

# **Silicon project Kemerton**

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**Simcoa Operations Pty Ltd**

**Proposed change to environmental conditions**

**Report and recommendation  
of the Environmental Protection Authority  
(as requested under Section 46 of the Environmental Protection Act 1986)**

**Environmental Protection Authority  
Perth, Western Australia  
Bulletin 631  
June 1992**



## THE PURPOSE OF THIS REPORT

This report contains the Environmental Protection Authority's environmental assessment and recommendations to the Minister for the Environment on the environmental acceptability of the proposal.

Immediately following the release of the report there is a 14-day period when anyone may appeal to the Minister against the Environmental Protection Authority's recommendations.

After the appeal period, and determination of any appeals, the Minister consults with the other relevant ministers and agencies and then issues his decision about whether the proposal may or may not proceed. The Minister also announces the legally binding environmental conditions which might apply to any approval.

## APPEALS

If you disagree with any of the assessment report recommendations you may appeal in writing to the Minister for the Environment outlining the environmental reasons for your concern and enclosing the appeal fee of \$10.

It is important that you clearly indicate the part of the report you disagree with and the reasons for your concern so that the grounds of your appeal can be properly considered by the Minister for the Environment.

## ADDRESS

Hon Minister for the Environment  
18th Floor, Allendale Square  
77 St George's Terrace  
PERTH WA 6000  
CLOSING DATE

Your appeal (with the \$10 fee) must reach the Minister's office no later than 5.00 pm on June 26, 1992.



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## **1. Background**

Simcoa Operations Pty Ltd, previously known as Barrack Mines Ltd, received approval from the Minister for the Environment to develop the silicon smelter at Kemerton and the quartzite mine at Moora on 13 May 1988, subject to a number of legally binding environmental conditions and commitments. That approval was given after preparation of a Public Environmental Review (PER), receipt of public and government agency submissions, and release of the Environmental Protection Authority's assessment reports on the proposal (EPA Bulletins 279, 326 and 328).

In 1988 Simcoa Operations Pty Ltd proceeded to develop the quartzite mine at Moora and construct the silicon smelter at Kemerton. Since commissioning of the smelter in December 1989, the operation has consistently produced silicon metal at the rate of 70 to 75 tonnes per day.

## **2. The proposal**

Simcoa Operations Pty Ltd (Simcoa) has requested permission, on an as needed basis, to bypass the baghouse and vent furnace off-gases directly to the atmosphere for up to 50 hours per year (Appendix 1). This conflicts with Environmental Condition 3 of the Minister's Statement of Approval ie:

"The proponent shall not cause or allow the direct venting of furnace off-gases to the atmosphere. All furnace off-gases shall be passed through the baghouse."

The Minister for the Environment has requested that the Environmental Protection Authority report in accordance with Section 46 of the Environmental Protection Act (1986).

## **3. Advice of the Environmental Protection Authority**

### **3.1 Causes of direct venting of furnace off-gases from smelter**

Under normal operation, furnace off-gases are removed from the smelter complex using a baghouse system. The accompanying fine dust, which is predominantly amorphous silica, is collected in hoppers and subsequently packaged for sale or disposed of in an approved land fill site.

Direct venting of furnace off-gases to the atmosphere (bypassing the baghouse) can and has occurred at the plant since commissioning, due to sudden and unexpected malfunctions. In the 11 month period to 9 May 1992, a total of 11 hours of direct venting was recorded by the company. Venting occurrences were typically less than 15 minutes duration at a frequency of two to three times each month, although longer periods of up to four hours were recorded.

The silicon smelter is designed such that, if fumes are not removed, dampers above the furnaces automatically open. If the fumes remain in this area, the resultant high dust loadings would constitute an unacceptable health risk to employees in the furnace complex. Shutdown of the fans which suck the dust laden air into the baghouse has been the main cause of the stack dampers opening automatically. Stack dampers have also opened during periods of maintenance or testing, but silica fume was not emitted.

Causes of fan shutdowns to date include:

- tripping out due to high oil temperatures of the fans;
- power cuts to the SECWA grid; and
- shearing of fan drive shafts.



### 3.2 Environmental impact of direct venting

During the assessment of the silicon smelter when it was proposed for the Picton area, the Environmental Protection Authority was cautious about the effect that silica fume resulting from direct venting would have on the residential population. The Authority maintained its stance when the site was changed to Kemerton.

In 1988 advice was sought from the Health Department of Western Australia in relation to conflicting reports on the harmful nature of the silica dust, and what constituted hazardous levels in the air for the general public, children and those people already suffering from breathing problems.

The Health Department's response, which is appended in EPA Bulletin 326, concluded as follows:

- there were no public health standards for silica fume at the time;
- amorphous silica did not seem to be harmful by itself, but the presence of crystalline silica would constitute a potential silicosis risk;
- recommended silica fume limits were an annual average of 70 micrograms per cubic metre ( $\mu\text{g}/\text{m}^3$ ) and a 24 hour average of  $100\mu\text{g}/\text{m}^3$  (based on draft occupational health standards and considered similar to proposed World Health Organisation guidelines for total suspended particles at the time);
- if the plant could operate within these limits, it was unlikely that there would be any public health concerns; and
- these recommended levels would protect all but the most sensitive of individuals.

Recently the Health Department of Western Australia was again consulted about the health implications of Simcoa's request to direct vent furnace off-gases to the atmosphere. The monitoring information outlined below was provided to the Health Department of Western Australia for their appraisal.

### 3.3 Summary of environmental monitoring to date

#### 3.3.1 Silica fume monitoring at residential areas

Environmental Condition 4 and pollution control licence Condition A5 both specify silica fume limits of  $70\mu\text{g}/\text{m}^3$  on a 24 hour average basis and  $100\mu\text{g}/\text{m}^3$  on an annual basis.

Simcoa has monitored ambient dust concentrations, which includes dust from all sources (including silica fume), every sixth day since October 1988 at two locations near residential areas - Wellesley Special Rural (east of the plant site) and Leschenault Parklands Special Residential (west of the plant site), at sites acceptable to the Authority. These data (Table 1) show that ambient dust levels in these areas have not changed significantly as a result of the silicon smelter's operations, which began in December 1989. There have been only two days since the smelter commenced operating where ambient dust levels have been higher than  $70\mu\text{g}/\text{m}^3$  ( $75.5\mu\text{g}/\text{m}^3$  on 4 January 1990 and  $77.4\mu\text{g}/\text{m}^3$  on 17 April 1991); these events were probably attributable to sources other than the plant. On most days the dust levels were typically half to a third of the limits, and were normally only higher than these levels if burning off or road construction was taking place in the vicinity of the monitoring equipment.

Condition A4(b) of the pollution control licence requires the company to maintain a log of the periods when furnace off-gases are direct vented to the atmosphere, and record the date, time, duration and explanation for each event. To date, no monitoring days have coincided with significant periods of direct venting, to gauge the short term effects of direct venting on dust levels.



**Table 1. Summary of ambient dust monitoring by Simcoa at Leschenault and Wellesley areas**

Table 1a. Ambient dust concentrations — Leschenault

Quarter	Concentration ( $\mu\text{g}/\text{m}^3$ )			
	Mean	Std. Dev.	Max	Min
4th 1988	52.8	21.6	114.0	35.3
1st 1989	30.6	8.7	41.0	13.9
2nd 1989	29.4	10.5	62.3	19.2
3rd 1989	21.1	6.4	31.7	10.1
4th 1989	27.4	9.3	47.4	15.1
1st 1990	28.9	9.7	48.9	15.8
2nd 1990	25.6	10.6	62.8	16.6
3rd 1990	27.0	13.3	60.2	10.0
4th 1990	25.7	9.0	40.4	15.1
1st 1991	29.6	9.5	43.1	13.8
2nd 1991	32.2	18.7	77.4	15.2
3rd 1991	24.0	7.3	37.8	15.0
4th 1991	26.2	8.8	48.5	12.4

Table 1b. Ambient dust concentrations — Wellesley

Quarter	Concentration ( $\mu\text{g}/\text{m}^3$ )			
	Mean	Std. Dev.	Max	Min
4th 1988	48.7	13.2	67.7	21.6
1st 1989	32.8	13.5	64.3	14.8
2nd 1989	28.3	15.9	77.5	15.3
3rd 1989	17.3	5.2	28.8	9.0
4th 1989	36.0	20.9	96.7	17.3
1st 1990	36.4	17.2	75.5	16.0
2nd 1990	24.7	9.8	45.6	16.7
3rd 1990	21.6	8.9	41.2	10.6
4th 1990	26.6	9.4	45.8	15.3
1st 1991	32.1	8.8	46.0	17.2
2nd 1991	30.1	17.2	69.3	17.2
3rd 1991	21.1	4.9	28.5	11.8
4th 1991	26.6	13.9	69.1	12.4



### **3.3.2 Ambient dust monitoring at plant boundaries**

As a condition of the pollution control licence (Condition A6), the Authority has stipulated that the company is to ensure that the concentration of airborne dust from the premises (at the site boundaries) is not to exceed 1000µg/m<sup>3</sup>. The concentration is to be determined by the difference between two measurements of 15 minutes duration within a 60 minute period, made either side (upwind and downwind) of the plant and within 5 metres of the plant boundary.

Two sets of monitoring at the plant boundaries were undertaken by the company's consultant in May 1991. The differences in upwind and downwind values of ambient dust levels were measured at 89µg/m<sup>3</sup> and 295µg/m<sup>3</sup>, which are well within the licence limits.

### **3.3.3 Monitoring of the dust emission handling system**

Condition A3 of the pollution control licence requires the company to treat dust emissions in a dust emission handling system such that the emissions of dust do not exceed 50 mg/m<sup>3</sup> (50,000µg/m<sup>3</sup>).

Measurements of particulate loading by the company's consultant in May 1991 in six locations around the baghouse ranged from 0.1 to 1.5mg/m<sup>3</sup>, indicating that the dust emission system under normal operating conditions is highly efficient.

### **3.3.4 Crystalline silica in silica fume**

Critical to the concerns of both the Health Department of Western Australia and the Environmental Protection Authority during the assessment of the proposal was the nature of the silica fume, specifically the concentration of crystalline silica.

In accordance with their environmental commitments (Commitment 3.5.6), Simcoa has introduced a programme of regularly sampling silica fume from the baghouse and submitting samples for X-ray diffraction analysis, to detect any contamination by crystalline silica. Test work to date which has been reported to the Authority shows that quartz content in silica fume ranges from zero to 1.5%, which is near the limits of detection for quartz by X-ray diffraction. These levels compare favourably with measurements on fume at similar plants in Tasmania ie 1.2% at BHP's TEMCO ferrosilicon plant, and 6.0% at Pioneer's silicon plant.

Although best results are presently obtained using X-ray diffraction, problems have been identified in accurately determining crystalline silica in an amorphous silica matrix. Simcoa are engaged in a university research project aimed at more accurate determinations of amorphous and crystalline silica in silica fume.

## **4. Conclusions and recommendation**

In its initial assessment of the silicon project, the Environmental Protection Authority expressed concerns about silica fume impacts resulting from direct venting of furnace off-gases. Monitoring of dust and the nature of the silica fume by Simcoa since the smelter has been operating now indicates that the environmental impacts to date are minimal.

The Authority concludes that the operations of the smelter, including the occasional periods of direct venting, have not significantly impacted on the quantity of dust in the air at the nearest residences. Furthermore, it would appear that the silica fume emitted from the Simcoa plant is not as hazardous as was initially expected at the time of the environmental assessment, as measurements show that crystalline silica is barely detectable. The Health Department of Western Australia concurs with the Authority's conclusions.

The establishment of the buffer zone around industries at Kemerton has resulted in greater protection of residential areas from the effects of the smelter.

The Environmental Protection Authority recommends that Condition 3 of the Minister's statement, published on 13 May 1988, should be amended to require that furnace off-gases be passed through an approved dust collection facility. Direct venting of furnace off-gases to the atmosphere is to be allowed only provided:

- all reasonable and practical measures are taken by Simcoa to avoid direct venting;
- Simcoa prepares a contingency plan as part of the Environmental Monitoring and Management Plan, with the specific objective of minimising the periods of unplanned direct venting and any effects on the environment;
- Simcoa notifies the Environmental Protection Authority within 24 hours of any direct venting;
- Simcoa does not carry out any direct venting of furnace-off-gases as a consequence of planned maintenance without the prior approval of the Environmental Protection Authority; and
- Simcoa monitors and reports ambient dust levels, silica fume characteristics and episodes of direct venting of furnace off-gases to the atmosphere to the satisfaction of the Environmental Protection Authority.

Given the need for direct venting of furnace off-gases at the smelter under emergency conditions, the Authority considers that the control and duration of these events should be managed through the pollution control licence conditions.

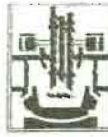




## **Appendix 1**

**Letter from Simcoa Operations Pty Ltd to the Environmental Protection  
Authority requesting permission to direct vent furnace off-gases to the  
atmosphere**





**SIMCOA  
OPERATIONS  
PTY. LTD.**

INCORPORATED IN WESTERN AUSTRALIA

ACN 009 064 653

MARRIOTT ROAD, WELLESLEY, WESTERN AUSTRALIA 6230  
P.O. BOX 1389, BUNBURY, WESTERN AUSTRALIA 6230  
TELEPHONE: (097) 91 2588 FACSIMILE: (097) 91 2787

Our Ref: 0515/DMS/LS

29 June 1991

Mr M Chopping  
The Director  
Pollution Control Division  
Environmental Protection Authority  
1 Mount Street  
PERTH WA 6000

ENVIRONMENTAL PROTECTION AUTHORITY
2 - JUL 1991
File No 176/80 Initials

Dear sir,

**SIMCOA OPERATIONS PTY LTD  
LICENCE NO. 2176  
VENTING OF FURNACE GASES TO  
ATMOSPHERE BY-PASSING THE GAS CLEANING PLANT**

Current practices with respect to venting of furnace gases to the atmosphere are as described in our memorandum from 24 May 1991 (ref 0403/DMS/LS).

The practice of idling the furnaces in case of even minor disturbances to the gas cleaning plant is not always practicable due to the significant disruption it causes to the smelter operations.

We therefore request an alteration in our EPA licence to allow us to vent furnace gases by by-passing the gas cleaning plant for up to 50 hours per year. This would still represent a level of venting significantly less than that permitted at other competitor silicon smelters both in Australia and abroad but is important in assisting Simcoa to remain competitive under very difficult conditions in the silicon industry.

It is most likely that only a small proportion of this 50 hours would be used each year.

Typical incidents would involve venting for 10-15 minutes due to a sudden failure of the gas cleaning control system. Planned maintenance of the gas cleaning plant could also mean venting for longer periods (possibly several hours) but this would only be at infrequent intervals, typically less than once per year, and in such cases the EPA would be notified well in advance of any such event.

Furthermore, in case of venting due to planned maintenance Simcoa Operations would undertake to schedule this to have a minimum effect on the surrounding area.

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Should the EPA licence be altered to permit limited direct venting the present dust monitoring programs would remain in place and Simcoa will continue to maintain atmospheric dust loadings within the limits specified in the EPA licence (Sections A5-A7). The current practice of logging all incidents of direct venting and reporting them to the EPA on a quarterly basis would also be continued.

Finally, despite any agreed alterations to the EPA licence to permit limited direct venting of furnace off gases, Simcoa would maintain a commitment to avoid the use of this dispensation wherever possible.

Yours faithfully,

A handwritten signature in dark ink, appearing to be 'J. Brosnan', with a long horizontal flourish extending to the right.

J Brosnan  
Met & Tech. Services Supt.