NOTE BY THE DIRECTOR-GENERAL

UPDATE OF A REFERENCE TOOL FOR STATES PARTIES COMPILING LISTS OF OTHER CHEMICAL PRODUCTION FACILITIES

Background

1.   The Second Special Session of the Conference of the States Parties to Review the Operation of the Chemical Weapons Convention "stressed the importance of the timely submission of initial declarations and annual declarations in an accurate and complete manner by all States Parties under Article VI (facilities, aggregate national data, and notifications and declarations of transfers of Schedule 1 chemicals) in accordance with the timelines in the Convention. It encouraged the Secretariat to continue to provide support to States Parties in connection with the preparation and submission of declarations" (paragraph 9.60 of RC-2/4, dated 18 April 2008).

2.   The Technical Secretariat (hereinafter "the Secretariat") prepared a reference tool in 2010 (S/862/2010/Rev.1, dated August 2010) that was intended to be used by States Parties to determine whether further attention is warranted to ensure the completeness of the information received by the Secretariat in regard to the compilation by them of a list of other chemical production facilities (OCPFs). The document (S/862/2010/Rev.1) comprised a set of publicly available indicators, whereby the correlations between two sets of data (data on the values of each indicator and the value of the declared number of OCPF plant sites) were evaluated. While the information cannot be used either to identify facilities or to predict the number of OCPF plant sites, the indicators are expected to further augment the ability of National Authorities when they work closely with their domestic industries to assess the number of OCPF plant sites.

3.   This Note provides an update of the information contained in S/862/2010/Rev.1, with five publicly available indicators, of which three were from the same information source that was specified in the previous Note. The use of one indicator was discontinued, due to the unavailability of information and another indicator was replaced by a new one that shows a higher correlation with the declared number of OCPF plant sites.

4.   If a State Party would like further help in compiling its list of OCPFs in an accurate and complete manner, the Secretariat stands ready to work with that State Party, and

to provide assistance in accordance with paragraph 7 of Part IX of the Verification Annex to the Chemical Weapons Convention.

Indicators

5. In preparing this reference tool, several widely recognised economic and other indicators, which are considered relevant to the chemical industry, were analysed in order to ascertain to what extent they were correlated with the number of declared OCPF plant sites. The relevance of these indicators to the chemical industry is based on various assumptions—that the chemical industry provides essential materials to economic activities, that it applies scientific knowledge, that it requires a labour force, that it requires energy resources, and that it emits carbon dioxide (CO_2) through its activities.

6. The indicators analysed in this Note and the sources of information for each of them are as follows:

    (a)   gross domestic product (purchase power parity basis; source: the World Bank);

    (b)   total primary energy supply (tonnes of oil equivalent; source: the International Energy Agency (IEA); this is a new indicator);

    (c)   paid employment in manufacturing of chemicals ((in thousands); source: the International Labour Organization (ILO));

    (d)   research and development expenditure (purchase power parity basis; source: the United Nations Educational, Scientific and Cultural Organization (UNESCO)); and

    (e)   industry output of chemicals (converted to the value of purchase power parity basis; source: the United Nations Industrial Development Organisation (UNIDO); a new indicator).

Results and conclusions

7. Each indicator described in paragraph 6 (using the latest available data for each indicator at the time the analysis was carried out; the data used was primarily from 2010 and included the number of declared OCPF plant sites) was combined with data on the number of declared OCPF plant sites in each State Party (as contained in EC-69/CRP.1, dated 4 June 2012). For each indicator, States Parties can estimate the number of declared OCPF plant sites on their territory by comparing the number of OCPF plant sites they have currently declared with the empirical data provided in the attached charts. The Annex to this document provides a detailed analysis.

8. This information on its own is aimed not at indicating specific figures, but rather at providing a range for the number of OCPF plant sites that have been typically declared by States Parties in relation to an indicator. For example, since the structure of the economy and the industry are different in each country, one would expect the actual number of OCPF plant sites to vary from one State Party to another for the same value of the indicator. Therefore, the analysis illustrates a range, rather than a specific value. It is possible that the information contained would provide additional

support to States Parties when they compile their list of OCPFs. For example, if a State Party finds that, for several indicators, the number of OCPF plant sites that have been currently declared is relatively remote from the main trend range, the State Party may wish to look into the information in further detail.

9.   For the indicators, the degree of correlation observed (the correlation coefficient value ρ was in the range of 0.87~0.92) is high mathematically and compares favourably with the results obtained with the previous reference tool (ρ=0.76~0.89). An increase in the degree of correlation for two indicators that appeared both in this analysis and in the previous analysis was noted. This means that amendments and/or updates of declaration information that the Secretariat received from States Parties since the last analysis have strengthened the correlations observed and reported in this reference tool.

10.   Since correlation does not imply causation, the indicators do not lead to the conclusion that a specific number of OCPF plant sites exist on the territory of a specific State Party. However, these indicators can be used as a reference tool by States Parties when they are compiling their lists of OCPFs, in addition to other tools and methods that are available.

Annex: Update of a Reference Tool for States Parties Compiling Lists of Other Chemical Production Facilities: A Detailed Analysis

Annex

**UPDATE OF A REFERENCE TOOL FOR STATES PARTIES
COMPILING LISTS OF OTHER CHEMICAL PRODUCTION
FACILITIES: A DETAILED ANALYSIS**

Principles

1.   To analyse the relationship between each of the following indicators and the number of declared OCPF plant sites, both data were plotted on a chart with logarithmic axes:

    (a)   gross domestic product (purchase power parity basis; source: the World Bank);

    (b)   total primary energy supply (tonnes of oil equivalent; source: the International Energy Agency (IEA); this is a new indicator);

    (c)   paid employment in manufacturing of chemicals ((in thousands); source: the International Labour Organisation (ILO));

    (d)   research and development expenditure (purchase power parity basis; source: the United Nations Educational, Scientific and Cultural Organization (UNESCO)); and

    (e)   industry output of chemicals (converted to the value of purchase power parity basis; source: the United Nations Industrial Development Organisation (UNIDO); a new indicator).

2.   For the purpose of the analysis, a linear model has been applied. The trend line that was drawn (the solid straight line in the graph) achieves the least sum of squared deviations (that is, the least sum of variances); the range lines (dotted lines) show the ±2σ (σ: standard deviation) area where 95% of the data is contained; these calculations are based on the assumption that the normal distribution is applicable to the data. The correlation coefficient value (ρ) between the data was calculated so as to evaluate the degree of statistical relationship between the sets of data. All the data are treated as having two significant digits.

3.   Although a value of "zero" cannot be plotted on logarithmic axes, indicators for States Parties having no declared OCPF plant sites were also plotted, in order to provide points of reference. The zero plot data was not used in calculating the main trend line or the supplemental lines.

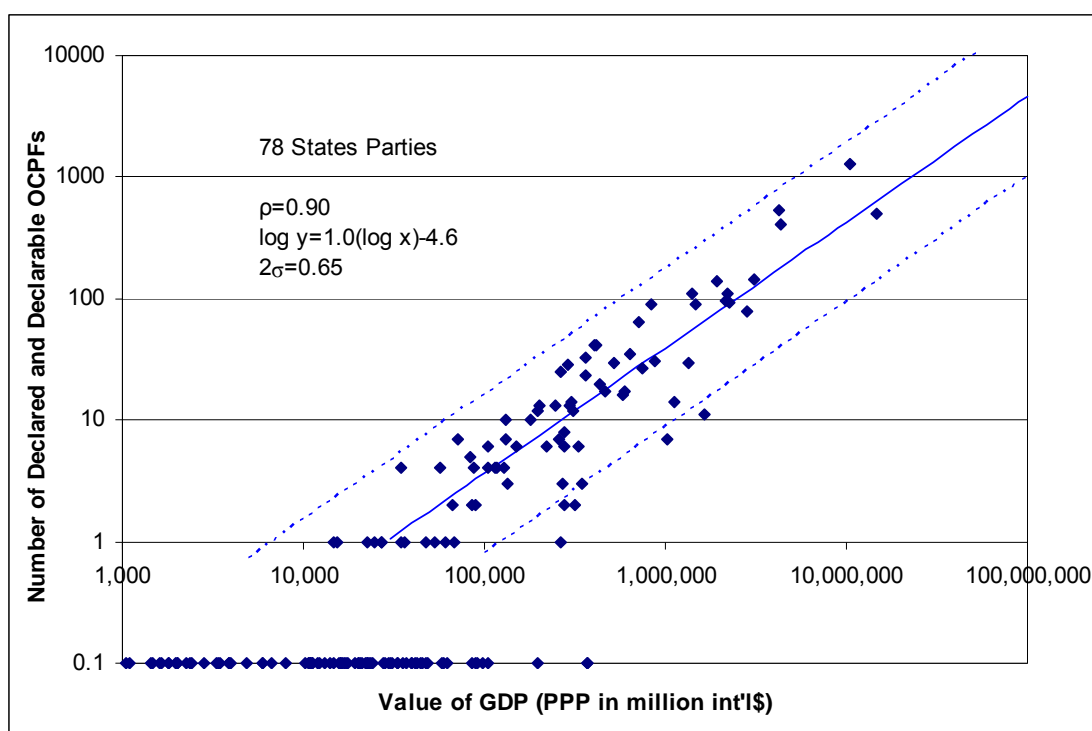**Analysis of each indicator**

Gross domestic product

4.   Figure 1 shows the number of declared OCPF plant sites against the value of the gross domestic product (on the basis of purchase power parity[1]). Data was available for

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[1]   PPP GDP (purchase power parity gross domestic product) is the gross domestic product converted to international dollars through the application of purchase power parity rates (sources: the World Bank, the Organisation for Economic Cooperation and Development (OECD), and the United Nations).

78 out of 80 States Parties that have declared at least one OCPF plant site. The correlation coefficient value (ρ) between the value of the gross domestic product and the number of declared OCPF plant sites was calculated as $\rho=0.90$, which statistically indicates a large degree of relationship between the two sets of data. The source of the gross domestic product data was the World Development Indicators Database of the World Bank. To give an example of how to find out the related range, a gross domestic product of ten billion international dollars[2] could be in relation to about 94 to 1,900 declared OCPF plant sites (with a statistical reliability of 95%).

5. In comparison with the data in the previous Note (S/862/2010/Rev.1), the correlation became larger (from $\rho=0.88$ to 0.90). This means that amendments/updates of declaration information that the Secretariat received in these last two years has strengthened the relationship between two sets of data.

FIGURE 1:   NUMBER OF DECLARED OCPF PLANT SITES AGAINST THE VALUE OF THE GROSS DOMESTIC PRODUCT
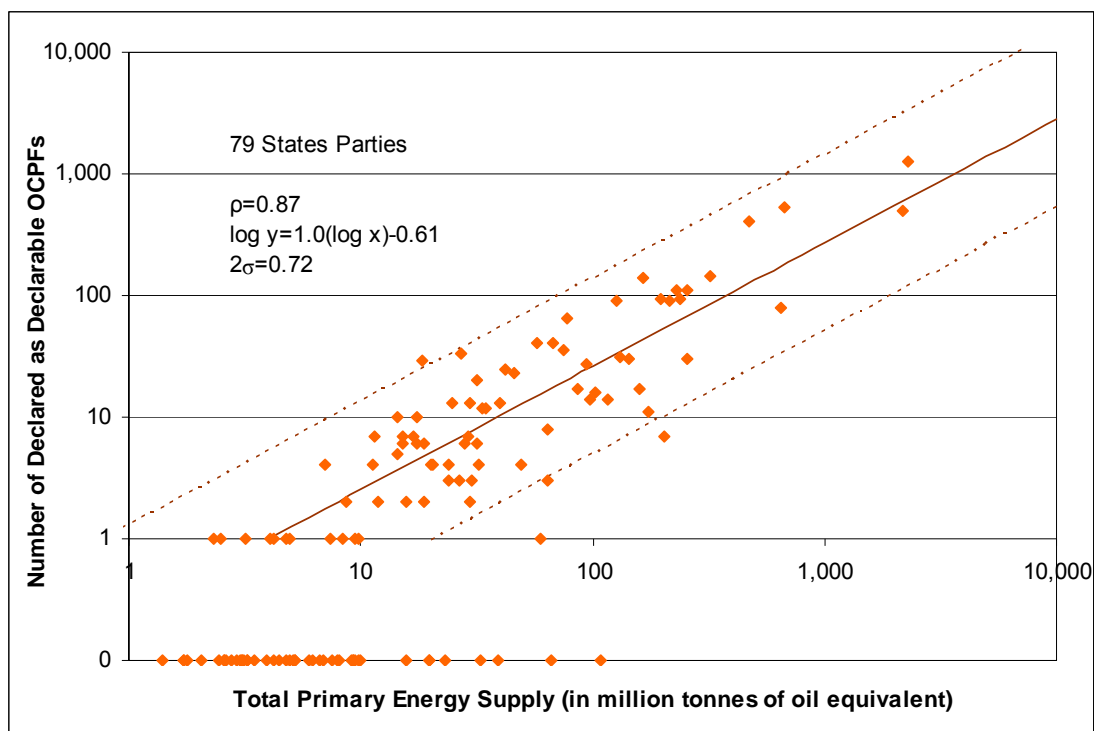

Total primary energy supply

6. Figure 2 shows, on logarithmic axes, the number of declared OCPF plant sites against the amount of total primary energy supply[3]. Data was available for 79 States Parties, which is almost all the 80 that have declared at least one OCPF plant site. Compared to Figure 1, the distribution of the plots showed smaller but still statistically a large degree of correlation ($\rho=0.87$) and broader deviation ($2\sigma=0.72$). The source of the energy data is the Key World Energy Statistics 2011 of the IEA. To give an example

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[2]   An international dollar has the same purchasing power in terms of GDP as a US dollar has in the United States of America (sources: the World Bank, the OECD, and the United Nations).

[3]   The unit used to demonstrate the amount of primary energy supply that one tonne of oil equivalent is defined to be 41.868 gigajoules (source: the IEA).

of how the related range can be found, the total primary energy supply valued at 1,000 million tonnes of oil equivalent (a hypothetical figure) could be in relation to about 51 to 1,400 declared OCPF plant sites (with a statistical reliability of 95%).
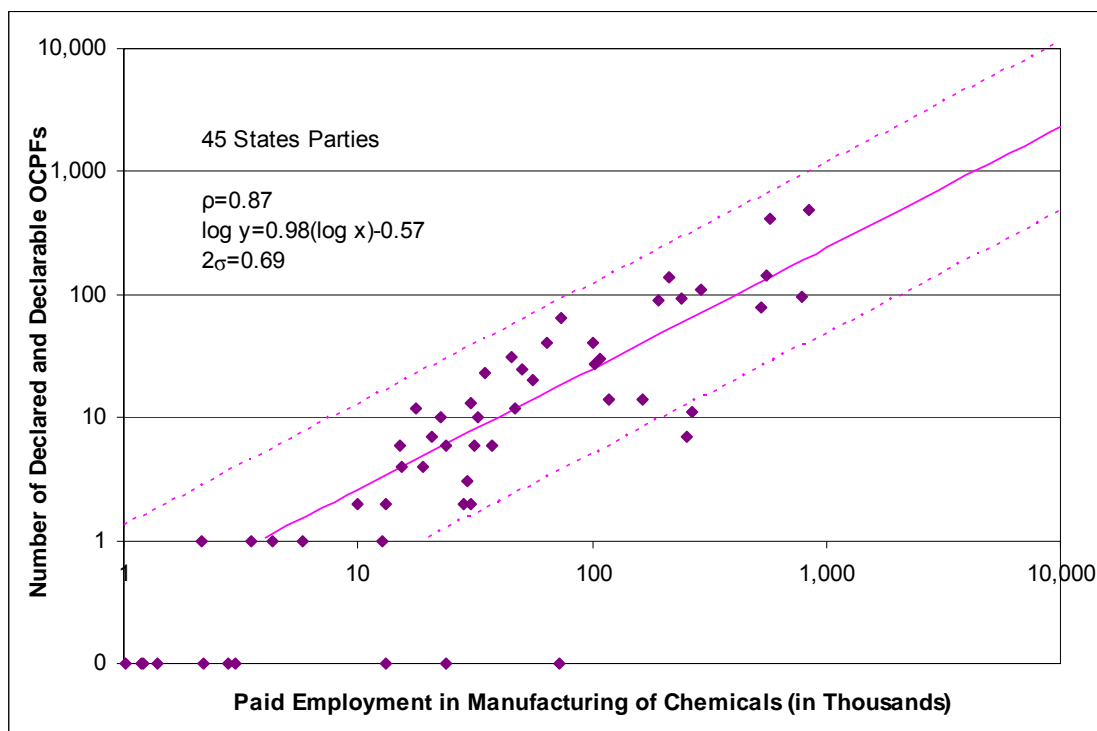
FIGURE 2: NUMBER OF DECLARED OCPF PLANT SITES AGAINST THE AMOUNT OF TOTAL PRIMARY ENERGY SUPPLY

Number of Declared as Declarable OCPFs

79 States Parties

$\rho=0.87$
$\log y = 1.0(\log x) - 0.61$
$2\sigma = 0.72$

Total Primary Energy Supply (in million tonnes of oil equivalent)

Paid employment in manufacturing of chemicals

7.   Figure 3 shows the numbers of declared OCPF plant sites against the number of paid employment in manufacturing of chemicals (in thousands); the term "manufacturing of chemicals" means the total amount of the manufacture of chemicals and chemical products, and the manufacture of pharmaceutical products. Data was available for 45 States Parties that have declared at least one OCPF plant site. The degree of correlation ($\rho=0.87$) is statistically considered as large. The source of the data on the paid employment is the Labour Statistics Database (LABORSTA) provided by the ILO. To give an example of how the related range can be found, a hypothetical figure of one million "paid employment in manufacturing of chemicals" could be in relation to about 49 to 1,200 declarable OCPF plant sites (with a statistical reliability of 95%).

FIGURE 3:   NUMBER OF DECLARED OCPF PLANT SITES AGAINST NUMBER OF PAID EMPLOYMENT IN MANUFACTURING OF CHEMICALS (IN THOUSANDS)

45 States Parties

$\rho=0.87$
$\log y=0.98(\log x)-0.57$
$2\sigma=0.69$

Number of Declared and Declarable OCPFs

Paid Employment in Manufacturing of Chemicals (in Thousands)
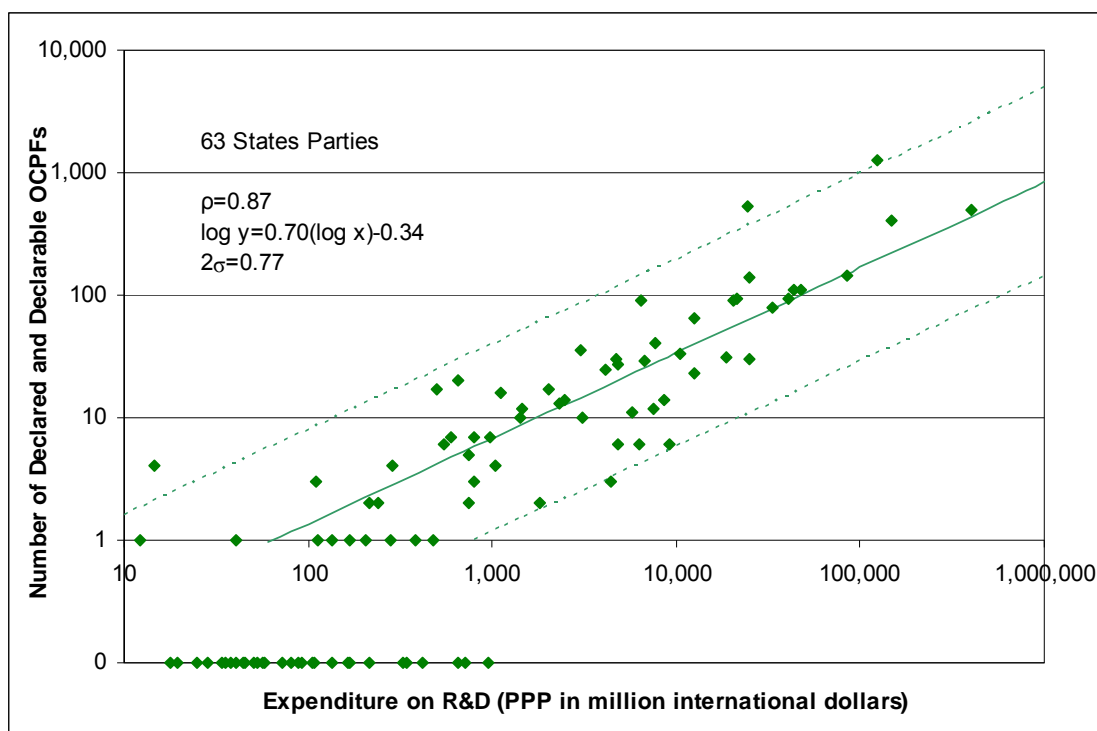
Expenditure on research and development

8.   Figure 4 shows the numbers of declared OCPF plant sites against the expenditure on research and development. Compared to the results of the same indicator discussed in the previous analysis (S/862/2010/Rev.1), a larger correlation (an increase from $\rho=0.86$ to 0.87[4]) was observed, suggesting a closer relationship between the number of declared OCPF plant sites and the amount of expenditure on research and development than was indicated in the previous Note. The source of the data on research and development expenditure has been provided by the Institute of Statistics of UNESCO.   To give an example of how the related range can be found, a hypothetical expenditure on research and development of 100,000 million international dollars could be in relation to about 29 to 980 declarable OCPF plant sites (with a statistical reliability of 95%).

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[4]   Considering that the theoretical maximum value for the correlation coefficient is 1.0, this small difference is considered as an increase (this is also the case for Figure 1).
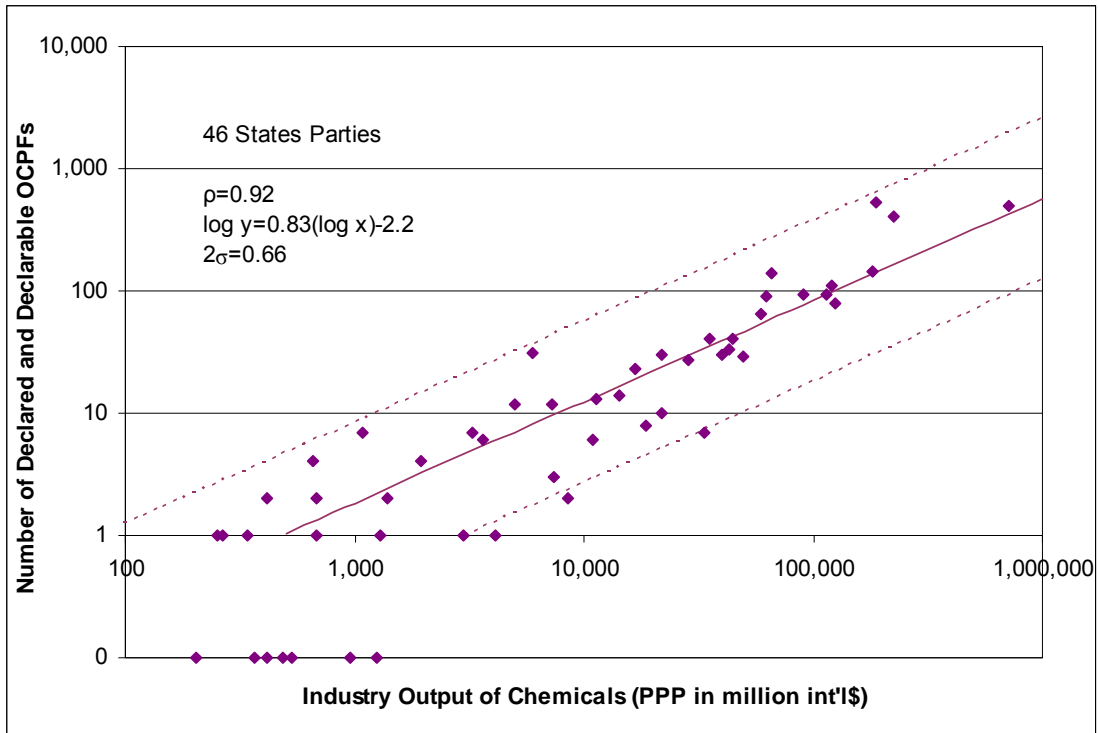
FIGURE 4: NUMBER OF DECLARED OCPF PLANT SITES AGAINST AMOUNT OF EXPENDITURE ON RESEARCH AND DEVELOPMENT

Industry output of chemicals

9. Figure 5 shows the number of OCPF plant sites declared by each State Party against the value of industry output of chemicals (as a sum of the output of basic chemicals and the output of other chemicals). The data of industry output is from the INDSTAT (provided by UNIDO) and is available on the United Nations Data Retrieval System. To enable a comparison to be made, the original industry output data based on the local currencies were converted to the value based on the international dollars, using the rate of the World Bank. The relationship between the sets of data can be considered as one of the largest among the indicators analysed in this report ($\rho=0.92$). To give an example of how the related range can be found, a hypothetical figure of an industry output of chemicals with the value of 100,000 million international dollars could be in relation to about 18 to 380 declarable OCPF plant sites (with a statistical reliability of 95%).

FIGURE 5: NUMBER OF DECLARED OCPF PLANT SITES AGAINST VALUE OF INDUSTRY OUTPUT OF CHEMICALS

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