Item 16.1:   Method of Calculation of National Subscriptions-Czech National Committee for Chemistry

The Czech National Committee for Chemistry has submitted the following proposal for consideration by the Council.

Starting from the year 2002, the National Subscriptions to IUPAC shall be based on the product of per capita chemical turnover and total population of a country.

Background information on the current formula for determining National Subscriptions and a summary of the intent of the Czech proposal are given below. The following pages contain copies of the correspondence from the Czech National Committee describing their proposal and its background in detail. Subsequent pages contain an analysis of the consequences of adopting the Czech proposal and comments from the Finance Committee.

Background. In a report dated 14 July 1983, Prof. Guy Ourisson, the then Secretary General, described a proposed new "Improved Dues Structure." This was prepared for the 1983 General Assembly in Lyngby. The Council had already adopted a dues structure based on Chemical Turnover at Leuven (1981), but it was felt that the mechanism used was too discontinuous. In that system NAOs were assigned to dues brackets based on Chemical Turnover. This led to large jumps in the National Subscription when the Chemical Turnover crossed one of the boundaries. There was a provision that a NAO could request assignment to the next lower category, with the approval of the Council. The present system was approved at Lyon (1985) with an updated version accepted at Lund (1989).

The formula derived in 1983 arose from a plot of the log of the then-existing National Subscriptions vs. the log of Chemical Turnover for all NAOs for which reliable data were then available. A least squares fit of a straight line through the data points gave a good fit with a slope of 0.68. This translates to the "4L" formula:

$$NS_i/TNS = (CT_i^{\,0.68})/\mathbf{\dot{a}}(CT_i^{\,0.68})$$

relating CT and NS for the *i*'th country, with TNS = Σ NS$_i$. Application of this formula resulted in significant changes in NS for some countries, and a phase-in period was allowed. Since then the formula has been used, with rare exceptions granted to account for rapid currency changes or abrupt economic downturn in a particular country.

Czech Proposal.   The Czech proposal, given on the following pages, proposes to substitute the value of 1.0 for 0.68 in the exponent in order to increase the amounts paid by the largest countries, which the Czech National Committee feels are unduly favored by the present formula. The wording of the Czech proposal is couched in terms of "per capita CT", but the actual proposal deals with "per capita CT multiplied by population", which simply results in CT as the basis, just as at present.

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**Proposal for Revision of the Procedure for Calculating
The National Subscriptions to IUPAC
Submitted to the Council Meeting
At the 41st IUPAC General Assembly in Brisbane, July 2001**

At the present time, National Subscriptions to IUPAC are calculated according to the formula given in the heading of the attached table with model calculations using a value of the exponent $x = 0.68$. This clearly discriminates small countries with medium and small chemical turnovers in favour of big countries with large turnovers.

The Czech National Committee for Chemistry believes that a fair way for calculating the National Subscriptions is to make them proportional to the per capita chemical turnover and the total population of the nation. This is fulfilled if an exponent of unity is used in the formula referred to.

As a support for the suggested approach, it can be observed that in international government organisations, such as the United Nations Organisation or UNESCO, the per capita gross national product is the determining parameter in calculating national contributions.

IUPAC Statute S9.1 reads: Each Adhering Organisation shall pay an annual subscription to the Union, due 1 January and payable before 31 December in each year. The minimum amount of this annual subscription shall be decided from time to time by the Council.

Thus, the Czech National Committee for Chemistry puts forward the following motion to the Council:

**Starting from the year 2002, the National Subscriptions to IUPAC
Shall be based on**
The product of per capita chemical turnover and total population of a country.

31st January, 2001

MODEL CALCULATIONS OF NATIONAL SUBSCRIPTIONS TO IUPAC

Calculated as $(NS)_i = (NS)_i^{'}/? (NS)_i^{'}$, where the non–normalised value $(NS)_i^{'}$ is given by the formula $(NS)_i^{'} = [(CT)_i/? (CT)_i]^x × ? (NS)_i$. $(NS)_i$ is national subscription of the i-th country (in USD), $(CT)_i$ is chemical turnover of the i-th country (in USD), x is an exponent varying between 0.68 and 1, $? (NS)_i = 700\ 000$ USD. P- population of a country, in millions; $(S)_{pc}$ - per capita subscription (in USD); $(CT)_{pc}$ - per capita chemical turnover (in USD).

Country	P	$(CT)_i × ×10^{-9}$	$(NS)_i$	$(S)_{pc} × ×10^4$	$(NS)_i$	$(S)_{pc} × ×10^4$	$(NS)_i$	$(S)_{pc} × ×10^4$	$(NS)_i$	$(S)_{pc} × ×10^4$	$(CT)_{pc}$
				$x = 1$		$x = 0,89$		$x = 0,78$		$x = 0,68$	
U.S.A.	274	315.88	180 410	6.58	155 600	5.68	130 980	4.78	109 310	3.99	1152.8
Japan	126	277.82	158 670	12.59	138 800	11.02	118 500	9.40	100 170	7.95	2204.9
Germany	82	109.54	62 560	7.63	60 620	7.39	57 340	6.99	53 200	6.49	1335.9
France	59	72.38	41 340	7.01	41 500	7.11	41 500	7.03	40 130	6.80	1226.8
China/Beijing	1262	57.54	32 860	0.26	34 700	0.27	34 340	0.27	34 340	0.27	45.6
UK	59	50.37	28 770	4.88	30 360	5.15	31 280	5.30	31 370	5.32	853.7
Italy	57	46.35	26 470	4.64	28 200	4.95	29 320	5.14	29 640	5.20	813.2
Spain	40	26.27	15 000	3.75	17 010	4.25	18 830	4.71	20 150	5.04	656.8
Netherlands	16	24.46	13 970	8.73	15 960	9.98	17 810	11.13	19 190	12.00	1528.8
Switzerland	7.3	23.27	13 290	18.21	15.270	20.92	17 130	23.46	18 550	25.41	3187.7
China/Taipei	22.0	20.90	11 940	5.43	13 880	6.31	15 750	7.16	17 250	7.84	950.0
Canada	30.6	20.72	11 830	3.87	31 770	4.50	15 640	5.11	17 140	5.60	677.1
India	982	19.36	11 060	0.11	12 960	0.13	14 840	0.15	16 370	0.17	19.7
Belgium	10	18.21	10 400	10.40	12 280	12.28	14 150	14.15	15 070	15.70	1821.0
Puerto Rico	3.8	14.12	8 060	21.22	9 790	5.76	11 600	30.53	13 210	15.70	3715.8
South Africa	39	11.70	6 680	1.71	8 280	2.12	1 020	2.57	11 620	34.76	300.0
Australia	18.5	10.15	5 800	3.13	7 300	3.94	8 970	4.85	10 550	2.98	548.6
Rep. of Korea	46	9.74	5 560	1.21	7 030	1.53	8 680	1.89	10 260	2.23	211.7
Brazil	166	9.60	5 480	0.33	6 940	0.42	8 590	0.52	10 160	0.61	57.8
Russia	147	8.95	5 110	0.35	6 520	0.44	8 130	0.55	9 690	0.66	60.9
Austria	8.1	7.63	4 360	5.38	5 660	6.99	7 180	8.86	8 690	10.73	942.0
Sweden	8.9	7.55	4 310	4.84	5 610	6.30	7 120	8.00	8 630	9.70	848.3
Ireland	3.7	7.55	4 310	11.65	5 610	15.16	7 120	19.24	8 630	23.32	2040.5
Egypt	66	6.79	3 880	0.59	5 100	0.77	6 550	0.99	8 030	1.22	102.9
Turkey	64.5	5.04	2 880	0.45	3 910	0.61	5 190	0.81	6 560	1.02	78.1
Poland	38.7	4.71	2 690	0.70	3 680	0.95	4 930	1.27	6 260	1.62	121.7
Denmark	5.3	4.60	2 630	4.96	3 610	6.81	4 840	9.13	6 160	11.62	867.9
Israel	6.0	4.03	2 300	3.84	3 210	5.35	4 360	7.27	5 630	9.38	671.7
Norway	4.4	3.90	2 230	5.06	3 120	7.08	4 250	9.66	5 510	12.52	886.4
Finland	5.1	3.69	2 110	4.13	2 970	5.81	4 070	7.99	5 300	10.40	723.5
Portugal	9.9	3.28	1 870	1.89	2 670	2.70	3 720	3.75	4 900	4.94	331.3
Hungary	10.1	2.94	1 680	1.66	2 420	2.40	3 410	3.38	4 540	4.50	291.1
Greece	10.6	2.69	1 540	1.45	2 240	2.11	3 180	3.00	4 280	4.04	253.8
Czech Rep.	10.3	2.55	1 460	1.41	2 130	2.07	3 050	2.96	4 120	4.00	247.6
Chile	14.8	2.49	1 420	0.96	2 090	1.41	3 000	2.02	4 060	2.74	168.2
Argentina	36	2.23	1 270	0.35	1 890	0.53	2 750	0.76	3 770	1.05	61.9
Pakistan	148	1.68	960	0.06	1 470	0.10	2 200	0.15	3 110	0.21	11.4
New Zealand	3.8	1.58	900	2.37	1 390	3.67	2 100	5.53	2 980	7.84	415.8
Slovenia	2.0	1.38	790	3.94	1 240	6.18	1 890	9.45	2 720	13.58	690.0
Bulgaria	8.3	1.00	570	0.69	930	1.12	1 470	1.77	2 180	2.63	120.5
Slovakia	5.4	1.00	570	1.06	930	1.72	1 470	2.72	2 180	4.04	185.2
Yugoslavia	10.6	0.94	540	0.51	880	0.83	1 400	1.32	2 090	1.97	88.7
Croatia	4.5	0.37	210	0.47	380	0.85	680	1.51	1 110	2.47	82.2
Kuwait	1.8	0.14	80	0.44	160	0.90	320	1.76	570	3.18	77.8
Saudi Arabia	21.5	0.00	--	--	--	--	--	--	6 300[a]	--	0.0

Comment: Available input data has been used, which may not be quite accurate. The error thus introduced, however, does not affect the essence of the matter. [a] Self-imposed subscription at $(CT)_i = 0$.

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Financial Analysis of the Proposal

The exponent 0.68 in the "4L" formula was determined as the slope of the straight line on a log-log plot that best related the existing National Subscriptions to Chemical Turnover. The basic Czech proposal is to change the formula for calculating National Subscriptions from one with a slope of 0.68 to one with a slope of unity.

Table 1 is a calculation of the current NS and that using the proposed formula using the Chemical Turnovers used for 2000 and the total National Subscriptions for 2000. The proposed formula increases the subscriptions for the United States, Japan, Germany, France, and China/Beijing by USD 75,200, 39,300, 10,700, 3,100, and 1,000, respectively. The total increase for these five NAOs is USD 129,300. All other NAOs have decreases. Table 2 shows the distribution of total National Subscriptions for the first five NAOs, the second five, etc. Under the Czech proposal, the proportion of National Subscriptions paid by the larger contributors would drastically increase.

The proposal focuses on a slope of 1.0. Figure 1 is a plot of log NS_i vs. log CT_i to illustrate the effects of using values of the exponent both larger and smaller than the value of 0.68 that was established in 1983.

Comments on the Analysis by the Finance Committee

1. The Finance Committee is concerned with maintaining a stable and easily administered procedure for determining the National Subscriptions. In 1981 Chemical Turnover was introduced as an approximate measure of the strength of the chemical enterprise within a country. It was expected that this quantity would correlate to some extent with such matters as the importance of chemistry, the numbers of chemists, the size of chemical societies, and the taxes obtained from the chemical industry, which may provide a rationale for government support of IUPAC.

2. Prior to 1981 the level of support from each NAO was negotiated, and the Finance Committee was involved in repeated efforts to persuade NAOs to accept a particular level of subscription. As a result of many years of experience, a widely accepted set of National Subscriptions was in place in 1983. These were related to Chemical Turnover by a least squares fit to provide the current formula. The "4L" formula has been in place since the 1980s and has resulted in a stable and predictable set of National Subscriptions, with normally no large annual changes. Any alteration in the basis of the calculation that makes large changes in the assessments of the larger countries, or one that shifts more of the financial burden to smaller countries, is unlikely to gain acceptance by organizations and governments in the affected countries unless there is a very strong rationale for the change. Since all NAOs, large and small, are under continuing pressure to raise the required funds, the desire of one country to reduce its burden by shifting it to another country is not likely to be convincing.

3. The letter from the Czech NAO implies that the per capita Chemical Turnover is a better measure of relative ability to pay. Use of per capita CT, either in the present formula or in one with an exponent of 1.0, would cause drastic cuts in NS for all the

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large countries and enormous increases for such countries as Puerto Rico, Ireland and Switzerland. The actual proposal from the Czech National Committee uses the product of per capita CT and population, which of course is just CT.

4. In conclusion, the Finance Committee believes that the proposal does not present a strong rationale for changing the current formula and believes that such a change would be very disruptive to the Union.

Appendix: Derivation of the "4L" Relationship

The equation given by Ourisson was obtained by doing a least squares fit of a straight line to a plot of $\log(NS_i/TNS)$ vs $\log CT_i$ for the values actually used in 1982-83. This gives an equation of the form:

$$\log(NS_i/TNS) = m*(\log CT_i) + b \quad \text{(eq 1)}.$$

The slope of the line, m, was found empirically to be 0.68.

Taking the antilog of both sides we obtain

$$(NS_i/TNS) = (CT_i)^{0.68}*b \quad \text{(eq. 2)}.$$

By summing both sides and noting that the left side sums to unity, we obtain

$$b = 1/\Sigma(CT_i)^{0.68}.$$

Table 1

NS calculations-2000	CT 1995/96 Biennial Av (USD10^9)	NS-Current	NS-Czech	Delta	Delta-%
USA	349.0	107.4	182.6	75.2	70.0%
Japan	229.3	80.7	120.0	39.3	48.7%
Germany	119.6	51.8	62.5	10.7	20.7%
France	83.4	40.5	43.6	3.1	7.7%
China/Beijing	72.3	36.8	37.8	1.0	2.7%
UK	53.8	30.1	28.1	-2.0	-6.6%
Italy	51.5	29.2	26.9	-2.3	-7.9%
Spain	31.6	20.9	16.5	-4.4	-21.1%
Netherlands	30.1	20.3	15.7	-4.6	-22.7%
Korea, Republic of	25.1	17.9	13.1	-4.8	-26.8%
Switzerland	24.9	17.8	13.0	-4.8	-27.0%
Belgium	24.7	17.7	12.9	-4.8	-27.1%
China/Taipei	20.9	15.8	10.9	-4.9	-31.0%
Canada	20.7	15.7	10.8	-4.9	-31.2%
India	18.6	14.6	9.7	-4.9	-33.6%
Puerto Rico	14.1	12.1	7.4	-4.7	-38.8%
Russia	14.0	12.1	7.3	-4.8	-39.7%
Australia	11.8	10.7	6.1	-4.6	-43.0%
Ireland	10.0	9.6	5.3	-4.3	-44.8%
Brazil	9.6	9.3	5.0	-4.3	-46.2%
Sweden	9.6	9.3	5.0	-4.3	-46.2%
Argentina	9.3	9.1	4.8	-4.3	-47.3%
South Africa	7.9	8.2	4.1	-4.1	-50.0%
Poland	6.6	7.2	3.5	-3.7	-51.4%
Denmark	5.7	6.6	3.0	-3.6	-54.5%
Austria	5.7	6.5	3.0	-3.5	-53.8%
Israel	5.5	6.4	2.9	-3.5	-54.7%
Turkey	5.6	6.4	2.9	-3.5	-54.7%
Saudi Arabia	0.0	6.3	6.0	-0.3	-4.8%
Finland	4.9	5.9	2.6	-3.3	-55.9%
Portugal	4.4	5.5	2.3	-3.2	-58.2%
Norway	4.3	5.4	2.2	-3.2	-59.3%
Greece	3.6	4.8	1.9	-2.9	-60.4%
Czech Republic	3.3	4.6	1.8	-2.8	-60.9%
Hungary	3.2	4.4	1.7	-2.7	-61.4%
Chile	3.0	4.2	1.6	-2.6	-61.9%
Slovenia	2.2	3.4	1.1	-2.3	-67.6%
Egypt	2.1	3.3	1.1	-2.2	-66.7%
Pakistan	1.7	2.9	1.0	-1.9	-65.5%
New Zealand	1.6	2.7	1.0	-1.7	-63.0%
Slovakia	1.3	2.3	1.0	-1.3	-56.5%
Bulgaria	1.1	2.1	1.0	-1.1	-52.4%
Yugoslavia	0.0	2.0	2.0	0.0	0.0%

Table 1

NS calculations-2000	CT 1995/96 Biennial Av (USD10^9)	NS-Current	NS-Czech	Delta	Delta-%
Croatia	0.4	1.0	1.0	0.0	0.0%
Kuwait	0.2	1.0	1.0	0.0	0.0%
Total	1,307.8	692.5	694.7	2.2	

Table 2

National Subscriptions-distribution

	Current	Czech
Top five	45.8%	64.3%
Second five	17.1%	14.4%
Third five	11.8%	8.2%
Fourth five	7.8%	4.5%
All others (25)	17.5%	8.6%
	100%	100%

Net Increase for US, Japan, Germany, France, China/Beijing

129.3

All others net decrease

Log NS vs. Log CT

NS x 10^3

CT x 10^9
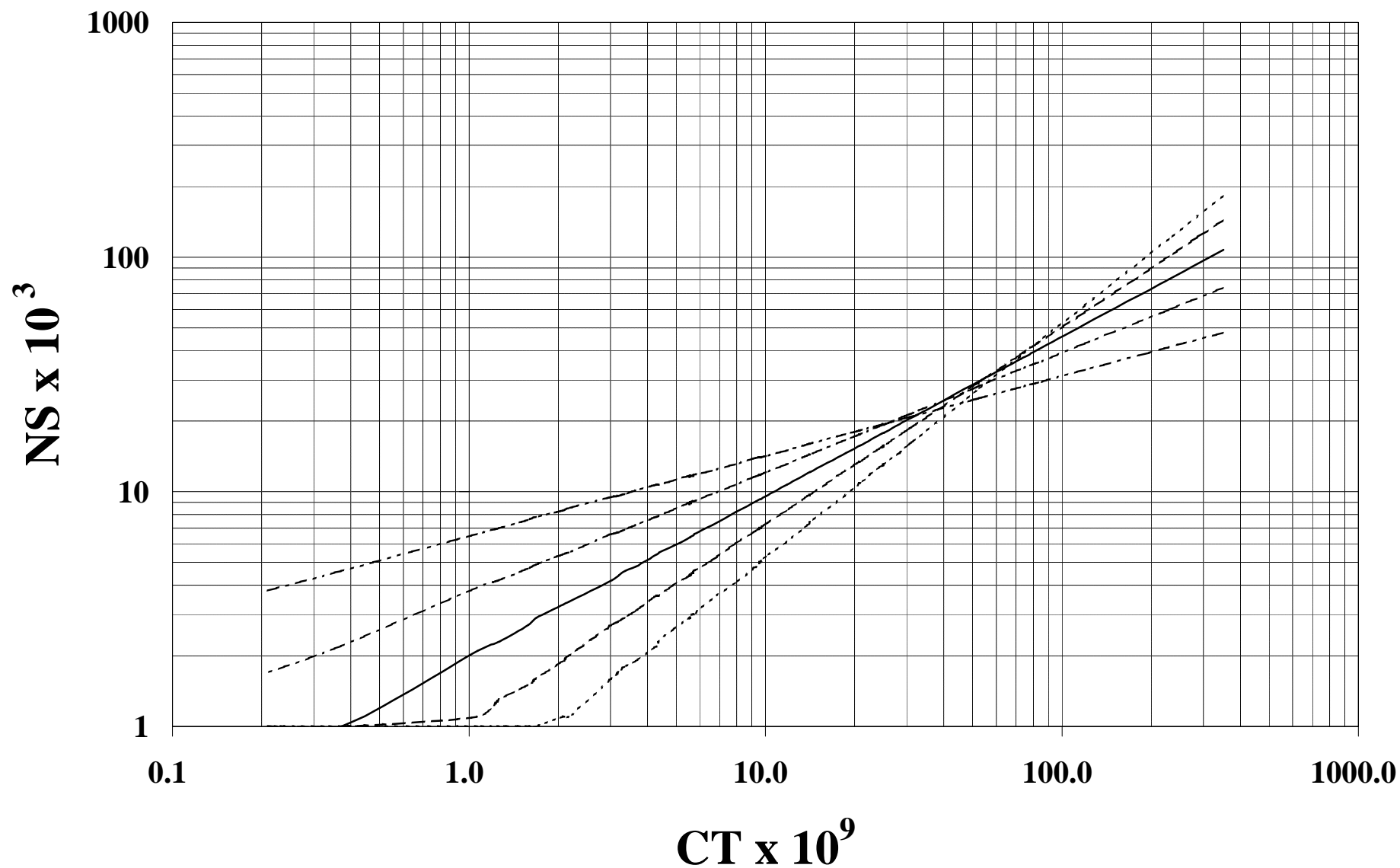
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