Platinum Protects the Environment

POLLUTION CONTROL FOR STAND-BY GENERATORS

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Although the electric power supplies provided by the grid systems of the Western World are generally reliable, there is still a chance that these power supplies will fail for short periods, possibly during severe storms. For many users of electricity a break in the supply could be disastrous. Precautions are therefore made to overcome any such interruption, the most common being the installation of a local stand-by electric power generator.

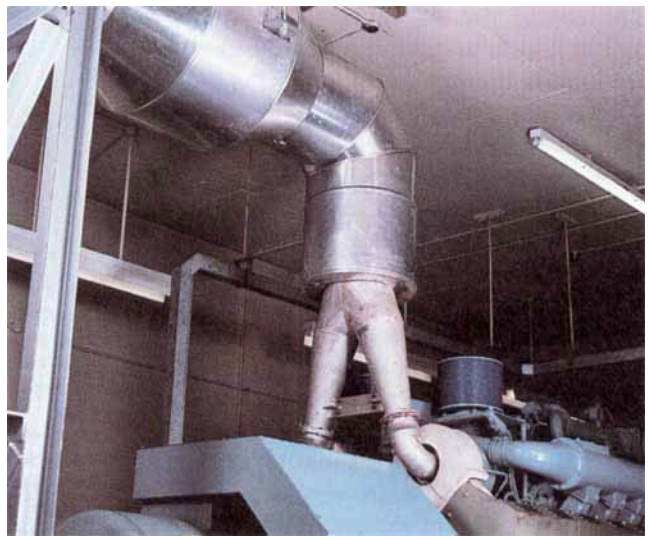
Often these generators are diesel driven and their exhaust emissions can seriously impair the environment when the stand-by power is needed. These engine fumes can cause irritation to the eyes, nose and throat of people in the immediate vicinity, who may even experience drowsiness and headaches. In addition there is the risk that a product may be spoilt. To check that they are in good working order stand-by generators must be run-up regularly, often for a few hours each week; thus engine emissions can be a very real problem. For this reason, expensive and often unsightly chimneys are erected to disperse the exhaust emissions into the atmosphere.

Growing public anxiety about the pollution of the environment by emissions of poisonous hydrocarbons and toxic carbon monoxide has brought into question the use of dispersion and dilution as an acceptable method of exhaust emissions disposal, and favours instead the destruction of the exhaust emissions at source.

The simplest and most effective way of achieving this is by catalytic incineration which changes the polluting gases coming from the engine into carbon dioxide and water vapour, both of which are already present in the atmosphere, naturally.

A Diesel Exhaust Purifier

For stand-by applications, diesel exhaust purifiers are now available based on the same, very successful Johnson Matthey catalyst technology that is used for cleaning the exhaust



Catalysts containing platinum group metals enable the gaseous exhaust emissions from diesel fuelled stand-by electric generators to be incinerated at normal engine combustion temperatures. In addition to maximising catalyst surface area, the honeycomb support helps to reduce engine noise. The compact, flanged catalyst module can be readily installed in the exhaust pipework of new or existing plant. Once installed, little maintenance is required and the catalyst will perform reliably when the generator is turned on, even after long periods of inactivity

emissions from gasoline fuelled motor cars. These catalysts are now a legal requirement on all United States and many European cars and light vehicles, and well over 100 million are already in use (1).

Many similar emission control catalysts are also in use on mobile diesel engines working in enclosed spaces such as mines, mineral caverns and warehouses, where the emission of diesel fumes would otherwise make working conditions most unpleasant, and could contaminate the product being handled. Other applications include pumps and compressors driven by diesel engines, as well as on specialised vehicles such as mechanical road sweepers and construction equipment (2).

The Platinum Metals Catalyst

The diesel exhaust purifier catalyst comprises a ceramic honeycomb, coated with a porous washcoat within which are dispersed very small amounts of finely divided platinum metals. This arrangement causes minimum pressure drop as the exhaust gases pass through the catalyst unit, and gives maximum surface area of catalyst so promoting the incineration reaction at temperatures lower than those at which this would normally take place. As the engine combustion temperature is high enough to cause the reactions to proceed, the catalyst unit is fitted directly into the exhaust gas stream. The construction of the catalyst modules enables them to be installed readily in both new and existing plants.

An additional benefit resulting from the use of a ceramic honeycomb support is that it serves to reduce engine noise significantly.

The platinum metals content of the catalyst averages 40g/cuft; for a 900 brake horse power engine generating 500 kW of electrical power, a typical exhaust purifier would contain approximately 120 grams of platinum metals.

The catalyst does not alter significantly the concentration of either sulphur oxides or nitrogen oxides. However, in general, diesel oil does not contain large quantities of sulphur; and properly tuned diesel engines generate minimum amounts of nitrogen oxides.

Most hydrocarbon fuel combustion processes produce soot particles. Some, but not all, of the soot produced in the diesel exhaust is burnt off over the catalyst. However, because the unburnt hydrocarbons in the exhaust emission have been converted to carbon dioxide, the soot particles are free of the sticky, tarry coating normally present on diesel soot and do not form disfiguring stains on adjacent structures.

Application on Stand-By Electricity Generators

A relatively new application for diesel exhaust purifiers is on the diesel engines used to power stand-by electric power generator sets. Exhaust emissions from these static engines are almost always released near to large buildings and it is obviously desirable to avoid degradation of the working conditions in these areas when the generator is in use. This may be achieved by building a high chimney, but this

The world famous Radcliffe Hospital, Oxford, is perhaps typical of the type of location where catalytic incineration of diesel exhaust emissions is superior to pollution dispersion through a high chimney stack. The stand-by generator is situated adjacent to areas where any form of pollution would be unacceptable, and where a chimney stack would constitute a visual intrusion. Here the exhaust exit is surrounded by a fence which serves as a bicycle store

is usually an expensive solution and is not always possible. The use of diesel exhaust purifiers obviates this need, and allows regular stand-by generator testing to take place in normal working hours; since there is no risk of exhaust emissions polluting the immediate environment. This is particularly applicable for generators installed to provide emergency power to hospital complexes, but is also important for computer installations, department stores, hotels, large banks, radio and television stations, railway stations, telephone exchanges and other large buildings.

References

1 M. P. Walsh, *Platinum Metals Rev.*, 1986, **30**, (3), 106

2 E. J. Sercombe, *Platinum Metals Rev.*, 1975, **19**, (1), 2

The Largest Producer of Platinum Metals

Platinum in South Africa, Special Publication No. 12

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Within the geological formation known as the Bushveld Complex lies, perhaps, eighty per cent of the world's known reserves of platinum. The currently exploitable reserves occur in the Merensky Reef, the Platreef and the UG-2 chromitite layer, and from these strata approximately fifty per cent of the world's requirements for platinum group metals are produced. As is well known to the readers of *Platinum Metals Review*, the properties of the platinum group metals ensure their use for a wide variety of industrial applications. In addition, platinum finds use in the manufacture of jewellery and as a store of wealth, and over the past 35 years the requirement for it has increased enormously, but somewhat erratically. One result of a recent increase in the demand for platinum is that several new platinum producers are emerging. This interesting publication, which reviews the past and present activities in platinum mining in South Africa before going on to consider the future outlook, is therefore timely.

A summary is given of the discovery of platinum and the early mining operations in the 1920s as many companies were established to exploit the various Bushveld deposits. When expectations were not realised, ambitious plans were abandoned and the industry suffered a severe set-back. This led to rationalisation and the emergence of Rustenburg Platinum Mines as the only significant producer in South Africa.

After World War II there was an upsurge in demand for the platinum group metals, especially by the chemical and oil industries, and Rustenburg Platinum Mines embarked upon a programme of expansion. By 1957 their production of platinum group metals was at an annual rate of 430,000 ounces, but by 1958 another set-back resulted when the oil industry reduced its requirements significantly. However, in response to the development of new outlets for the metals, the 1970s showed a dramatic growth in South African output, following the entry of three new major platinum producers, but once again a period of severe market imbalance resulted. By the end of the decade stability was restored and the price of platinum increased substantially encouraging existing mines to expand their activities. Now several new concerns have announced their intention to enter the industry. It should be noted, however, that recent changes in the financial markets of the world have occurred since this book was prepared, and may be expected to influence future plans.

The authors consider briefly the present availability of supplies from other established sources. The U.S.S.R., for many years the leading producer of platinum and still the second largest producer of platinum group metals, appears to be retaining part of its output for growing applications within its sphere of influence, while Canada, the U.S.A and Australia make a worthwhile contribution to supplies.

As to the future, it is suggested that co-operation between producers may be the best way to avoid the dramatic surges and set-backs experienced by the industry in the past, but at present this is regarded as unlikely. It is difficult to disagree with the opinion that the producer industry will be heavily dependent on both the expansion of existing industrial uses and the development of new applications, and that further research must be vigorously pursued so that the latter will be achieved.