



Verification Division  
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### NOTE BY THE DIRECTOR-GENERAL

#### INITIATIVE BY THE DIRECTOR-GENERAL ON A METHODOLOGY FOR THE SELECTION OF OTHER CHEMICAL PRODUCTION FACILITIES FOR INSPECTION

##### Background

1. Paragraph 11 of Part IX of the Verification Annex to the Chemical Weapons Convention (hereinafter “the Verification Annex”) states that the Technical Secretariat (hereinafter “the Secretariat”) shall randomly select plant sites for inspection through appropriate mechanisms.
2. The current site-selection methodology was introduced by the Secretariat in 2007 as an initiative of the Director-General on the basis of consultations in the Industry Cluster that had taken place up until 2007 (S/641/2007, dated 25 May 2007 and Corr.1, dated 4 June 2007). The site-selection methodology referred to as “the modified methodology” in the aforementioned document is to be referred to henceforth as “the S/641 methodology”. The Director-General explained to the Executive Council (hereinafter “the Council”) at its Fiftieth Session (paragraph 5.36 of EC-50/4, dated 28 September 2007) that the methodology is an interim measure pending agreement among States Parties on a definitive site-selection methodology in accordance with paragraphs 11 and 25 of Part IX of the Verification Annex. The S/641 methodology has been used to select other chemical production facility (OCPF) plant sites for inspections conducted from 2008 to 2011.
3. The Second Special Session of the Conference of the States Parties to Review the Operation of the Chemical Weapons Convention noted the desirability of directing inspections towards facilities of greater relevance to the object and purpose of the Chemical Weapons Convention (hereinafter “the Convention”) in relation to OCPF inspections (paragraph 9.65 of RC-2/4, dated 18 April 2008).
4. The Council at its Fifty-Ninth and Sixtieth Sessions recognised the need for industry verification to be directed towards those sites of most relevance to the object and purpose of the Convention, in particular to improve the effectiveness of the verification regime (paragraph 5.23 of EC-59/4, dated 26 February 2010 and paragraph 5.13 of EC-60/3, dated 22 April 2010).



### **Revision of the site-selection methodology**

5. At its Sixty-First Session, the Council appointed Ambassador Fauziah Mohamad Taib and Ambassador Pieter de Savornin Lohman as the co-facilitators for a consultation on the OCPF site-selection methodology. The co-facilitators reported on the site-selection methodology for OCPFs to the Council at its Sixty-Fifth Session (EC-65/WP.1, dated 10 June 2011). In their report, the co-facilitators recommended that the Director-General modify the interim OCPF site-selection methodology (paragraph 9 of EC-65/WP.1) to better target OCPF inspections, without the need for States Parties to provide additional information in declarations (paragraph 5 of EC-65/WP.1). The Council at the same session noted the report of the co-facilitators (paragraph 6.32 of EC-65/4, dated 15 July 2011).
6. Based on the aforementioned recommendation from the Industry Cluster consultations, the Director-General intends to improve the S/641 methodology accordingly (the improved methodology will henceforth be referred to as “the revised methodology”).
7. The revised methodology will be in effect for the selection of OCPF plant sites to be inspected from January 2012.
8. The status of the revised methodology will remain unchanged, that is, it is an interim measure pending agreement among States Parties on a definitive site-selection methodology in accordance with the requirements of the Convention. In implementing the revised methodology, the Secretariat will ensure that the total number of inspections received by a State Party stays within the maximum set in Part IX of the Verification Annex.
9. As requested by the Council (paragraph 6.32 of EC-65/4), the Secretariat intends to report annually on the performance of the revised methodology, starting in early 2013.
10. The annex to this Note describes the details of the revised site-selection methodology and discusses the performance to be expected.

Annex: Detailed Information on the Initiative by the Director-General on a Methodology for the Selection of Other Chemical Production Facilities for Inspection

## Annex

### DETAILED INFORMATION ON THE INITIATIVE BY THE DIRECTOR-GENERAL ON A METHODOLOGY FOR THE SELECTION OF OTHER CHEMICAL PRODUCTION FACILITIES FOR INSPECTION

#### Features of the revised site-selection methodology

1. As recommended by the co-facilitators for the consultation on the OCPF site-selection methodology (paragraph 4 of EC-65/WP.1), the Director-General intends to improve the site-selection methodology by incorporating the following two ideas:
  - (a) “OCPF plant sites not yet inspected would be selected through the use of three selection pools—instead of, as now, a single pool. For each State Party, the Secretariat would annually divide equally the declared OCPFs into three pools: one third of OCPFs with the relatively highest A14 values into pool A; the next third into pool B; and one third with the relatively lowest A14 values into pool C. The pools of each State Party would then be combined by the Secretariat into three overall pools (i.e. the A-pools of all States Parties would be put together into one overall A-pool, and so on). The simulations done by the Secretariat suggest that—in order to get the optimal results—85% of OCPF inspections should be conducted at facilities selected from pool A, 10% from pool B, and 5% from pool C. OCPFs from each pool would be randomly selected in the same way as now”; and
  - (b) “The G-factor of the currently applied A14 algorithm would be fine-tuned” (the A14 algorithm was developed by the Secretariat in 2000 to focus inspections on relevant OCPFs and is used when the weighting factor for information available to the Secretariat is calculated). “On the basis of the experience and insights gained through previous inspections, the Secretariat would re-categorize the product group codes.”

#### General features

2. The general features of the revised methodology are as follows:
  - (a) it is a one-step methodology for the random selection of a given plant site for inspection (unchanged);
  - (b) the probability that a given plant site will be selected for inspection will be a function of the combined probabilities from the algorithms for equitable geographic distribution and for the information available to the Secretariat (in accordance with subparagraphs 11(a) and 11(b) of Part IX of the Verification Annex; unchanged);
  - (c) States Parties that have declared a relatively large number of OCPFs can expect more inspections than those that have declared relatively fewer (unchanged);

- (d) the methodology does not take account of subparagraph 11(c) of Part IX of the Verification Annex, which refers to proposals by States Parties. Thus, the methodology remains an interim measure pending agreement among States Parties on a definitive site-selection methodology in accordance with paragraphs 11 and 25 of Part IX of the Verification Annex (unchanged);
- (e) the modified A14 algorithm (to be referred to henceforth as “the A15 algorithm”; see paragraph 3 below), which is used to estimate the relevance of OCPFs, has better correlation between the relevance of OCPFs as observed through the previous inspections than the A14 algorithm has (new);
- (f) States Parties that have declared OCPFs with relatively high A15 values are given larger probabilities of inspections than those that have declared OCPFs with relatively low A15 values (unchanged);
- (g) the methodology is designed to select a larger number of OCPFs with relatively high A15 values (which are deemed to be more relevant) and a smaller number of OCPFs with relatively low A15 values, compared to the S/641 methodology, through the use of multiple selection pools (new); and
- (h) the geographical distribution of OCPF inspections for each State Party remains essentially the same.

#### Modification of the *G* factor

3. The modification of the A14 algorithm to the A15 algorithm only affects the value of weighting factor *G*; both the values of other weighting factors and the overall equation remain unchanged. The new values of the *G* factor were determined based on the experiences of the Secretariat in conducting inspections, in order to achieve better correlation between the relevance of OCPFs actually observed by the inspectors. The A15 value is calculated as follows:

$$(A15value) = N^{1.5} \times M \times G \times P \times A, \text{ where:}$$

<b>Weighting Factor</b>	<b>Description</b>
<i>N</i>	Number of DOC <sup>1</sup> plants (including PSF <sup>2</sup> plants) on this plant site
<i>M</i> = 1	If the production range of the plant site is between 200 and 1,000 tonnes per year
<i>M</i> = 3	If the production range of the plant site is between 1,000 and 10,000 tonnes per year
<i>M</i> = 1	If the production range of the plant site is 10,000 tonnes or more per year
<i>P</i> = 1	If there is no PSF plant
<i>P</i> = 7	If there is at least one PSF plant on this plant site

<sup>1</sup> DOC = unscheduled discrete organic chemicals.

<sup>2</sup> PSF = an unscheduled discrete organic chemical containing the elements phosphorous, sulfur, or fluorine.

$A = 1$	If no inspection occurred at the plant site during the previous 10 years
$A = (A_1 - A_2)/10$	If the plant site has been inspected during the previous 10 years, where $A_1$ is the year of the planned inspection and $A_2$ is the year of the previous inspection
$G = 1$	For group codes: 511-513, 524, 531-533, 551, 553, 554, 562, 592, 593, 597
$G = 3$	For group codes: 514, 516, 522, 523, 525, 571-575, 579, 581-583, 598, 599
$G = 7$	For group codes: 515, 541, 542, 591

#### Change of the selection pools

4. For the purpose of annual selection, the Secretariat will divide the OCPFs declared by each State Party into four groups, namely:
- OCPFs not yet inspected, in the bracket of the highest one third of the A15 values in the State Party (the number is rounded to the nearest integer) (pool A);
  - OCPFs not yet inspected, in the bracket of the middle one third of the A15 values in the State Party (the number is rounded up) (pool B);
  - OCPFs not yet inspected, in the bracket of the lowest one third of the A15 values in the State Party (the number is rounded down) (pool C); and
  - OCPFs that have already been inspected (pool D; there is no change to this pool).

For a given State Party, OCPFs that have not yet been inspected and that have the same A15 value will be put in the same selection pool.

5. From each selection pool, the following numbers of OCPFs are to be selected:
- a number of inspections are set aside for subsequent (repeat) inspections and are to be selected from pool D (from 2005 to 2011, the Director-General set this as 5% of the total number of budgeted OCPF inspections);
  - of the remaining OCPF inspections, 85% are to be conducted at OCPFs selected from pool A, 10% from pool B, and 5% from pool C. This strikes a balance between targeting and the deterrence factor of inspections; and
  - the numbers to be selected are rounded to the nearest integers when necessary.

The Director-General will annually review the figures mentioned in subparagraphs (a) and (b).

Selection of OCPF plant sites for inspection (unchanged)

6. For the purpose of selecting OCPFs from each selection pool, the same site-selection methodology as was applied in the period from 2008 to 2011 (that is, the S/641 methodology) will be used. Details of the methodology are given below.
7. Before conducting random selection, the selection probability needs to be calculated for each OCPF plant site. The sum for each State Party of the probabilities for all OCPFs in the pool is firstly calculated as follows:

- (a) The contribution to the number of OCPF inspections to be carried out within a particular State Party from the weighting factor of geographical distribution (geographical points) is derived by the following calculation: one plus half the square root of the number of declared OCPF plant sites of the State Party within the pool, namely:

$$Ng_i = 1 + \frac{\sqrt{n_i}}{2}, \text{ where:}$$

$Ng_i$  is the value of geographical points assigned to State Party  $i$ ; and

$n_i$  is the number of inspectable OCPF plant sites declared by State Party  $i$  and in a specific pool.

The geographical probability for one State Party is obtained by calculating the fraction of the geographical point of the State Party to the sum of the geographical points of all States Parties:

$$Pg_i = \frac{Ng_i}{\sum_{i=1}^a Ng_i}, \text{ where:}$$

$Pg_i$  is the contribution of the geographical factor to the sum probability of State Party  $i$ ; and

$a$  is the number of States Parties that declared any inspectable OCPF plant sites in a specific pool.

- (b) The contribution to the number of OCPF inspections to be carried out within a particular State Party from the weighting factor of information available to the Secretariat (technical points) is determined by the following calculation: one plus half the square root of the sum of the A15 values for all declared OCPF plant sites of the State Party within the pool.

$$Nt_i = 1 + \frac{\sqrt{\sum_{j=1}^{n_i} A15_{i,j}}}{2}, \text{ where:}$$

$Nt_i$  is the value of technical points assigned to State Party  $i$ ; and

$A15_{i,j}$  is the value calculated by the A15 algorithm for inspectable OCPF plant site  $j$  declared by State Party  $i$  and in a specific pool.

The technical probability for one State Party is obtained by calculating the fraction of the technical point of the State Party to the sum of the technical points among all States Parties:

$$Pt_i = \frac{Nt_i}{\sum_{i=1}^a Nt_i}, \text{ where:}$$

$Pt_i$  is the contribution of the technical factor to the sum probability of State Party  $i$ .

- (c) The expected number of inspections in a particular State Party is determined from the two components above. The probability for State Party  $i$  to be selected in one draw from a selection pool can be calculated as:

$$P_i = \frac{Pg_i + Pt_i}{2}, \text{ where:}$$

$P_i$  is the probability for State Party  $i$  to be selected in one draw from a specific pool.

Then the expected number of inspections for a State Party can be calculated as follows:

$$E_i = x_A P_{A,i} + x_B P_{B,i} + x_C P_{C,i} + x_D P_{D,i}, \text{ where}$$

$E_i$  is the expected number of inspections for State Party  $i$ ;

$x_{A(or B,C,D)}$  is the number of inspections to be selected from a specific pool A~D; and

$P_{A(or B,C,D),i}$  is the probability for State Party  $i$  to be selected in one draw from a specific pool A~D.

8. Secondly, the probability that a particular OCPF plant site will be selected for inspection is calculated as follows:

- (a) Each OCPF plant site within a State Party receives an equal portion of the contribution from the geographical probability of the State Party. This can be calculated as:

$$Pg_{i,j} = \frac{Pg_i}{n_i}, \text{ where:}$$

$Pg_{i,j}$  is the probability of geographical factor assigned to OCPF plant site  $j$  in State Party  $i$ .

- (b) Each OCPF plant site within a State Party receives a portion of the contribution from the technical probability of the State Party that is proportional to the A15 value for that plant site and thus given as a fraction of the A15 value of the plant site to the sum of A15 values for all declared facilities within the State Party. The technical probability for each OCPF can be calculated by:

$$Pt_{i,j} = Pt_i \times \frac{A15_{i,j}}{\sum_{j=1}^{n_i} A15_{i,j}}, \text{ where:}$$

$Pt_{i,j}$  is the probability of technical factor assigned to OCPF plant site  $j$  in State Party  $i$ .

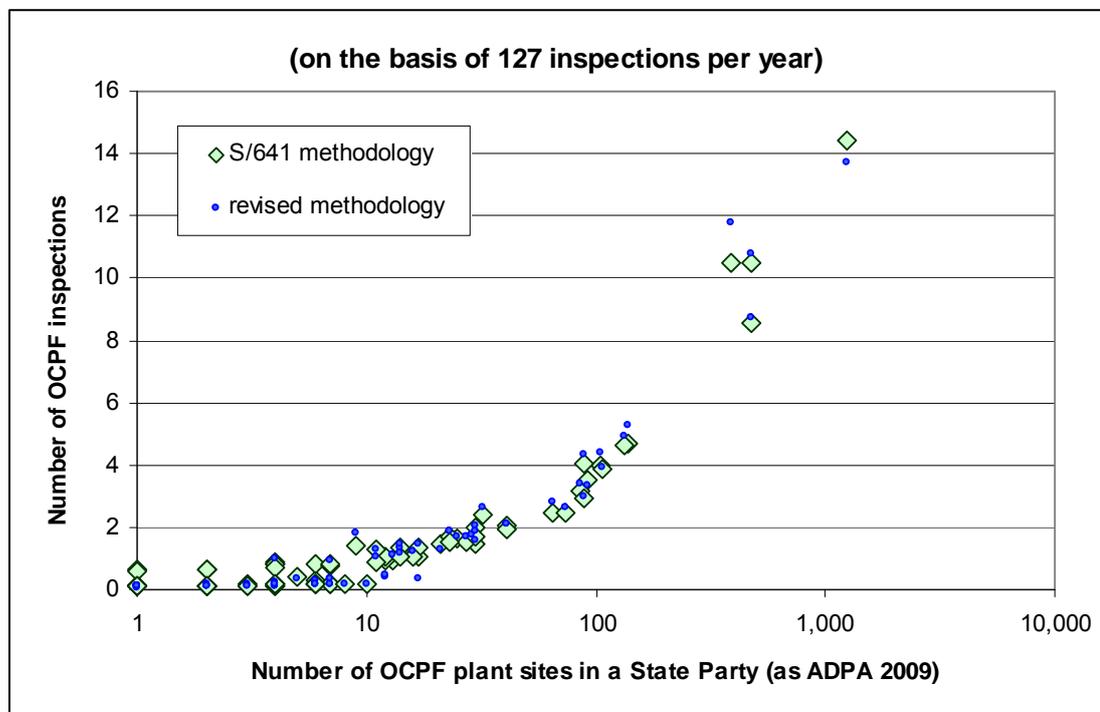
- (c) The probability that a given OCPF plant site will be selected for inspection is derived from the sum of the two components above. The power of the two weighting factors is set to be equal. Accordingly, the selection probability for an OCPF plant site for every draw  $P_{i,j}$  can be obtained as follows:

$$P_{i,j} = \frac{Pg_{i,j} + Pt_{i,j}}{2}.$$

**Expected selection results after application of the revised methodology**

9. As was the case for the S/641 methodology, the expected number of OCPF inspections in a particular State Party is a function of both the number of inspectable OCPF plant sites and the relevance of these plant sites as assessed by the A15 algorithm. Within the State Party, the probability that a site will be selected is in a linear relationship with its relevance as assessed by its A15 value.

**FIGURE 1: EXPECTED NUMBER OF OCPF INSPECTIONS PER STATE PARTY PER YEAR**



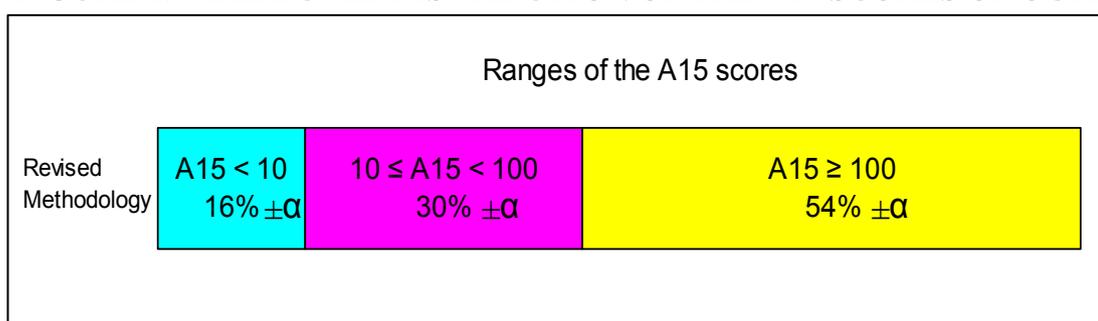
(ADPA = annual declaration on past activities)

10. Figure 1 shows the expected number of OCPF inspections per year per State Party for the S/641 methodology and the revised site-selection methodology, as a function of

the number of declared and inspectable OCPF facilities, based on the declaration information from States Parties as of July 2011. The calculation assumes 127 OCPF inspections per year, which is the number approved in the OPCW Programme and Budget for 2011 (C-15/DEC.6, dated 2 December 2010).

11. The revised methodology retains the major aspect of the S/641 methodology, namely, that the expected number of inspections will depend on the number of declared plant sites and the characteristics of these plant sites:
  - (a) a State Party with a large number of inspectable OCPFs will be likely to receive a higher number of inspections than a State Party with fewer OCPFs; and
  - (b) a State Party with more OCPFs deemed to be highly relevant (according to the A14 or the A15 algorithm) can expect to receive more inspections than those with fewer highly relevant sites, irrespective of the number of sites in each State Party.
12. The revised methodology thus results in the same level of inspections for each State Party as conducted under the S/641 methodology.
13. Figure 2 shows the expected percentage of OCPF inspections per year by the categories of the A15 values with the following assumptions:
  - (a) information declared by States Parties as of July 2011;
  - (b) 127 OCPF inspections are conducted in total; and
  - (c) 15% of inspections are conducted at OCPFs that have already been inspected.

**FIGURE 2: EXPECTED DISTRIBUTION OF THE A15 SCORES OF OCPFs**



14. While the A15 values represent a new baseline for the comparison and cannot be directly compared to the previous results using the A14 algorithm, the revised methodology is considered to result in selecting more relatively high-relevance OCPFs and fewer relatively low-relevance OCPFs.
15. A number of factors will affect the actual results; this is represented in the above chart by “±α”:

- (a) new and amended information declared by States Parties;
- (b) the continuous conduct of OCPF inspections, which moves a number of OCPFs from pools A - C to pool D;
- (c) the randomness of the selection, which is a requirement of the Verification Annex; and
- (d) other factors, including the rate of subsequent (repeat) inspections.

**Other elements**

- 16. In implementing the revised methodology, the Secretariat will also carefully ensure that it complies fully with paragraphs 12 and 13 of Part IX of the Verification Annex, which stipulate that no plant site shall receive more than two inspections per year, and that the combined number of inspections to be received by a State Party per calendar year shall not exceed three, plus five percent of the total number of plant sites declared by a State Party as Schedule 3 sites and OCPFs, or 20 inspections, whichever of these two figures is lower.
- 17. As was the case before, a critical factor for any site-selection methodology is the timely submission and update of correct declarations. Late submissions of declarations can mean that sites are not included in the selection process or that the selection is based on outdated information. Inaccurate declarations can lead to a selection of OCPF plant sites that are found to be not inspectable, or to a selection with a focus on irrelevant OCPF plant sites, in the course of inspection.