conducted in accordance with *ISO1996 Acoustics – Description, measurement and assessment of environmental noise* (or equivalent). The results of monitoring will include:

- Date, time and location of monitoring;
- Name of person conducting the monitoring;
- Statistical descriptors to be recorded for 15-minute intervals include LAeq, LAmax and LA90 levels;
- Instrumentation to be fitted with wind shields, and calibrated prior to measurements to measure drift; and
- Details of site activity, environmental noise characteristics and weather to be noted during monitoring.

Noise instrumentation is to comply with the requirements of *IEC61672-1 Electroacoustics – Sound Level Meters – Part 1: Specifications* and carry appropriately accredited certification.

6. Conclusion

An assessment of operational and construction noise impacts for the Project has been completed by Jacobs in accordance with the local and international regulatory guidelines for this type of impact. The Project was assessed using available information of the proposed site, the equipment types and their associated noise levels, and the location of the nearest noise sensitive receptors.

Weather conditions at the site are generally from south to north, and are favourable for the mitigation of operational noise at the nearest receivers.

The assessment of operations from Riau CCPP alone indicate that operational noise impacts are unlikely to generate an exceedance of the international noise goals during either day or night time periods under adverse weather conditions. Under neutral and favourable weather conditions, noise impacts will be lower.

The assessment of cumulative impacts of both Riau CCPP and Tenayan CFPP operations indicate that operational noise impacts at receivers in the vicinity of Riau CCPP are unlikely to be substantially different to those of the CCPP operating along. Cumulative noise levels are expected to comply with international noise goals under all meteorological conditions.

The IFC industrial noise goals and Indonesian noise guidelines (*KEP-48/MENLH/11/96)* are met for all predicted operational scenarios. Overall operational noise impacts are predicted to be negligible.

To ensure that there are no exceedances of the proposal criteria, operational mitigation measures are recommended to be implemented during the detailed design phase. Additionally, where proposed equipment is substantially different to that assessed in this document, further assessment should be carried out.

Construction noise impacts would typically meet the noise criteria for the proposal due to the distance from the site to receiver locations. Noise from the site would vary depending on the activities being undertaken and their location within the site. Site construction noise impacts are predicted to be negligible.

During construction of the access road, transmission line and gas pipeline, noise goals may be exceeded where construction takes place in close proximity to receiver locations, however this impact would be of short duration. Construction noise impacts during these work stages are predicted to be minor or negligible. Mitigation measures and safeguards should be employed to minimise these impacts where possible.

7. References

Indonesian State Minister of Environment Decree No 48;

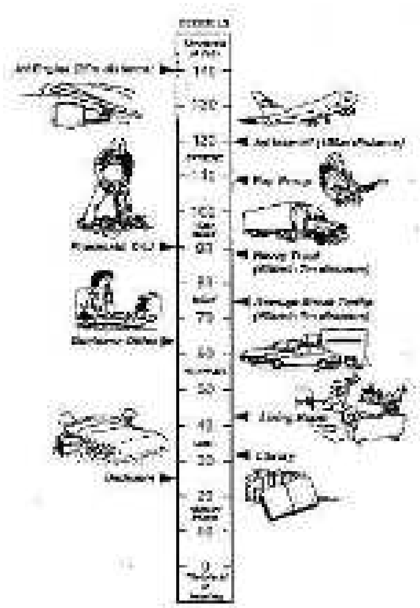
IFC / World Bank Group Environmental, Health and Safety General Guidelines (April 2007); and

IFC/World Bank Group Environmental, Health and Safety Guidelines for Thermal Power Plants (December2008)

Appendix A. Acoustic Terminology

A-weighted sound pressure	The human ear is not equally sensitive to sound at different frequencies. People are more sensitive to sound in the range of 1 to 4 kHz (1000 – 4000 vibrations per second) and less sensitive to lower and higher frequency sound. During noise measurement an electronic '*A-weighting*' frequency filter is applied to the measured sound level *dB(A)* to account for these sensitivities. Other frequency weightings (B, C and D) are less commonly used. Sound measured without a filter is denoted as linear weighted dB(linear).
Ambient noise	The **total** noise in a given situation, inclusive of all noise source contributions in the near and far field.
Community annoyance	**Includes** noise annoyance due to: ▪ character of the noise (e.g. sound pressure level, tonality, impulsiveness, low-frequency content) ▪ character of the environment (e.g. very quiet suburban, suburban, urban, near industry) ▪ miscellaneous circumstances (e.g. noise avoidance possibilities, cognitive noise, unpleasant associations) ▪ human activity being interrupted (e.g. sleep, communicating, reading, working, listening to radio/TV, recreation).
Compliance	The process of checking that source noise levels meet with the noise limits in a statutory context.
Cumulative noise level	The total level of noise from all sources.
Extraneous noise	Noise resulting from activities that are not typical to the area. Atypical activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.
Feasible and reasonable measures	Feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors: ▪ Noise mitigation benefits (amount of noise reduction provided, number of people protected). ▪ Cost of mitigation (cost of mitigation versus benefit provided). ▪ Community views (aesthetic impacts and community wishes). ▪ Noise levels for affected land uses (existing and future levels, and changes in noise levels).

Impulsiveness	Impulsive noise is noise with a high peak of short duration or a sequence of these peaks. Impulsive noise is also considered annoying.
Low frequency	Noise containing major components in the low-frequency range (20 to 250 Hz) of the frequency spectrum.
Noise criteria	The general set of non-mandatory noise levels for protecting against intrusive **noise** (for example, background noise plus 5 dB) and loss of amenity (e.g. noise levels for various land use).
Noise level (goal)	A noise level that should be adopted for planning purposes as the highest acceptable noise level for the specific area, land use and time of day.
Noise limits	Enforceable noise levels that appear in conditions on consents and licences. The noise limits are based on achievable noise levels, which the proponent has predicted can be met during the environmental assessment. Exceedance of the noise limits can result in the requirement for either the development of noise management plans or legal action.
Performance-based goals	Goals specified in terms of the outcomes/performance to be achieved, but not in terms of the means of achieving them.
Rating Background Level (RBL)	The rating background level is the overall single figure background level representing each day, evening and night time period. The rating background level is the 10^{th} percentile min L_{A90} noise level measured over all day, evening and night time monitoring periods.
Receptor	The noise-sensitive land use at which noise from a development can be heard.
Sleep disturbance	Awakenings and disturbance of sleep stages.
Sound and decibels (dB)	**Sound** (or noise) is caused by minute changes in atmospheric pressure that are detected by the human ear. The ratio between the quietest noise audible and that which should cause permanent hearing damage is a million times the change in sound pressure. To simplify this range the sound pressures are logarithmically converted to decibels from a reference level of 2 x 10-5 Pa. The picture below indicates typical noise levels from common noise sources.



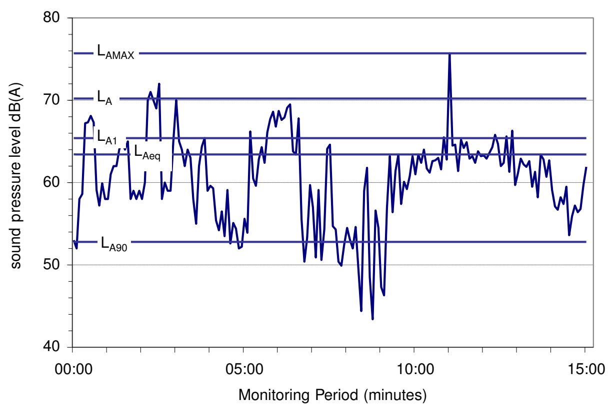
dB is the abbreviation for decibel – a unit of sound measurement. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure.

Sound power Level (SWL) The sound power level of a noise source is the sound energy emitted by the source. Notated as SWL, sound power levels are typically presented in *dB(A)*.

Sound Pressure Level (SPL) The level of noise, usually expressed as SPL in *dB(A)*, as measured by a standard sound level meter with a pressure microphone. The sound pressure level in *dB(A)* gives a close indication of the subjective loudness of the noise.

Statistic noise levels **Noise** levels varying over time (e.g. community noise, traffic noise, construction noise) are described in terms of the statistical exceedance level.

A hypothetical example of A weighted noise levels over a 15 minute measurement period is indicated in the following figure:



Key descriptors:

L_{Amax} Maximum recorded noise level.

L_{A1} The noise level exceeded for 1% of the 15 minute interval.

	L_{A10} Noise level present for 10% of the 15 minute interval. Commonly referred to the average maximum noise level. L_{Aeq} Equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound. L_{A90} Noise level exceeded for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).
Threshold	The lowest sound pressure level that produces a detectable response (in an instrument/person).
Tonality	Tonal noise contains one or more prominent tones (and characterised by a distinct frequency components) and is considered more annoying. A 2 to 5 dB(A) penalty is typically applied to noise sources with tonal characteristics

Appendix B. Construction Noise Contour Map

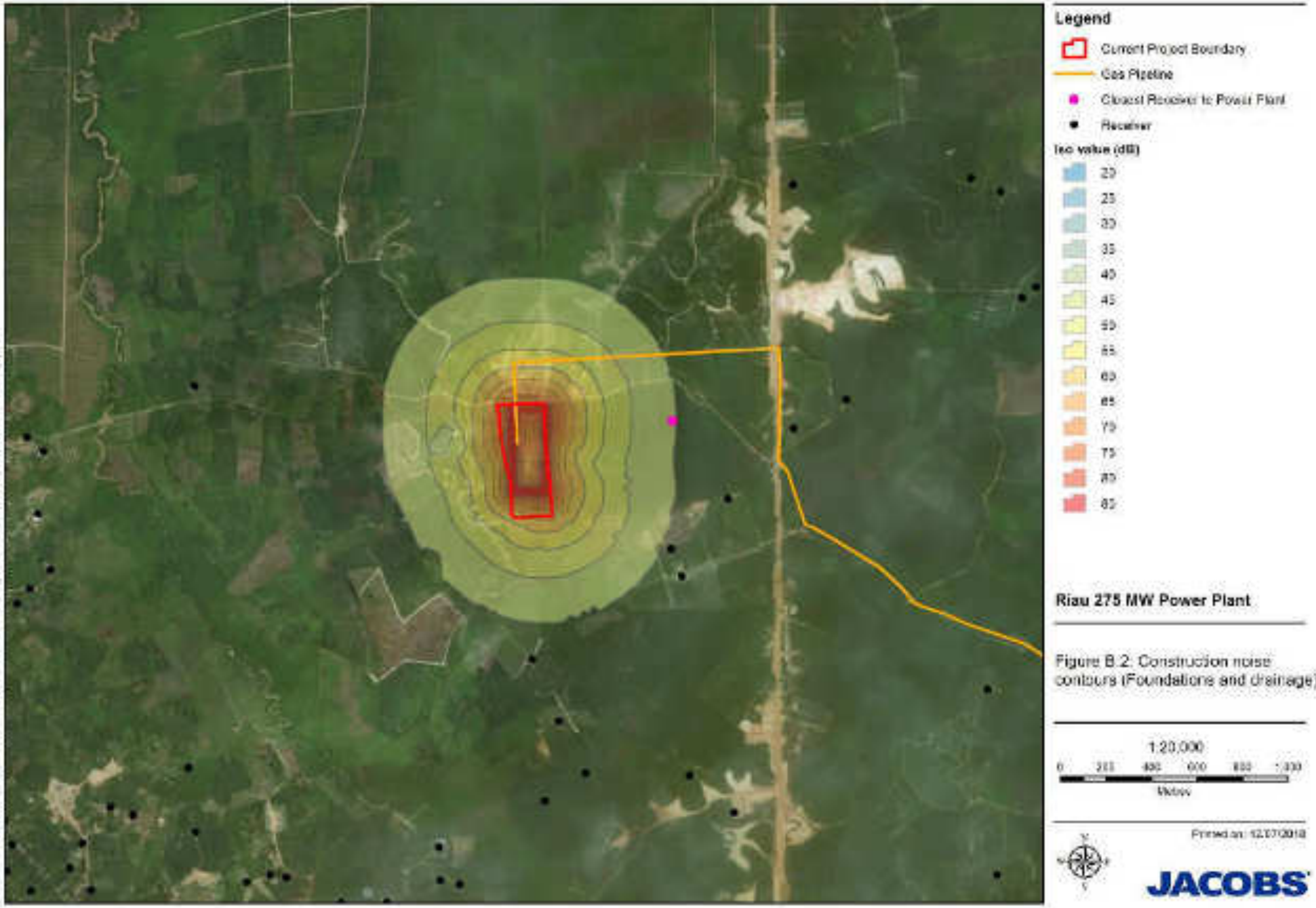
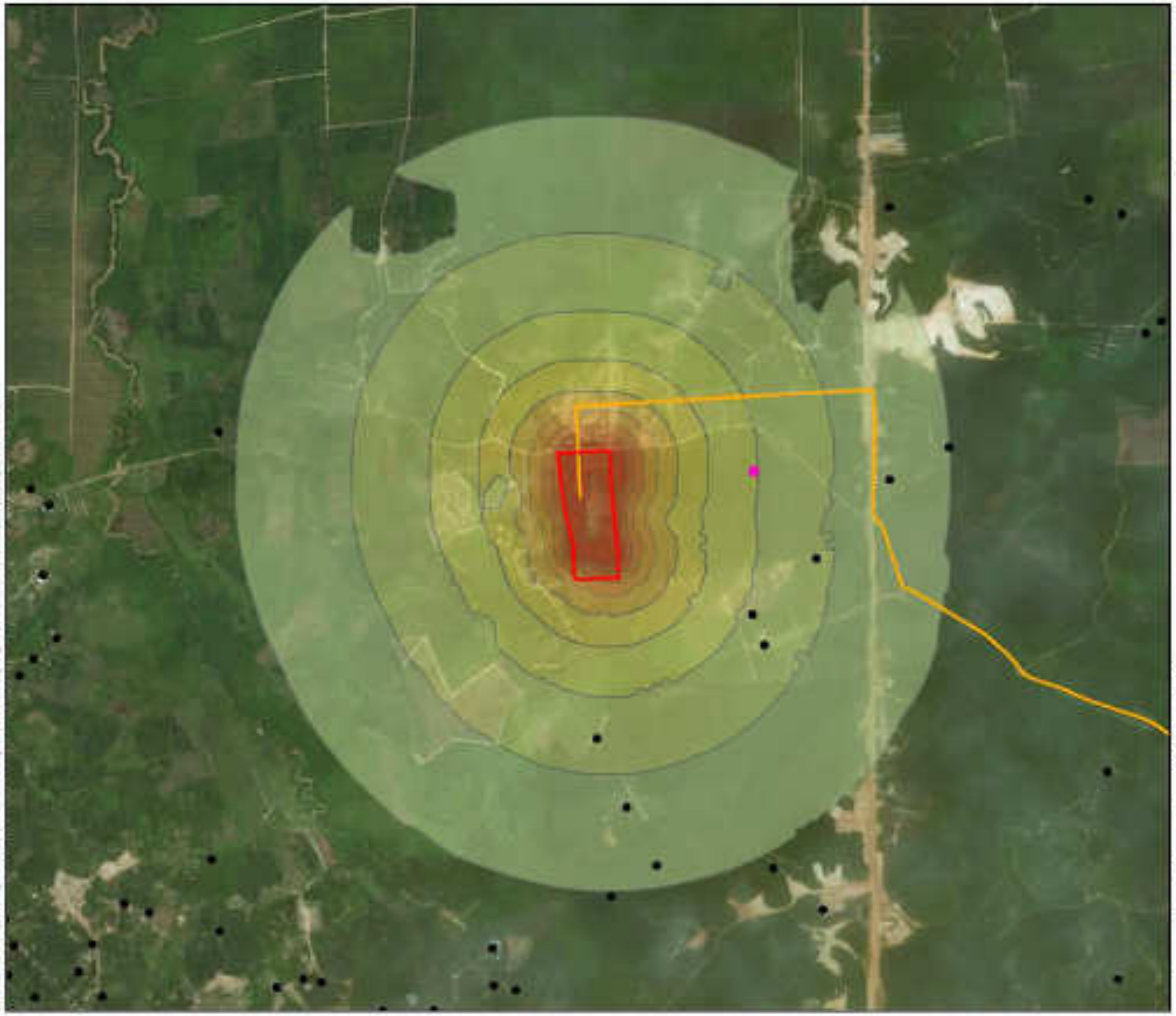


Figure B.2: Construction noise contours (Foundations and drainage)



Riau 275 MW Power Plant

Figure B.1: Construction noise contours (Clearing and earthworks)

Appendix J. Technical Report – Water Quality and Freshwater Ecology Assessment

Riau 275 MW Gas Combine Cycle Power Plant IPP - ESIA

Medco Ratch Power Riau

Technical Report - Water Quality and Aquatic Ecology Technical Report

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November 2018

Document history and status

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Draft A	January 2018	Draft assessment for power plant only for internal review (excluding gas pipeline route)	I Wiseman	S Treadwell	n/a
Draft B	March 2018	Draft assessment for power plant and pipeline route	I Wiseman	S Treadwell	B Clarke
V0	April 2018	Final Draft for Issue	A Kubale	B Clarke	E Morrissey
V1	May 2018	Final Draft for Disclosure	A Kubale	B Clarke	E Morrissey
V2	July 2018	Final Draft for IFC Disclosure	I Wiseman	B Clarke	E Morrissey
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Draft B	March 2018	27 March 2018	Medco Ratch Power Riau	Draft issued for client review
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