

## C MINING INDICATORS

The indicators selected for final recommended are divided into various categories as seen from the point of view of the basic requirements of sustainable development. With the exception of salt production via the evaporation of sea water, mining is not a sustainable industry. However, mining is a large and extremely important source of foreign exchange and income for the Namibian government and industry. While this income lasts it is essential to use it to achieve the aims of sustainable development by diversifying the economy, educating and training Namibians to manage that diversification efficiently in terms of good economic and environmental practices and thereby improve the quality of life of all its citizens. In other words, resources should be used and the revenue therefrom must be applied in such a way to ensure sustainable development. In achieving this, efficient administration of a country is one of the key factors otherwise inefficiencies lead to overexploitation and degradation of renewable resources and the environment. The result is unsustainable development. For an efficient administration, a knowledgeable and well-trained work force is essential. Most of the indicators selected to monitor mining therefore cover a range of aspects of the requirements of sustainable development, some being specifically aimed at testing whether Namibia is successfully directing funds from mining into diversifying the economy and training a competent work force in readiness for careers in government and industry, some aimed at testing the effectiveness of government ministries tasked with encouraging international investment in Namibia.

With respect to mining and the environment, the identification of meaningful indicators has been particularly difficult largely because there has been a major improvement in environmental awareness and responsibility in the mining industry in recent years. This will be further strengthened by forthcoming legislation. EIAs are carried out nowadays for all new operations. Thus, indicators based on the number of major mines that have and apply Environmental Management Plans (EMPs) become meaningless since such indicators have already reached 100%. However, an EMP on its own is not enough. It must be constantly applied, tested and upgraded. Thus, an indicator could be generated on the frequency of auditing of EMPs once it has been established how often plans should be audited. At present some companies only audit their EMPs "*as and when necessary*" which is rather meaningless. In addition, an indicator could be established on how often the plan is improved and new or additional measures taken to further reduce impacts. EMPs should contain regular monitoring programmes of various aspects of the mining activity that affect the social and natural environment. Indicators could be generated from these results of this monitoring. However, EMPs are such a recent development in the Namibian mining industry that auditing thereof is not yet well established and thus practical indicators that would be easily calculable for SOER purposes are difficult to identify at present. Furthermore, mining operations and environmental impacts vary so much from mine to mine that identifying a universally applicable indicator will also be difficult. Reality, may require that that indicators be developed for specific mines.

All prospecting on claims and Exclusive Prospecting Licence (EPL) now takes place under cover of an Environmental Contract which was introduced in 1998. Thus the percentage of new claims and EPLs with Environmental Contracts is 100%. However, an indicator has been developed to test the compliance of prospectors with their Environmental Contracts.

Groundwater monitoring boreholes exist below the dumps and tailings dams of most mines. Indicators could be generated on the frequency of incidents of groundwater pollution and the frequency and time taken to remedy each incident. However, the Ministry of Agriculture, Water and Rural Development does not always receive analyses of water from monitoring boreholes on a regular basis, and some mines do not have an adequate coverage of such boreholes. Furthermore, no overall synthesis of results is made. Analyses are kept in a series of different files which makes it difficult for anyone not in the Department of Water Affairs to compile the data needed to generate an indicator.

Another fairly universal indicator that is difficult to apply in Namibia is simply the total volume of waste rock or overburden mined and dumped. The difficulty arises for two reasons. Different mines use the waste rock in different ways and there is no overall synthesis of the total amount of waste mined. For example, Tsumeb, Kombat and Otjihase used the waste rock as fill underground and dumped very little on surface. Otjihase also used most of the tailings remaining after crushing and extraction of the ore minerals as underground fill. Rössing, Navachab and Okorusu dump all their waste rock outside the open pits. The salt mines have virtually no waste. Rosh Pinah is dumping large amounts of waste rock in old mined out open pits but some material is placed on waste-rock heaps. Auchas waste is now being dumped back in the old mined out workings. Namdeb returns most of the overburden to adjoining mined out areas (as an ongoing rehabilitation process) or pumps much lesser amounts offshore. The offshore diamond mining operations dump most of their waste materials overboard. Reports of the amount of waste mined are not readily available and no synthesis of the total amount of waste mined is made. Large amounts of waste are used for rehabilitation or as underground or open pit fill. Thus, an indicator on the amount of waste mined would be meaningless and no single company reports on the different amounts placed in surface dumps and in old mined out areas as fill.

Arising from the above, the indicators finally recommended for adoption out of the initial 33 considered are: income generation – 1 (Indicator C1), diversification of the economy, particularly export of manufactured goods – 1 (C4), small mining – 1 (C6), test of the efficiency of the Ministry of Mines and Energy and the government approach to mining – 1 (C11), test of the efficiency of the Geological Survey – 2 (C14), health and safety on the mines – 1 (C33), test of the effectiveness of mine Environmental Management Plans – 1 (C29), test of the efficiency of the Ministry of Environment and Tourism in relation to mining and the environment – 1 (C31). The selected indicators are given below.

**Income generation**  
**INDICATOR C1: CONTRIBUTION OF MINING TO GDP**  
 (Indicator C1 in initial list)

<b>INDICATOR NAME</b>	Contribution of Mining to GDP, C1
<b>DEFINITION</b>	Annual GDP from mining as a proportion of total annual GDP
<b>MEASUREMENT</b>	National Accounts, expressed as %

**SIGNIFICANCE OF INDICATOR**

<b>PURPOSE:</b> This indicator measures the proportional contribution of mining to the total economy and tracks the changes in the country's reliance on primary mineral production for economic production and the extent and rate at which the country is moving towards or away from being a mineral-based economy.	
<b>RELEVANCE:</b> The indicator is most useful at a national level and tracks changes in the relative importance of the mining sector in the total Namibian economy over time. Mining is important for job creation (for every job in mining, almost 2 jobs are created in Namibian supplier industries), revenue generation (for every N\$ 1 that mining contributes to GDP, supplier industries contribute N\$ 0,44), foreign exchange earnings (range 36 to 57% from 1990 to 1998). Vulnerable to world commodity price fluctuations.	<b>LINKAGES TO OTHER INDICATORS:</b> Linked to the following Agenda 21 indicator: 'Share of Natural Resource Intensive Industries in MVA'. Also linked to depletion of mineral resources, multiplier effects of mining, MVA from mining, training, health and safety indicators in the mining industry, environmental awareness/protection indicators in the mining industry. Direct links to Indicator C2 – Mining forex, C5 – Namibian sourced backward multiplier
<b>UNDERLYING VARIABLES AND DEFINITIONS:</b> The indicator consists of five variables, namely, mine surplus + wages + depreciation + indirect taxes – intermediate inputs (intermediate inputs = expenditure).	<b>MEASUREMENT OF INDICATOR:</b> Data published in the Statistical Abstracts and National Accounts by the Central Bureau of Statistics. Data is thus readily available.
<b>LIMITATIONS OF THE INDICATOR:</b> There are two major shortcomings related to mine surplus and intermediate inputs. In years of high commodity prices, mine surplus is high but so is the repatriation of dividends to non-resident shareholders. Thus in good years, mining GDP over-emphasises the contribution of mining to the economy. Conversely, in bad years when the mine surplus is very low and dividends are low or passed, mining GDP under-emphasises the contribution of mining to the economy. Furthermore, intermediate inputs into the economy are often not much less in bad years than they are in good years because they are necessary to keep a mine running. This further under-emphasises the multiplier effects of mining and its contribution to the economy in bad years. In addition, in calculating GDP, only total intermediate inputs are calculated without consideration of import leakages. A very high proportion of intermediate inputs (44 %) flows directly into the Namibian economy which is not obvious from the way that GDP is calculated.	

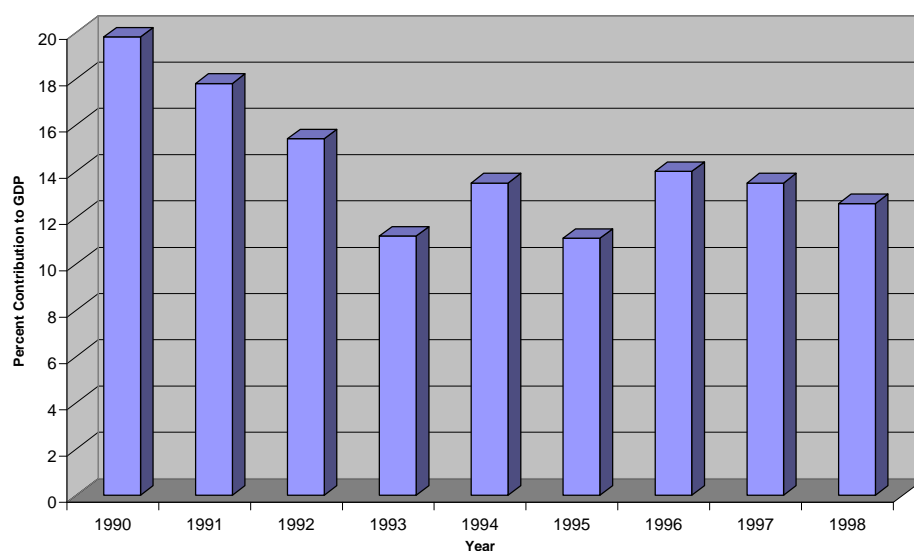
### C1.1 PAST PERFORMANCE

The contribution of mining to GDP increased from N\$ 1084 million to N\$ 1847 million (at market prices or current Namibian dollars) from 1990 to 1998, an average annual increase of less than 9%. However, its percentage contribution to total GDP decreased from 19.8% to 12.6% from 1990 to 1998 with a low of 11.1% in 1995.

**Table C1.1: Mining GDP and Mining's Contribution to total GDP, total Export Revenue and Government Revenue (N\$ million at current prices, percent of total at current prices)**

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Mining GDP, N\$ millions	1084	1104	112	851	1268	1146	1654	1785	1847
Total GDP, N\$ millions	6081	6882	8093	8630	10641	11778	13537	14987	16917
Mining forex earnings, N\$ millions	1799	1989	2106	2349	2367	2649	3344	3651	3183
Total forex earnings, N\$ millions	3157	3656	4224	4971	5608	6288	7485	7942	8875
<b>Percentage contributions to:</b>									
GDP	19.8	17.8	15.4	11.2	13.5	11.1	14.0	13.5	12.6
Total Export Revenue	57.0	54.4	49.9	47.3	42.2	42.1	44.7	46.0	35.9
Govt. revenue	17.7	10.5	5.4	7.3	9.9	8.7	6.4	6.7	

(Source: Central Bureau of Statistics, National Accounts)



**Fig. C1.1 Percentage contribution of mining in Namibia to GDP**

## **C1.2 INTERPRETATION**

An international standard for measuring the contribution of a specific sector to the total economy. The mining sector's contribution to total GDP is decreasing through reduced output, falling world commodity prices in real terms and increasing contributions from other sectors of the economy. This is also reflected in the gradual reduction of the labour force in mining. It also indirectly reflects the slow pace of exploration and the very slow rate at which new mines are brought into production to replace the falling output of old mines.

## **C1.3 DATA REQUIREMENTS**

Data is published annually by the Central Bureau of Statistics in the Planning Commission in the publication "National Accounts."

## **C1.4 CALCULATION AND FUTURE UPDATING OF THE INDICATOR**

Sector and total GDPs are calculated and published annually by the Central Bureau of Statistics. Updating will merely require reading off the relevant numbers from the above publication.

**Diversification of the economy****INDICATOR C2: OTHER MANUFACTURING/MINING FOREIGN EXCHANGE EARNINGS RATIO**

(Indicator C4 in initial list)

<b>INDICATOR NAME</b>	Other manufacturing vs mining foreign exchange earnings ratio; Indicator C2
<b>DEFINITION</b>	Annual forex earnings of manufacturing other than fish and meat processing as a proportion of mining forex earnings
<b>MEASUREMENT</b>	National Accounts, expressed as %

**SIGNIFICANCE OF INDICATOR**

<b>PURPOSE:</b> To indicate the diversification of the economy, particularly manufacturing other than fish and meat processing, away from a reliance on mining for export earnings	
<b>RELEVANCE:</b> Most useful at a national level. Allows an evaluation of whether the economy is successful in expanding export earnings from manufactured products, other than fish and meat processing, in order to supplement and eventually replace those from mining. A measure of diversification of export earnings.	<b>LINKAGE TO OTHER INDICATORS:</b> To be read in conjunction with Indicator C3 – Other manufacturing GDP vs Mining GDP. Comparison of Tables C37 and C38 indicates that the diversification that is taking place is to serve local demand only and is not directed at exports. The sharp increase in 1998 may indicate a diversification towards increased export earnings from manufacturing but will need confirmation in the years ahead. Also linked to Indicator C8 – Mining capital investment vs total capital investment
<b>UNDERLYING VARIABLES AND DEFINITIONS:</b> Indicator consists of two annual variables, mining forex earnings and forex earnings by 'other manufacturing' sector in the National Accounts	<b>MEASUREMENT OF THE INDICATOR:</b> Data published in the Statistical Abstracts and National Accounts by the Central Bureau of Statistics. Data is thus readily available.
<b>LIMITATIONS OF THE INDICATOR:</b> Namibia is far from large markets for capital goods and it may well be difficult to diversify the economy and thus export earnings into 'other manufacturing' and the country may have to rely largely on other sectors of the economy. The EPZs may significantly alter the situation however. If export earnings from mining decline, it will give a false signal of an increase in export earnings from 'other manufacturing'; the reverse also applies.	

## C2.1 PAST PERFORMANCE

The proportional contribution of other manufacturing to foreign exchange earnings has decreased from 1990 to 1997 but with a sharp increase in 1998 (Fig. C2.1).

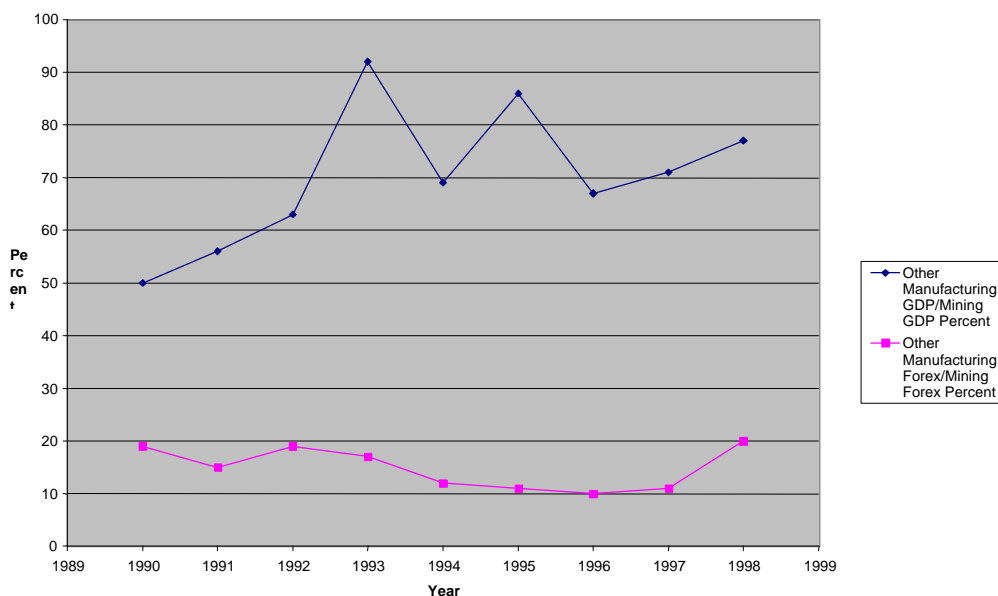


Fig. C2.1 Manufacturing/Mining GDP and Forex Ratios

## C2.2 INTERPRETATION

The ratio is intended to test whether efforts at diversifying the economy into manufacturing, other than meat and fish processing, away from a heavy dependence on mining are bearing fruit and at the same time making an increasing contribution to foreign exchange earnings. The ratio needs to be considered in conjunction with the ratio of other manufacturing GDP to mining GDP. The GDP ratio has increased from 1990 to 1998 indicating that other manufacturing has been making a greater proportional contribution to GDP (Fig. C2.1). However, the fall in the contribution of other manufacturing to foreign exchange earnings suggests that other manufacturing has increased in response to local demand but that it has not diversified into foreign markets. This trend must be of concern as it indicates that the proportional foreign exchange earnings from other manufacturing are decreasing faster than those from mining. This would suggest that other manufacturing is either not geared for export or has not been very successful in developing export markets for its products or both.

## C2.3 DATA REQUIREMENTS

Data is published annually by the Central Bureau of Statistics in the Planning Commission in the publication "National Accounts."

#### C2.4 CALCULATION AND FUTURE UPDATING OF THE INDICATOR

Sector and total foreign exchange earnings are calculated and published annually by the Central Bureau of Statistics. Updating will merely require reading off the relevant numbers from the above publication (Tables C2.1 and C2.2).

**Table C2.1: Other manufacturing GDP relative to Mining GDP** (fish and meat processing excluded) (current prices: N\$ millions)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Other manufacturing GDP <b>A</b>	543	619	698	784	880	989	1111	1260	1423
Mining GDP <b>B</b>	1084	1104	1112	851	1268	1146	1654	1785	1847
<b>A/B</b> %	50	56	63	92	69	86	67	71	77

Source: National Accounts, Central Bureau of Statistics

**Table C2.2: Other manufacturing foreign exchange earnings relative to Mining foreign exchange earnings** (fish and meat processing excluded) (current prices: N\$ millions)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Other manufacturing forex <b>A</b>	322	299	392	401	273	296	319	405	650
Mining forex <b>B</b>	1673	1989	2106	2349	2367	2649	3344	3605	3183
<b>A/B</b> %	19	15	19	17	12	11	10	11	20

Source: National Accounts, Central Bureau of Statistics

## Small Miners

**INDICATOR C3: MEMBERSHIP OF SMALL MINERS ASSOCIATION**  
(Indicator C6 in initial list)

<b>INDICATOR NAME</b>	Membership of Small Miners Association: Indicator C3
<b>DEFINITION</b>	Membership of Small Miners Association as a proportion of the total number of small miners
<b>MEASUREMENT</b>	Numbers supplied by the Small Miners Association (SMA)

**SIGNIFICANCE OF INDICATOR**

<b>PURPOSE:</b> Gives a measure of the degree of organisation and control amongst the small miners a thus an improvement in the lot of more small miners.	
<b>RELEVANCE:</b> Small miners are not well organised, largely chaotic and most small miners do not pay much heed to mining, safety and environmental laws. Marketing of most products is haphazard and opportunistic. Prices obtained are often well below international market price. SMA only markets a limited number of products on behalf of the small miners. Increasing values of the indicator should indicate better organisation of the small mining industry and possibly a consequent increase in revenue for the small miners.	<b>LINKAGE TO OTHER INDICATORS:</b> Linked to social, health and educational indicators in the Socio-economic SOER since most small miners are extremely poor.
<b>UNDERLYING VARIABLES AND DEFINITIONS:</b> Probably an erratic membership. Only 84 out of about 1 000 small miners were members of the SMA in 1998.	<b>MEASUREMENT OF THE INDICATOR:</b> Numbers supplied by the Small Miners Association (SMA)
<b>LIMITATIONS OF THE INDICATOR:</b> Very few small miners belong to the SMA or can afford the fees. No true indication of exactly how many small miners there are in total. SMA funded by donor funds and its future uncertain. Membership of SMA cannot sustain SMA on its own	

### **C3.1 PAST PERFORMANCE**

New indicator. Small Miners' Association only formed recently. Data only available for 1998 for which indicator has a value of 8.4.

### **C3.2 INTERPRETATION**

Value of 8.4 for the indicator derived from the fact that only 84 small miners out of about 1 000 were members of the Small Miners' Association in 1998. Small mining is not well organised. Organisation and the lot of the small miners could improve if more were to join the Small Miners' Association. This should lead to better marketing opportunities, better prices for products, higher incomes, better equipment, better mining, more regards for safety and the environment, and better control. Increasing membership will cause the ratio to increase.

### **C3.3 DATA REQUIREMENTS**

Membership numbers and estimated number of small miners (estimate difficult to make and probably not very reliable) have to be requested each year from the Small Miners' Association.

### **C3.4 CALCULATION AND FUTURE UPDATING OF THE INDICATOR**

Divide number of small miners that are members of the Small Miners' Association by the total number of small miners. Show result as a percentage.

**Efficiency of the Ministry of Mines and Energy; government approach to mining**  
**INDICATOR C4: PENDING MINERAL LICENCE APPLICATIONS**  
 (Indicator C11 in initial list)

<b>INDICATOR NAME</b>	Pending mineral licence applications; Indicator C4
<b>DEFINITION</b>	Total number of unprocessed applications for mineral licences
<b>MEASUREMENT</b>	Total number of unprocessed applications for mineral licences at the end of each year

**SIGNIFICANCE OF INDICATOR**

<b>PURPOSE:</b> Tests the efficiency of MME in processing applications for mineral licences, mainly exploration licences,	
<b>RELEVANCE:</b> Important to encourage investment through quick and efficient management of applications. A test of the efficiency of one link in the chain of sustainable development, efficient administration of investment that specialises in mining. <b>Persistently high numbers of unprocessed application will deter investment. Red flag indicator of inefficiencies or staff shortages in MME</b>	<b>LINKAGE TO OTHER INDICATORS:</b> Relates to indicators measuring the success of Geological Survey and MME and government in attracting investment, and the international perception of Namibia as a destination for exploration; i.e.C14 – Geological mapping, C15 – Geophysical surveying, C16 – Conference attendance, C17 – Data sales, C18 – Positive/negative events in Namibian mining industry. Relates to numbers of applications for mineral licences; C9 and C10 – Exploration activity
<b>UNDERLYING VARIABLES AND DEFINITIONS:</b> Number of applications will depend on commodity prices, interest of international exploration companies in exploring in Namibia, success of Geological Survey and MME in enticing mining investment to Namibia, international competitiveness of Namibia's mining law and tax regime. Ability of MME to process applications will depend on staff complement and their experience. High number of unprocessed applications is likely to be due to staff shortages which, in turn, is generally the result of uncompetitive salaries. Delays in processing can also be due to bad record keeping by MME, over pegging, disputes etc	<b>MEASUREMENT OF THE INDICATOR:</b> Data readily available from Mining Commissioner. Shown as a total of unprocessed applications (Table C16)
<b>LIMITATIONS OF THE INDICATOR:</b> Will unfairly reflect on MME if there is suddenly a large increase in applications since each takes time to process	

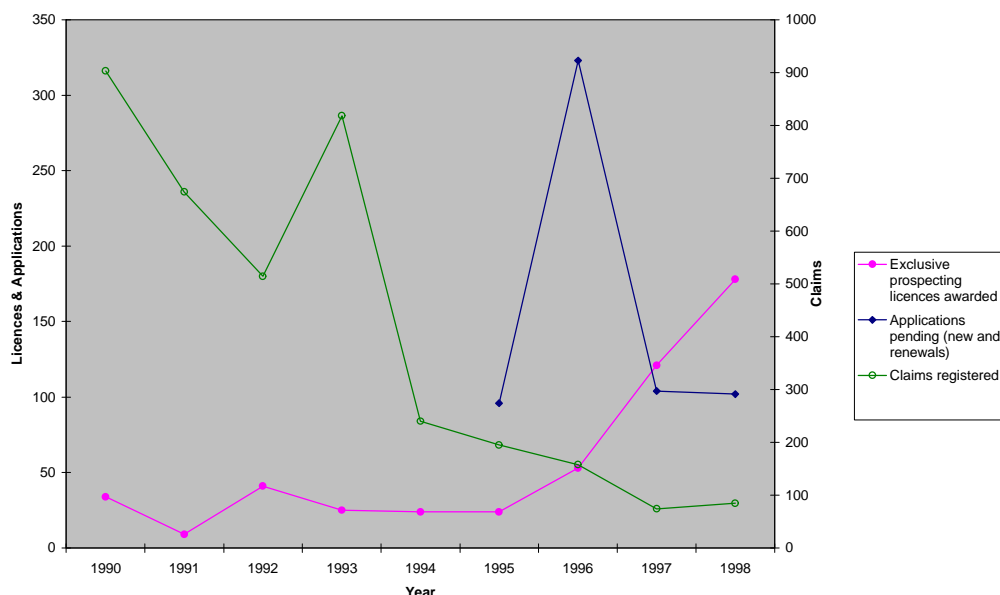
**C4.1 PAST PERFORMANCE**

Data only available since 1995. A major backlog of 323 pending applications in 1996 was eliminated by 1997 and number of pending applications for mineral licences at the end of each year appears to have stabilised at about 100 (Table C4.1, Fig. C4.1)..

**Table C4.1: Numbers of prospecting and mining licences awarded and claims registered** (see section on legislation for brief descriptions of licences and claims)

Year	Non-exclusive prospecting licences issued	Exclusive reconnaissance licences issued	Exclusive prospecting licences awarded	Claims registered	Mineral deposit retention licences issued	Mining licences issued	Applications pending (new and renewals)
1990	200	0	34	903	0	0	na
1991	303	0	9	674	0	0	na
1992	294	0	41	514	0	0	na
1993	676	0	25	818	0	0	na
1994	552	0	24	240	0	1	na
1995	404	0	24	195	0	7	96
1996	488	0	53	158	0	1	323
1997	338	0	121	74	0	5	104
1998	476	3	178	85	9	4	102

(Source: Ministry of Mines and Energy)



**Fig. C4.1: Numbers of Exclusive Prospecting Licences awarded annually, claims registered and pending applications**

#### **C4.2 INTERPRETATION**

It is essential for the investor to be able to get on with his work as fast as possible. Thus the number of pending applications should be kept to a minimum. They, nevertheless, still need to be processed. This processing requires the knowledge of experienced professional personnel in the Ministry of Mines and Energy, particularly the Mining Commissioner's office. The indicator is therefore a measure of the manpower adequacy of the Mining Commissioner's office and its ability to process applications fast enough to encourage investors to continue to explore for mineral deposits. A large backlog will be of concern to the Ministry of Mines and Energy, to Namibia's efforts to attract investors and to the investors themselves.

#### **C4.3 DATA REQUIREMENTS**

Data must be requested annually from the Mining Commissioner. Also published in the annual report of the Chamber of Mines of Namibia.

#### **C4.4 CALCULATION AND FUTURE UPDATING OF THE INDICATOR**

Shown simply as the number of pending applications for mineral licences at the end of each year.

**Effectiveness of the Geological Survey**  
**INDICATOR C5: GEOLOGICAL MAPPING**  
 (Indicator C14 in initial list)

<b>INDICATOR NAME</b>	Geological mapping; Indicator C5
<b>DEFINITION</b>	Total number of 1:50 000 geological sheets mapped each year vs total 1:50 000 sheets covering mappable geology
<b>MEASUREMENT</b>	Count number of 1:50 000 geological sheets mapped each year

**SIGNIFICANCE OF INDICATOR**

<b>PURPOSE:</b> To test whether the Geological Survey has adequate staff and budget to carry out one of its prime line functions – mapping and providing the investor with data	
<b>RELEVANCE:</b> Gives a measure of the relative amount of a specific type of new geological data being made available to the investor and whether the Geological Survey is successfully carrying out one of its prime line functions essential for the promotion of investment in mining. Exploration is high risk with no guarantee of success. Geological and geophysical data are the only guide the explorationist/investor has when exploring for mineral deposits. This data is therefore critical to success in mineral exploration. The more data that is available, the greater will be the interest and investment from the international mining community. New/additional geological maps should be published on a regular basis to encourage investment.	<b>LINKAGE TO OTHER INDICATORS:</b> Relates to indicators measuring the success of Geological Survey and MME and government in attracting investment, and the international perception of Namibia as a destination for exploration; i.e.C11 – Pending mineral licence applications, C18 – Negative/positive events in the Namibian mining industry, C12 – Processing of work permits, C15 – Geophysical surveying, C16 – Conference attendance, C17 – Data sales, C18 – Positive/negative events in Namibian mining industry. Relates to numbers of applications for mineral licences; C9 and C10 – Exploration activity
<b>UNDERLYING VARIABLES AND DEFINITIONS:</b> Dependant on adequate budget and staff with the right qualifications and experience (highly technical). As long as maps continue to be published, the ratio for this indicator should increase. A static ratio will be a cause for concern needing investigation and remedying – normally uncompetitive salaries and shortages of professional and technical staff. With adequate staff at least 10 or more sheets should be mapped each year depending on the complexity of the geology. If staff numbers adequate but simply do not map, ratio will also be low. <b>Good achievement indicator – red flag if ratio low which it is at present.</b>	<b>MEASUREMENT OF THE INDICATOR:</b> Count number of 1:50 000 geological sheets mapped each year by Geological Survey. Calculated as a percentage.
<b>LIMITATIONS OF THE INDICATOR:</b> Cause of a low ratio not obvious from the indicator ratio. Cause needs to be determined and remedied, staff shortages, uncompetitive salaries, staff not prepared to do feold mapping, inadequate budget.	

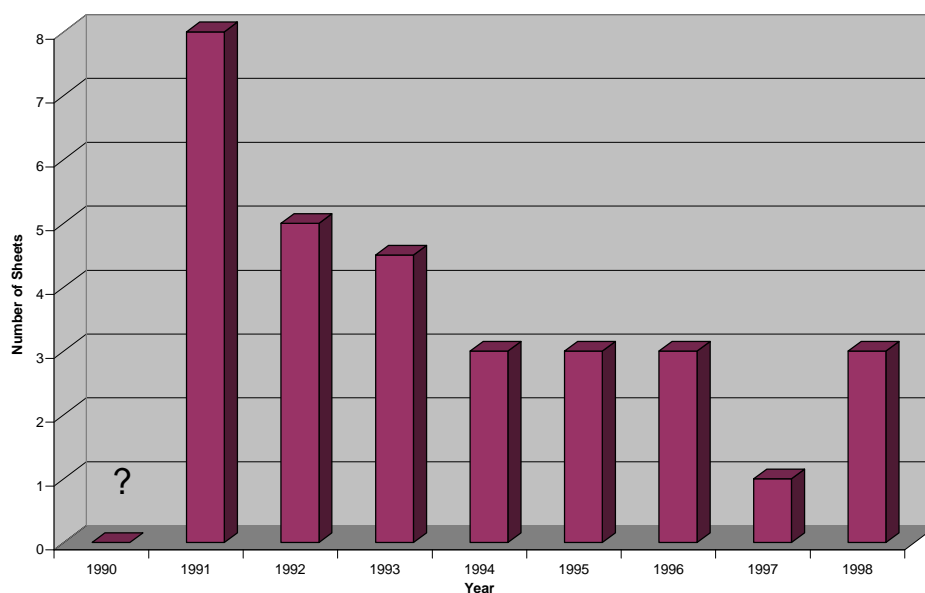
### C5.1 PAST PERFORMANCE

Total number of 1:50 000 geological sheets mapped per annum has decreased from 8 in 1991 to 3 in 1998.

**Table C5.1: Total number of 1:50 000 geological sheets mapped per annum**

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Number of sheets mapped (A)	?	8	5	4.5	3	3	3	1	3
Total number of mappable sheets (B)	930	930	930	930	930	930	930	930	930
A/B %		0.86	0.54	0.48	0.32	0.32	0.32	0.1	0.32

(Source: Geological Survey)



**Fig. C5.1: Total number of 1:50 000 geological sheets mapped by the Geological Survey per annum**

### C5.2 INTERPRETATION

To find mineral deposits, the exploration geologist needs as much geological and geophysical data as possible to ensure success. Geological Surveys the world over carry out geological and geophysical mapping to support effective exploration for and use of geological resources. In a country such as Namibia where large areas still need to be mapped in detail, such mapping is one of the prime functions of a Geological Survey. High-resolution geophysical surveys are an extremely powerful exploration tool and a major encouragement to international mining companies.

The indicator is designed to test whether the Geological Survey is functioning successfully and producing sufficient new maps each year. Mapping projects can last up to four years so progress is slow, particularly when there are inadequate staff to carry out the mapping, or staff are simply not mapping.

The indicator is very low for a Geological Survey of a country the size of Namibia. The primary reason for this is a lack of sufficient staff. The staff shortage is due to various reasons; inadequate salaries, competition with the mining industry for a limited supply of geologists, budget limitations, difficulty in obtaining work permits for foreigners, limitation of initial contracts to two years, reluctance of the government to employ foreigners or Namibians above the age of 60, too few Namibians qualifying as geologists. There are probably other reasons.

### **C5.3 DATA REQUIREMENTS**

Data supplied annually by the Geological Survey.

### **C5.4 CALCULATION AND FUTURE UPDATING OF THE INDICATOR**

Simply take the number of sheets mapped each year.

## Environmental

**INDICATOR C6: ANNUAL NUMBER OF MODIFICATIONS TO ENVIRONMENTAL MANAGEMENT PLANS WHICH RESULT IN REDUCED IMPACTS ON THE ENVIRONMENT**  
(Modification of Indicator C29 in initial list)

<b>INDICATOR NAME</b>	Annual number of modifications to environmental management plans which result in reduced impacts on the environment: Indicator C6
<b>DEFINITION</b>	Annual number of modifications to environmental management plans which result in reduced impacts on the environment
<b>MEASUREMENT</b>	Count up the annual number of modifications to environmental management plans which result in reduced impacts on the environment

## SIGNIFICANCE OF INDICATOR

<b>PURPOSE:</b> To test whether Environmental Management Plans are being regularly audited and whether the recommendations of the audits are incorporated into the EMP and applied to mining operations so as to further reduce the impacts of mining on the environment	
<b>RELEVANCE:</b> Useful at both national and individual mine levels. EMPs are not static documents and companies need to continuously strive to further reduce their impacts on the environment. Regular auditing of EMPs ensures outside evaluation by specialists and recommendations for reducing impacts. This process of continuously striving to reduce impacts will thus be similar to the process used by the International Standards Organisation for its ISO ratings.	<b>LINKAGE TO OTHER INDICATORS:</b> Linked to all the potential environmental indicators listed in Table C36, namely, Indicators C24 to C28 and C30 to C33. Linked to C7 and C8a and b below. Also linked to financial indicators since there must be sufficient funds to finance environmental management of operations (in some large international companies, costs of environmental management are approaching 20% of revenues).
<b>UNDERLYING VARIABLES AND DEFINITIONS:</b> Dependant on mines having and working according to EMPs. Requires regular auditing of the EMP and the performance of the company in working according to the EMP as well as auditing of the response of the company to recommendations in previous audits. Requires an independent environmental audit (could be parent company specialist not based on the mine). Requires submission of audit reports and reports on the company's response to the audit to be submitted to MME and MET.	<b>MEASUREMENT OF THE INDICATOR:</b> Count up the annual number of modifications to EMPs that resulted in a reduced impact on the environment. This number would be the indicator.

**LIMITATIONS OF THE INDICATOR:** companies may not carry out audits of their EMPs regularly enough. What the frequency of auditing should be is still to be determined. Companies may not respond to recommendations in the audit. Recommendations in the audit may be impractical. As time progresses, the impact-reducing actions will gradually all have been identified and implemented and the indicator will reduce to zero. A zero rating on a mine that has striven hard to reduce its impacts will need to be clearly distinguished from a zero rating on a mine that is not trying to reduce its impacts.

#### **C6.1 PAST PERFORMANCE**

New indicator. There is no historical data for this indicator since mines have only recently developed Environmental Management Plans (EMPs) and auditing thereof has not yet started on a regular basis. Since this is a new indicator, its form may need to be modified to clearly demonstrate whether the EMPs are effective, whether they are being effectively applied and/or whether auditing of the plans leads to regular modification and improvement and ultimately to actions that reduce environmental impacts – something along the lines required for ISO ratings. It could be applied to the mining industry as a whole as well as to individual mines.

#### **C6.2 INTERPRETATION**

The indicator would evolve through the regular auditing and company analysis of the effectiveness of EMPs. Auditing ought to reveal where an EMP is ineffective or could be improved. The indicator would then record the application of the proposed improvements. It would therefore be a dynamic indicator. Companies paying only lip service to an EMP would be very unlikely to make much effort to consider ways and means of reducing their environmental impacts. Thus, their EMPs would be unlikely to improve very much over time and the number of times that they modified their operating procedures to reduce environmental impacts would be very limited. In their case, the indicator would be likely to remain static at zero in which case it would be flagged in red. Initially it would be expected that the EMPs would be improved from time to time, operations modified and reduced impacts effected. However, as the EMP continued to improve, so further improvement may become more and more difficult. This would result in a falling value for the index which would not be due to lack of effort or intent but simply due to the fact that not further improvements can be made.

#### **C6.3 DATA REQUIREMENTS**

Companies would have to provide MME and MET with the audit reports of their EMPs and with reports on their response to recommendations in the audit reports and the results of that response.

#### **C6.4 CALCULATION AND FUTURE UPDATING OF THE INDICATOR**

On the basis of the reports submitted in C6.3 above, MET have to count up the annual number of modifications to EMPs that resulted in a reduced impact on the environment. This number would be the indicator.

**Environmental****INDICATOR C7: ENVIRONMENTAL CONTRACT COMPLIANCE**

(Indicator C31 in initial list)

<b>INDICATOR NAME</b>	Environmental contract compliance: Indicator C7
<b>DEFINITION</b>	Proportion of lapsed Exclusive Prospecting Licences (EPLs) that have complied with their environmental contracts relative to the total number of lapsed EPLs
<b>MEASUREMENT</b>	Proportion of lapsed Exclusive Prospecting Licences (EPLs) that have complied with their environmental contracts relative to the total number of lapsed EPLs, %

**SIGNIFICANCE OF INDICATOR**

<b>PURPOSE:</b> To test the compliance of the exploration companies with their environmental contracts and the ability of the Ministry of Environment and Tourism (MET) to verify in the field that environmental contracts have been complied with	
<b>RELEVANCE:</b> Useful at national level. If there are going to be environmental contracts, they must be complied with and they must be seen to be complied with. MET needs adequate staff to be able to carry out field inspections on a regular basis and police compliance.	<b>LINKAGE TO OTHER INDICATORS:</b> Linked to training and environmental awareness indicators. Also: C24 – Proportion of mines with EMPs, C25 – Proportion of mines with environmental staff, C26 - Proportion of mines with rehabilitation plans, C27 – Proportion of mines that conducted EIAs, C28 – Proportion of mines contributing to some form of rehabilitation fund, C29 – regularity of environmental auditing, C30 – Proportion of EPLs with environmental contracts, C32 – annual expenditure on environmental management
<b>UNDERLYING VARIABLES AND DEFINITIONS:</b> Variable levels of environmental awareness of mining company staff and various levels of willingness to limit and rehabilitate environmental damage. Lack of understanding of how to limit environmental damage or even that environmental damage is being caused. Staff shortages in companies and government.	<b>MEASUREMENT OF THE INDICATOR:</b> Proportion of lapsed Exclusive Prospecting Licences (EPLs) that have complied with their environmental contracts relative to the total number of lapsed EPLs, %
<b>LIMITATIONS OF THE INDICATOR:</b> Assessment of compliance is subjective, apparently severe damage may recover naturally in a relatively short space of time and not easy to assess this, may be difficult to inspect all lapsed EPLs because of limited staff, time and funds, EPLs can cover large areas and unrepaired damage may not be found during an inspection	

### **C7.1 PAST PERFORMANCE**

This is a new indicator. There is no historical data at present since the requirement that companies which are issued with exclusive prospecting licences or that register claims complete and comply with an environmental contract was only introduced in 1998.

### **C7.2 INTERPRETATION**

Environmental contracts are of no value if they are not complied with. They need policing to ensure they are complied with. This will mean physical inspecting in the field the areas that were covered by lapsed licences or claims. Ideally, the indicator would be the proportion of lapsed claims or exclusive prospecting licences that have complied with their environmental contracts against the total number of lapsed claims and exclusive prospecting licences. However, it will be impossible for the DEA to inspect all such lapsed claims and licences areas. Therefore, it is more practical to develop the indicator only in relation to the number of lapsed claims and exclusive prospecting licence areas that the DEA has been able to inspect in the field each year. Thus the indicator would then be the proportion of lapsed claims or exclusive prospecting licences that have been inspected each year in the field that have complied with their environmental contracts against the total number of lapsed claims and exclusive prospecting licence areas inspected in that same year. If compliance is low, the indicator will be low. If compliance is high, the indicator will be high. A low indicator will be a cause for concern and will point to the need for action to ensure compliance with environmental contracts.

### **C7.3 DATA REQUIREMENTS**

The DEA records all the claims and exclusive prospecting licences with environmental contracts. In 1999, the DEA carried out spot checks on certain licence and claim areas. Annual checking on a routine basis of a selection of recently lapsed claim and licence areas will generate the data for the indicator.

### **C7.4 CALCULATION AND FUTURE UPDATING OF THE INDICATOR**

Divide the number of lapsed claims or exclusive prospecting licences that have been inspected each year in the field that have complied with their environmental contracts by the total number of lapsed claims and exclusive prospecting licence areas inspected in that same year. Annual checking on a routine basis of a selection of recently lapsed claim and licence areas will generate the data for the indicator. Since DEA keeps all the records of environmental contracts and is largely the authority deciding on whether compliance is adequate or not, the DEA should carry out the annual inspections of a selection of recently lapsed areas.

## Health and safety

### INDICATOR C8a and b: FREQUENCY AND SEVERITY OF MINE ACCIDENTS (Indicator C33 in initial list)

<b>INDICATOR NAME</b>	Frequency and severity of mine accidents: Indicator C8a and b
<b>DEFINITION</b>	Frequency: Number of accidents/200,000 employee hours worked Severity: Number of shifts lost/200,000 employee hours worked
<b>MEASUREMENT</b>	Obtain annual frequency and severity statistics from Annual Report of the Chamber of Mines of Namibia

#### SIGNIFICANCE OF INDICATOR

<b>PURPOSE:</b> To obtain a measure of the levels of safety achieved in the mines and the efforts taken to improve safety and to develop an awareness safety requirements and the need to develop a culture of safety consciousness.	
<b>RELEVANCE:</b> Useful at both national and individual mine levels. Will highlight a deterioration in safety levels which could be traceable back to an individual mine via reports to MME.	<b>LINKAGE TO OTHER INDICATORS:</b> Links to indicators C21 (total employees) and C23 (contributions to staff welfare funds) in the list of potential indicators in Table C35. Links also to indicators C6 above (auditing of EMPs) since the human element and safety are important aspects of the environment.
<b>UNDERLYING VARIABLES AND DEFINITIONS:</b> Various types of mines, some open pit, some underground, some submarine, some not requiring large-scale excavations (e.g. salt). Vastly differing rock conditions on different mines. Marine mining having to contend with the weather and sea state and using divers. Different types of processing plants and metallurgical chemicals. Vast amount of training needed on use and operation of machinery and equipment. Regular training and refresher courses needed on safety and safety awareness. Varying degrees of adherence to safety regulations by different individuals.	<b>MEASUREMENT OF THE INDICATOR:</b> No calculation is needed. The data merely needs to be copied from the Annual Reports of the Chamber of Mines of Namibia.
<b>LIMITATIONS OF THE INDICATOR:</b> Cannot be used to prevent accidents or to develop safety awareness. Merely indicates the frequency and severity of accidents and thus is a general historical indicator.	

### C8.1 PAST PERFORMANCE

Although the Chamber of Mines has been reporting accident statistics in its annual report for many years, data has only been reported in the present form since 1995. Over the long term, accidents have reduced in number due to better training and awareness. As can be seen from the number of NOSA 5-star and NOSCAR awards and the statistics in Table C8.1, the frequency and severity rates are generally low. The severity rate, as measured by the number of shifts lost per 200 000 employee hours worked, was lowest in 1996. Fatalities and a higher number of accidents in the other years increased the severity rate.

**Table C8.1: Accident statistics on mines run by members companies of the Chamber of Mines of Namibia**

	1995	1996	1997	1998
Number of accidents	66	53	69	52
Fatalities	6	0	1	1
Shifts lost per accident	21.75	21.66	113.30	147.50
Frequency rate <sup>1</sup>	0.59	0.51	0.67	0.62
Severity rate <sup>2</sup>	360.10	11.08	75.13	91.54

(Source: Chamber of Mines Annual Reports)

<sup>1</sup>: Number of accidents/200 000 employee hours worked

<sup>2</sup>: Number of shifts lost/200 000 employee hours worked

### C8.2 INTERPRETATION

Low numbers for the frequency and severity rates indicate a low number of accidents and should therefore also give an indication of the success of safety training and the safety awareness displayed by all mine employees while on site.

### C8.3 DATA REQUIREMENTS

The data in Table C8.1 is given in the Annual Report of the Chamber of Mines of Namibia.

### C8.4 CALCULATION AND FUTURE UPDATING OF THE INDICATOR

No calculation is needed. The data merely needs to be copied from the Annual Reports of the Chamber of Mines of Namibia.