



Overview and Background Information
for the
Department of Environment and Conservation
Continuous Emission Monitoring System (CEMS) Code
for Stationary Source Air Emissions

DEPARTMENT OF ENVIRONMENT AND CONSERVATION
PERTH, WESTERN AUSTRALIA
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Overview

The *Department of Environment and Conservation Continuous Emission Monitoring System (CEMS) Code for Stationary Source Air Emissions* (the “CEMS Code”) is a technical document describing the design, installation, operational performance and quality assurance requirements for the continuous monitoring of specific gases emitted via adequately constructed stacks and ducts at stationary sources. Compliance with the CEMS Code will be required through Department of Environment and Conservation (DEC) works approval and/or licence conditions.

A review of all prescribed premises in Western Australia was conducted to determine which facilities will require compliance with the CEMS Code. Significant sulphur dioxide (SO₂) emissions of a highly variable nature, and those with a potential for highly variable nature (i.e. prone to random peaks in output), were targeted for the application of the CEMS Code. Where an SO₂ emission from a source was significant, but free from random peaks or high variability, and there was an acceptable alternative means of obtaining monitoring data, that source would be exempt from the application of the CEMS Code requirements. Environmental Protection Policy (EPP) restrictions on SO₂ emissions and proximity to community were also considered when determining whether a facility should be selected for CEMS Code implementation.

A total of six facilities were selected for application of the CEMS Code. These facilities are listed below by their common names:

1. KCGM Gidji Roaster
2. Kalgoorlie Nickel Smelter
3. Kanowna Belle Gold Mines
4. BP Refinery (Kwinana)
5. Cockburn Cement (Munster)
6. Tiwest (Kwinana)

The rollout of the CEMS Code Implementation Plan, which includes assessment of the facility CEMS against the requirements of the CEMS Code, is scheduled to commence in early September 2006. The aforementioned facilities are expected to be fully compliant with the CEMS Code within two years of the implementation date.

Background

On January 5, 2001, Part 8 of the *Environmental Protection Regulations 1987* (entitled “Monitoring”) was gazetted. However, the (then) Department of Environmental Protection (DEP) had concerns about the efficacy of the Part 8 Regulations in achieving the desired quality assurance in industry self-monitoring programs, and Part 8 was not implemented. Instead, approval was sought from the Minister for Environment and Heritage for the DEP to “investigate and implement the Monitoring Regulations, or an equivalent alternative.” The Industry Self-Monitoring (ISM) Project was thereby created to fulfil this objective.

The ISM Project commenced in 2003 and numerous documents were generated by mid-2004. It was a requirement of the Project Proposal that a report outlining evaluation of the existing Monitoring Regulations and potential alternatives be written, and a Steering Group, with representatives from Government, industry and community, be established to review the report and oversee implementation. A lengthy stakeholder review process was conducted in 2004-2005, and general acceptance of the documentation was reached. Many of the documents are still relevant in the current Department of Environment and Conservation (DEC) regulatory framework, and are now being progressed through to the final publication stage.

As part of the ISM Project, the document titled *Department of Environment and Conservation Continuous Emission Monitoring System (CEMS) Code for Stationary Source Air Emissions* was

one of several documents written as part of an alternative to Part 8 of the Regulations. The CEMS Code is a technical document describing the design, installation, operational performance and quality assurance requirements for the continuous monitoring of specific gases emitted via adequately constructed stacks and ducts at stationary sources. Compliance with the CEMS Code will be required through DEC works approval and/or licence conditions. An approved set of condition clauses for use in applicable DEC licences will be required to ensure the Code is legally enforceable. An Officer's Guide will likely be required to assist DEC officers in understanding the scope and applicability of the CEMS Code.

Two documents are required for the rollout of the CEMS Code. A brief overview of the two documents is given below.

- ***Department of Environment and Conservation Continuous Emission Monitoring System (CEMS) Code for Stationary Source Air Emissions***

A technical document describing the design, installation, operational performance and quality assurance requirements for the continuous monitoring of stack gases. The requirements are specific for:

- Sulphur dioxide (SO₂),
- Oxides of Nitrogen (NO_x),
- Carbon monoxide (CO),
- Total Reduced Sulphur (TRS),
- Hydrogen sulphide (H₂S),
- Oxygen (O₂),
- Carbon dioxide (CO₂),
- opacity, stack gas velocity/volumetric flow, and
- temperature.

Within the document there is a statement that other types of monitors are only required to satisfy the installation requirements and quality assurance requirements of the CEMS Code. Enforcement of the requirements is through DEC works approval and/or licence conditions.

- ***Department of Environment and Conservation Implementation Plan for the Continuous Emission Monitoring Emissions (CEMS) Code for Stationary Source Air Emissions***

This document explains the intended rollout plan for the CEMS Code. There is a requirement to assess existing CEMS at a facility for compliance with the CEMS Code within 4 months of rollout. Full compliance with the CEMS Code for designated facilities is to be completed within 24 months of rollout.

Although the CEMS Code addresses a suite of compounds, the DEC is currently focussing on significant emissions of sulphur dioxide (SO₂). This is in accordance with the DEC policies *Regulatory monitoring requirements for prescribed premises* and *Limits and targets for prescribed premises*. Sulphur dioxide poses a significant threat to human and environmental health and in key areas affected by SO₂ emissions Environmental Protection Policies (EPPs) have been established.

Framework

The CEMS code provides specific technical requirements for the design, installation, performance and ongoing quality assurance of continuous emission monitoring systems for stationary source air emissions. Compliance with the CEMS Code will be required through DEC works approval and/or licence conditions.

Review of documents

The following groups and individuals participated in the review process to a greater or lesser degree:

- Environmental Management Division Stakeholder Reference Group (SRG)
- Chamber of Commerce and Industry (CCI)
- Chamber of Minerals and Energy (CME)
- Clean Air Society of Australia & New Zealand (CASANZ)
- Environmental Consultants Association
- DoE (DEC) Program Managers
- DoE (DEC) Licensing Officers
- DoE (DEC) Air Quality Management Branch (AQMB)
- Crown Solicitor for the DoE
- Technical Working Group
 - Chamber of Commerce and Industry (CCI)
 - Chamber of Minerals and Energy (CME)
 - Mr. Keith James, on behalf of Stack-Air Pty Ltd
 - Dr. Rod Lukatelich, on behalf of BP Refinery (Kwinana) Pty Ltd
 - Mr. Neil Evans, on behalf of Alcoa World Alumina Australia
 - Mr. Frank Mofflin, on behalf of BP Refinery (Kwinana) Pty Ltd
 - Mr. Peter Christian, on behalf of Western Power Corporation
 - Dr. Roman Mandyczewsky, independent consultant
 - Mr. Giacomo Collica, on behalf of ECS Stack Pty Ltd
 - Ms. Laurinda Shaw, on behalf of CSBP Ltd

The documents have been approved by the various committees and groups that were involved in the review process.

Selection of candidates for compliance with CEMS Code

In order to implement the CEMS Code, the identification of premises which were potential candidates for application of CEMS was necessary, followed by a review of the shortlist to identify the candidates whose emissions were of such a nature that the installation of CEMS was justified and warranted. Since the installation, validation and upkeep of CEMS imposes a high cost on a proponent, the decision to impose the CEMS Code on a facility must be based on a comprehensive review and careful consideration of all the relevant factors.

The key factors in determining those premises potentially required to comply with the CEMS Code are listed below. These factors are discussed in greater detail later in this document.

- Premise priority rating.
- Presence of a suitable stack or duct.
- Relevant emission.
- Significance and variability of emission.

In this project, imposition of the CEMS Code was dependent on the facility or premise having actual or potential significant sulphur dioxide emissions. The final criteria applied to the shortlist of candidates focused on potential health and environmental effects of the emission on the receiving environment. Therefore the last criterion discussed in this document includes:

- Sulphur dioxide emissions.

Facilities with significant SO₂ emissions of a highly variable nature, or potentially highly variable nature (i.e. prone to random peaks in output), were targeted for the application of the CEMS Code. Where SO₂ emissions from a source was significant, but free from random peaks or high variability, and there was an acceptable alternative means of obtaining monitoring data, that source would be exempt from the CEMS Code. In some instances, calculations and Predictive Emission Monitoring Systems (PEMS) are suitable and satisfactory means of determining emissions and CEMS add little value to the dataset.

Those facilities that will have the CEMS Code imposed were determined from several successive reviews, with each review refining the field of candidates as follows:

1. **Premises priority rating:** Using the information available from the Licensing Priority Management Project¹, all facilities rated as “High” or “Medium/High” priority were included in the first group of potential CEMS Code candidates. Due to the significance of the Sulphur Dioxide Environmental Protection Policies (EPP) in Kwinana and Kalgoorlie, facilities that were listed as a “Medium” priority, but fell within these EPP areas, were also included in the review.
2. **Existence of a stack:** All premises that did not have a stack² were removed from the list of potential CEMS candidates. Facilities with a stack, but without monitoring requirements for emissions from those stacks were also removed from the list. Premises with a stack, but without “stack testing” requirements for sulphur dioxide, yet were within an EPP area, were considered to be candidates based on their obligations to meet ambient air limits.
3. **Non-CEMS analytes:** The CEMS Code only addresses the monitoring of the following compounds: sulphur dioxide (SO₂), Oxides of Nitrogen (NO_x), carbon monoxide (CO), carbon dioxide (CO₂), oxygen (O₂), hydrogen sulphide (H₂S), Total Reduced Sulphur (TRS), and opacity. Facilities with requirements to monitor particulate matter (PM) concentration, but not opacity, were also removed from the list. Opacity monitors are not ‘PM concentration monitors’, ‘particulate concentration monitors’, or ‘dust concentration monitors’ and as such the monitoring of the concentration of particulate matter cannot be addressed under the current CEMS Code. Premises that were only required to monitor compounds outside of the CEMS list (e.g. chlorine, ammonia, volatile organic compounds) were removed from the list.
4. **Facility-specific review of potential CEMS candidates:** The aforementioned selection process reduced the pool of CEMS Code candidates to 42 premises. The next stage involved assessing these premises individually, and comparing them as a group, to gain a better understanding of the overall significance of the emissions from each facility. Variability of emission was determined through consultation with individuals within the DEC who had knowledge and understanding of the processes at the various premises. Data from the National Pollutant Inventory (NPI) was used to identify the largest emitters of SO₂, NO_x, and CO³. The NPI review of the SO₂, NO_x and CO data from the various facilities identified the relative relationship each premise had in terms of emissions at state and national levels. Some facilities which were initially suggested to be of primary importance were actually shown to be far less of a concern when put into this context. This review

¹ The Licensing Priority Management Project was conducted by the Department of Environment and involved an assessment of key variables contributing to the overall significance of the operation. Factors reviewed included: likelihood of operation malfunction, environmental management (by the premise), compliance issues, and community interest or concern. A rating was given based on this assessment, and the premises ranked by this priority rating.

² For the purposes of CEMS selection, a stack was considered to be an emission point for waste gases that was greater than 0.20 m in diameter and could potentially accommodate a CEMS and the relevant stack sampling equipment required for audit purposes. Vents, pipes and other emission points which are not conventional stacks were not considered as suitable for CEMS.

³ Particulate emission data was also reviewed at the time, but this was not intended for use with the CEMS project.

process ensured that high-emitters were identified and appropriately assessed in regards to requiring CEMS.

These four criteria were used to determine the potential candidates for the application of the CEMS Code. The facilities on this shortlist were then reviewed against NPI data and the final criteria requiring the existence of sulphur dioxide emissions was applied.

5. **Sulphur dioxide emissions:** Sulphur dioxide poses a significant concern to human and environmental health as attested by the Environmental Protection Policies established for both the Kwinana and Kalgoorlie regions. Although the compounds SO₂, NO_x and CO were reviewed, SO₂ is currently the primary compound of concern for which CEMS Code requirements will apply.

Final selection of facilities requiring CEMS Code compliance

To provide an indication of the ranking that was generated for SO₂ emissions from the sources, the shortlist of facilities (assessed against the first four criteria listed above) was reviewed. The ranking of these facilities, against all total annual SO₂ emissions reported in the NPI, is provided in Table 1. Note that beyond the top 13 emission sources, the list was interspersed with emission sources not suited for CEMS; these other facilities and emission sources have not been included in the table. Note also that names used in Table 1 are common names for the premises, and not necessarily the legal names of the entities. The NPI data has been plotted in Figure 1 and Figure 2 to provide a graphical representation of the top 36 SO₂ emission sources in WA that were considered for CEMS^{4,5}. Only six premises in WA are within the top 30 significant SO₂ sources within Australia, as per the NPI data. The graphs clearly illustrate four distinct ranges of SO₂ emissions:

- Range 1 includes the primary source of SO₂ emissions in the state - WA rank 1;
- Range 2 includes WA rank 2, 3 and 4;
- Range 3 includes WA rank 5, 6, 7, 8 and 9; and
- Range 4 includes all other emitters - WA rank 10 and below.

Only ranges 1, 2 and 3 were determined to be significant emission sources. Emission sources that fell within range 4 would not be considered for CEMS unless they had the potential for high and variable emissions of SO₂ (i.e. a plant which normally generates low SO₂ emissions, but could potentially or sporadically emit large quantities of SO₂), or they were subject to the requirements of an EPP. The facilities that fall within ranges 1, 2 or 3 are highlighted in bold font in Table 1.

The facilities in ranges 1, 2 and 3 were accepted to be significant sources of SO₂, however this factor alone is not enough to warrant regulation under the CEMS Code. Each facility was assessed to determine if it was subject to an EPP, whether the emissions were highly variable, whether the emissions could be accurately calculated using PEMS or other means, and the proximity of the facility to nearby communities. The facilities in range 4 were reviewed for EPP requirements and highly variable emissions. The decision as to whether or not a facility then would be required to comply with the CEMS Code was based on this assessment.

Table 1: Sulphur dioxide emissions - National Pollutant Inventory data

Company*	Overall WA Rank (all sources, man-made or natural)	Australia Rank (all sources, man-made or natural)
KCGM Gidji Gold Roaster	1	2
Nickel West Kalgoorlie Nickel Smelter	2	11
Western Power Muja Power Station	3	12
Kanowna Belle Kalgoorlie Gold Mine	4	14
Transfield Collie Power Station	5	25
Worsley Alumina Collie Alumina Refinery	6	29
Western Power Kwinana Power Station	7	38
Iluka Resources North Capel Plant	8	<38
BP Kwinana Refinery	9	<38
Murrin Murrin	10	<38
Midland Brick Perth	11	<38
Tiwest Muchea	12	<38
Cockburn Cement Kwinana	13	<38
Millenium Organic Chem Bunbury	20	<38
Austral Bricks Bellevue	25	<38
Austral Bricks Malaga	27	<38
Alcoa Kwinana	28	<38
Austral Bricks Cardup	29	<38
Alcoa Pinjarra	31	<38
Alcoa Wagerup	35	<38
Austral Bricks Armadale	36	<38
Tiwest Kwinana	39	<38
WMC Resources Kwinana	<40	<38
LionOre Thunderbox	<40	<38
OMG Cawse Nickel Kalgoorlie	<40	<38
Oil Energy Corporation Wedgefield	<40	<38
Loongana Lime Kalgoorlie	<40	<38
WMC Resources Kambalda	<40	<38
Woodside Onshore Treatment	<40	<38
CSBP Kwinana	<40	<38
Iluka Resources Narngulu	<40	<38
Laminex Welshpool	<40	<38
Chevron Texaco Barrow Island	<40	<38
Chevron Texaco Thevenard Island	<40	<38
Arc Energy	<40	<38

*** Notes:**

1. Facilities that fall within range 1, 2 or 3 are highlighted in bold; for a description of these ranges, refer to above text.
2. The names used in the table are common names for the premises, and not necessarily the legal names of the entities.

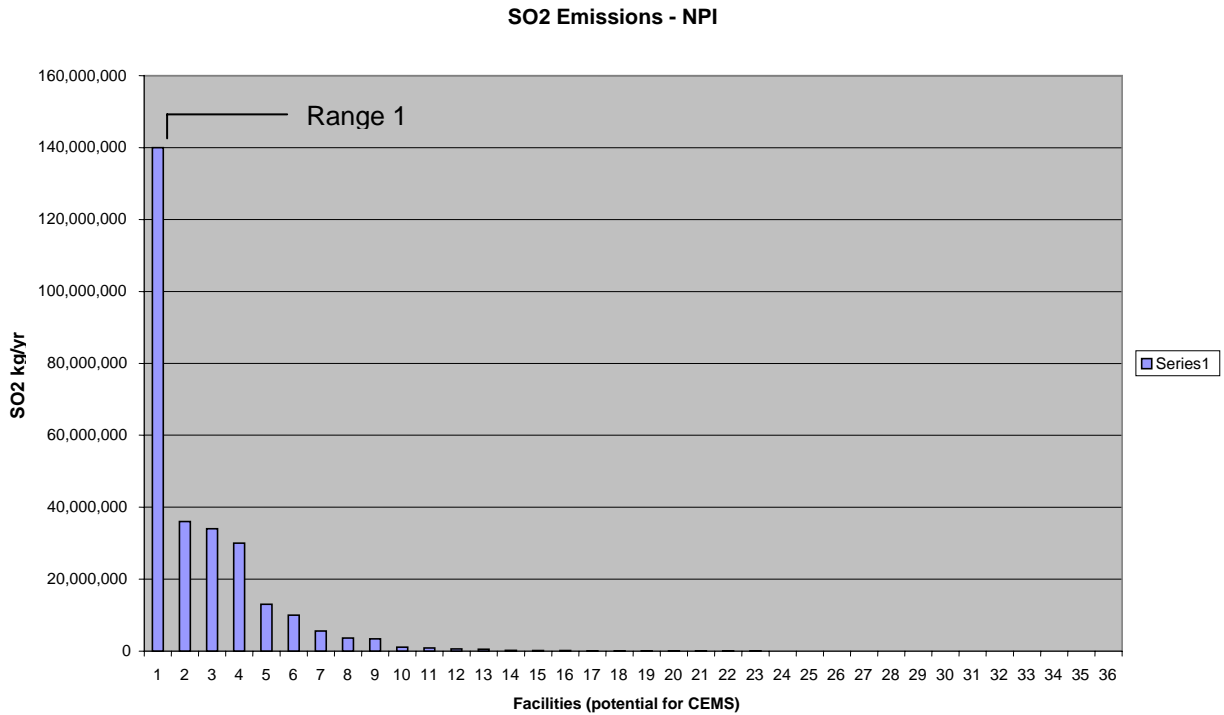


Figure 1: Graphical distribution of sulphur dioxide emissions from select⁴ WA premises

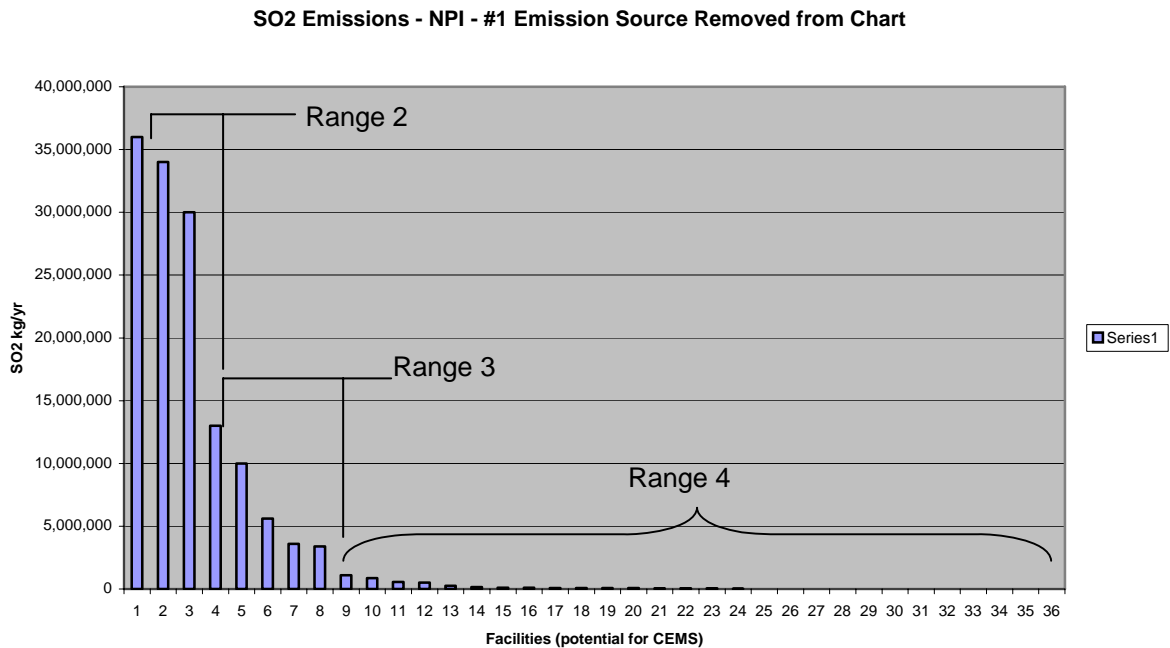


Figure 2: Graphical representation of sulphur dioxide emission rate from select WA premises with the #1 emission source removed from graph⁵

The key factors in determining which facilities would be subject to the requirements of the CEMS Code, and the outcome of this assessment, are detailed in Table 2, below.

⁴ Figure 1 consists of data from the top 36 facilities in Western Australia that emit SO₂ and were also considered for application of the CEMS Code (i.e. non-point source emissions are not included in this graph).

⁵ Figure 2 includes the same data as specified in footnote 4, however the top SO₂ emitter has been removed so that the distribution of the other data is more easily viewed.

Note: the HIs melt facility in Kwinana was included in Table 2; however it is a new plant and could not be assessed using NPI reporting data, but due to its location within an EPP area it needed to be reviewed.

Table 2: Facility assessment summary and outcome for CEMS Code application

Facility*	Assessment (key points)	Outcome
KCGM Gidji Gold Roaster	Largest SO ₂ emission source in WA; significantly greater emissions than any other source. Has EPP requirements. SO ₂ emissions are a significant concern in the Kalgoorlie region.	CEMS Code applicable.
Nickel West Kalgoorlie Nickel Smelter	Second largest SO ₂ emission source in WA. Has EPP requirements. SO ₂ emissions are a significant concern in the Kalgoorlie region.	CEMS Code applicable.
Western Power Muja Power Station	Despite being a significant source of SO ₂ , the facility is not in a populated area and is not subject to an EPP. As the combustion process utilised in power plants is stable and not overly complex, calculations exist which can be used to determine the SO ₂ emissions from a plant. This facility is also scheduled to close generating units 1 to 4 in less than 2 years time, therefore it is not reasonable to require such a large expenditure so close to unit closure. At this point in time justification cannot be found to warrant the installation of CEMS and the application of the CEMS Code to this facility.	Exempt from CEMS requirement.
Kanowna Belle Kalgoorlie Gold Mine	Large SO ₂ emission source in WA. Has EPP requirements. SO ₂ emissions are a significant concern in the Kalgoorlie region.	CEMS Code applicable.
Transfield Collie Power Station	Despite being a significant source of SO ₂ , the facility is not in a populated area and not subject to an EPP. As the combustion process utilised in power plants is stable and not overly complex, calculations exist which can be used to determine the SO ₂ emissions from a plant. At this point in time justification cannot be found to warrant the installation of CEMS and the application of the CEMS Code to this facility.	Exempt from CEMS requirement.
Worsley Alumina Collie Alumina Refinery	Although it is a significant source of SO ₂ in WA, this plant is not within an EPP area, and the source of the SO ₂ is not the actual alumina refining process but the on-site power plant. As discussed for the power stations, above, power plants tend to be stable processes and calculations exist which can be used to determine SO ₂ emissions from a plant. At this point in time justification cannot be found to warrant the installation of CEMS and the application of the CEMS Code to this facility.	Exempt from CEMS requirement.
Western Power Kwinana Power Station	This plant is a significant source of SO ₂ in WA. This facility is subject to the requirements of an EPP. However, the plant emissions are not highly variable, and calculations can provide the required emission data from this source. The contribution of SO ₂ to the EPP area is relatively constant, and little will be gained by requiring CEMS implementation at this facility. CEMS is not warranted in this instance.	Exempt from CEMS requirement.

Facility*	Assessment (key points)	Outcome
Iluka Resources North Capel Plant	This plant is a significant source of SO ₂ in WA. It is not in an EPP area. SO ₂ does not appear to be a high risk to the local community, but SO ₂ is monitored in-stack and with ambient monitors. At this point in time a CEMS Code requirement is unlikely, but may be subject to change should SO ₂ emissions become a significant concern in the future.	CEMS requirement is unlikely.
BP Kwinana Refinery	Although the emissions from the refinery are normally stable and controlled, there is the potential for sudden large, highly variable SO ₂ emissions. The plant is also in an EPP area. Application of the CEMS Code is warranted in this instance.	CEMS Code applicable.
Cockburn Cement Munster Plant	This plant has the potential for large, highly variable emissions. The plant is also in an EPP area. Application of the CEMS Code is warranted in this instance.	CEMS Code applicable.
Tiwest Kwinana Pigment Plant	Despite being a low SO ₂ emitter in comparison to the other facilities listed, the facility has potential for high SO ₂ emissions in the event of plant upset. The plant is also in an EPP area. Application of the CEMS Code is warranted in this instance.	CEMS Code applicable.
Hismelt	Hismelt is a new facility and NPI data (Table 1) is not available at this time. The plant is in an EPP area, and therefore will be discussed here. As per the Environmental Protection Agency (EPA) report and recommendations ⁶ , the installation of a flue gas desulphurisation system, the use of low-sulphur coal, and CEMS to report SO ₂ on a monthly basis to the DEC and annually to the NPI was sufficient emission control for the facility. It should be noted that air quality modelling predicted ambient SO ₂ levels to be well below the EPP requirements. At this point in time a CEMS Code requirement is not required, but may be subject to change should SO ₂ emissions become a significant concern in the future.	Exempt from CEMS requirement; may be subject to revision should SO ₂ emissions become a significant concern in future.

* Note that the names used in the table are common names for the premises, and not necessarily the legal names of the entities.

The following facilities have therefore been selected for requiring CEMS and information will be provided to them instructing them on the implementation of the CEMS Code. Implementation will involve an assessment at the premise to determine if any existing CEMS at the facility will satisfy the requirements of the CEMS Code, or whether the facility will need to install new CEMS in order to satisfy the requirements of the CEMS Code.

- Kalgoorlie Consolidated Gold Mines (KCGM) Pty Ltd (Gidji Roaster)
- BHP Billiton Ltd - Nickel West (Kalgoorlie Nickel Smelter)
- Kanowna Belle Gold Mines Ltd
- BP Refinery (Kwinana) Proprietary Limited
- Cockburn Cement Limited (Munster)
- Tiwest Joint Venture Pty (Kwinana Pigment Plant)

⁶ *Commercial Hismelt Plant, Kwinana, WA Report and Recommendations of the Environmental Protection Agency, Bulletin 1068, September 2002.*

Scheduled implementation of the CEMS Code

The CEMS Code will be rolled out with its associated document, the *Department of Environment and Conservation Implementation Plan for the Continuous Emission Monitoring System (CEMS) Code for Stationary Source Air Emissions* (the “CEMS Code Implementation Plan”). The CEMS Code Implementation Plan provides guidance to facility operators in regards to how to use the CEMS Code and how to assess their CEMS requirements or the compliance status of an existing CEMS. Commencement of the CEMS Code Implementation Plan is scheduled for 01 November 2006. The chosen facilities will be required to be fully compliant with the CEMS Code within 2 years after the start of the implementation phase (compliance anticipated by November 2008).