Development of a Method for the Tracking of Environmental Sustainability at Solid Energy
(Tools For Managing Sustainability)

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Background

Solid Energy is the largest coal producing company in New Zealand, employing 500 people and more than 250 mining contract personnel. The coal produced by Solid Energy plays a significant part in the energy mix for New Zealand being supplied to the coal-fired power station at Huntly. It is also supplied to a wide range of industrial users, NZ Steel, and primary processing.

It is fair to say however that the positive economic and social benefits of coal have to some extent been overshadowed by the negative environmental consequences of coal mining.

Over the past two years Solid Energy have been actively researching and addressing the impacts that they currently have on the environment and making a significant investment in environmental improvements, rehabilitation projects and environmental research to address historical and ongoing environmental issues. These investments have been driven by the company's commitment to its environmental policy, which states:

"*Solid Energy's overall environmental objective is for the cumulative result of all the activities we undertake to have a positive net effect on the New Zealand environment*"

With such significant investment it is essential that the company is able to target expenditure wisely, i.e. invest where there is greatest environmental gain to be had, and are also able to actively demonstrate to stakeholders the improvements that are achieved.

In order to be able to demonstrate the commitment and the steps that the company is making towards this goal a number of systems have been developed.

- Firstly an environmental management system along the lines of ISO14001 formalising the environmental processes, responsibilities, auditing and management review.
- Secondly as part of the planning element of the EMS an environmental management matrix, which allows the scoring of sites against environmental management goals, has been developed.
- Thirdly the monitoring and measuring tools have been upgraded with GIS driven relational databases installed for management of consent related information and monitoring results.

The development of the environmental management matrix has drawn on a number of existing systems such as the Australian Institute of Mining and Minerals Code 2000. In addition to adapting the scoring regimes from these methods the Solid Energy Environmental Matrix has

been further developed to ensure that it reflects the actual environmental impacts on site, as well as the management and audit systems that are in place to control them at a strategic level.

The development of this matrix has included a number of steps:

- Reviewing the information that stakeholders would be interested in
- Reviewing what was already available
- Development of systems to collect data and benchmark the current operations
- Setting up support systems to ensure that the correct information would be provided for scoring
- Development of a methodology for scoring and weighting
- Internal and external methodology reviews
- Internal training
- Internal scoring of individual sites
- External audit of scoring

This paper describes these steps and the management of the implementation of the scoring methodology.

Aims of the Matrix, and Benefits

The main aim of the matrix is to provide a robust method to demonstrate the outcomes of environmental management practice, guide future investment in this area in order to continuously improve environmental management practice, and measure positive or negative differences in environmental impacts on an annual basis.

The development of the matrix was undertaken in the knowledge that there are a wide range of parties with an interest in the progress of environmental management at Solid Energy sites, and as such a further aim was to try and satisfy their interest and requirements. The main stakeholders for the matrix include:

- SENZ Staff & Management Team
- SENZ Board
- Territorial Authorities
- Local Communities
- Other NGO's etc.

There are a number of benefits that have arisen from developing the Matrix, in particular the raising of site staff awareness of the performance indicators in this area, and in centralising the information on site environmental performance.

The matrix and scoring system have been subjected to a series of third party reviews, looking at various aspects of the method and scores and the recommendations and comments from these reviewers have been of great benefit in refining the method and providing ideas for its future development.

Matrix Process

Figure 1 illustrates the basic process behind the development of the EMM.

This figure shows the development process as linear, whereas in reality there have been a number of iterations, built upon through engagement with internal SENZ stakeholders. It is hoped that this has led to a thorough assessment of the environmental effects at the mines, their relative importance and the scores that each site should receive for the inaugural year of the EMM.

The first year for which data has been collected is 2002-2003, and the process will be repeated for the 2003-2004, the results from which will be presented in the SENZ annual report. The process will be ongoing on an annual basis, building up over time a significant database of information regarding the progress of environmental management at the sites.

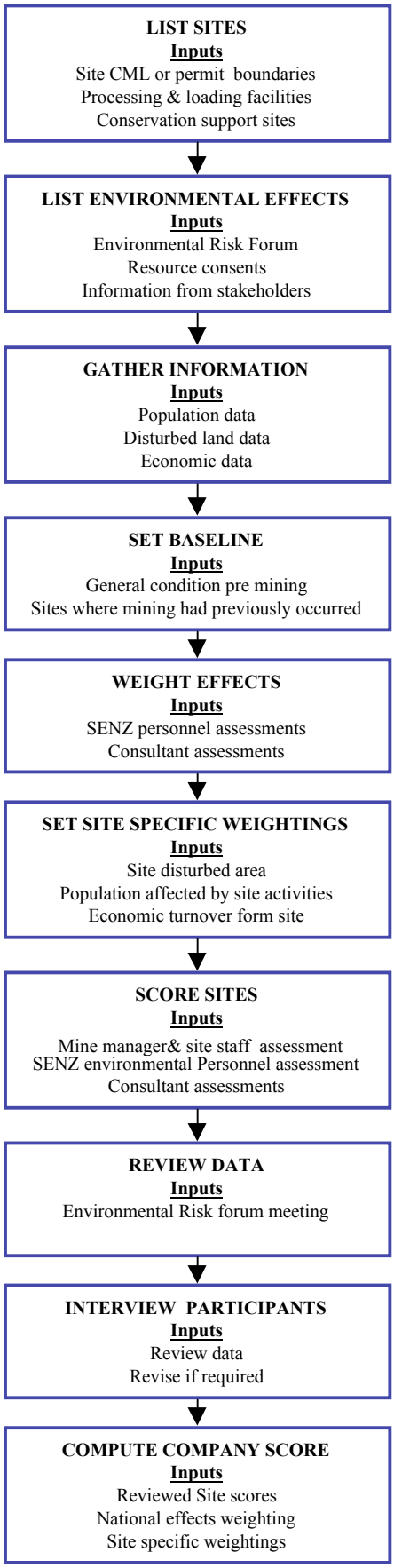
What to Measure? - Defining Effects

Solid Energy sought environmental performance measures to reflect the outcomes of management practices (generally lagging factors) rather than leading factors such as EMS practice, auditing and staff training. This reflects the practical nature of site personnel, public perception, stakeholder priorities and also the effects based regulatory regime.

The list below are the effects that are currently being measured within the matrix, for all of the SENZ sites, including active and inactive mines, load out facilities and sites where mitigation or community projects are being implemented.

- Visual Appearance (landforms, landscaping)
- Habitat Impacts
- Public Access and Resource
- Infrastructure (buildings, utilities, roadways and machinery)
- Subsidence and stability
- SponCom / Coal Fires (underground, opencast or stockpiles)
- Land Contamination / 'Hazardous' Wastes
- Waste Minimisation
- Greenhouse Gas Emissions (predominantly depend on energy use and methane)
- Water Impacts
- Air / Dust Impacts
- Noise Impacts

Figure 1 - EMM Process



- Light Impacts
- Blasting impacts (vibration)
- Formal Aspects (consents and incident reporting)
- Weed and pest control

Scoring

Sites are scored between 0 and 200 on their performance in each area listed above. The general philosophy is that the typical scoring range is 0-100. The 100 standard represents a neutral condition – one whereby there are no adverse impacts or where the conditions are unchanged from baseline conditions.

The result of this is that scoring 100 is impossible for many of the effects on most operating mine sites. Typically a reasonable target will be between 60-100.

'Best practise' was considered as a standard to score 100, however was not preferred because this still involves impacts on the environment and these impacts should be acknowledged. Furthermore best practise is in reality limited by business economics and technology available at the time, both of which change with time, thus limiting the usefulness for a measurement tool intended to have a long life.

Where rehabilitation effort or off site mitigation works are being undertaken that improve the environmental values to above the baseline condition (generally the pre mining, or pre acquisition state), scores above 100 may be obtained.

An illustration is given below of the guidelines that have been developed to assist people with scoring.

Score	Habitat Impacts – Scoring Guideline
0	Indigenous and / or rare habitats are destroyed or damaged such that repair to its previous state is unlikely within 5 years. Usual for open cast mines in ecologically sensitive areas.
60	Local habitat (ecological or agricultural) are destroyed or damaged such that repair to its previous state is unlikely within 5 years. Usual at opencast mines in agricultural areas
100	No, or limited, change to local habitat (usually at low impact underground mines) or at sites where the pre-mining condition had no significant habitat values
120	Offsite habitat creation projects for locally common habitat undertaken on sites with no current habitat values, or existing common habitats are enhanced to become rare or highly valued, (pest control projects) or onsite locally common habitat is created that exceeds the pre-mining condition
200	Offsite habitat creation or protection projects are undertaken for nationally rare or locally rare habitats, on sites with no current habitat values. (Could be native forest planting in abandoned mining or agricultural areas)

National Effects Weightings

The matrix contains a wide range of environmental effects encompassing more "obvious" mining impacts such as habitat destruction and water pollution, but also less high profile impacts such as the production of waste, and high profile but difficult to see impacts such as the production of greenhouse gases.

It was felt by the development team that when considering SENZ's environmental impacts some effects were more damaging (both to the environment and the companies reputation) than others. For this reason each of the effects has a weighting applied to it, which, it is hoped, reflects the importance of the effects both for environmental health and for the requirements of our stakeholders.

A group of people from Solid Energy, and external consultants, has ranked the importance of the effects in order compute with these weightings. These rankings were then averaged within the group and a relative number attached to each such that the total of all the weightings adds up to 1. Hence each effect is given a "percentage importance" as a National Weighting.

Site Specific Weightings

The SENZ sites are highly variable in a number of factors that affect the significance of their environmental impacts, notably:

- Their physical size (area impacted by mining), known in the matrix as "disturbed area"
- Their economic size (coal produced), known as "coal produced"
- The size and proximity of the local resident population, know as "population affected"

In order to reflect these differences in the overall company score a weighting system was devised that multiplies the score given by a factor that is dependent on one of these variables.

Which variable is appropriate to use as a weighting is dependent on the environmental effect in question. The variables chosen are as follows:

Figure 2 – Site Specific Weighting Variables

Visual Impacts	POPULATION AFFECTED
Habitat Impacts	LAND DISTURBED
Public Access and Resource	POPULATION AFFECTED
Redundant Infrastructure	COAL PRODUCED
Subsidence and stability	LAND DISTURBED
SponCom / Coal Fires	LAND DISTURBED
Land Contamination	LAND DISTURBED
Solid Waste Minimisation	COAL PRODUCED
Greenhouse Gas Emissions	COAL PRODUCED
Water Impacts	LAND DISTURBED
Air / Dust Impacts	POPULATION AFFECTED
Noise Impacts	POPULATION AFFECTED
Light Impacts	POPULATION AFFECTED
Blasting impacts	POPULATION AFFECTED
Formal Aspects	LAND DISTURBED
Weed and Pest Control	LAND DISTURBED

The site-specific weighting is computed as the site contribution (in each of the variables), as a percentage of the total for the company, as per the example below:

Table 1 – Site Weighting Example

	Site	SENZ Total	Weighting Factor
Land disturbed (hectares)	467	3,761	0.12
Population Affected	662	31,583	0.02
Coal Produced	1,574,855	4,093,922	0.38

Scoring the Sites

Scores have been gathered from a range of people including:

- Mine manager and other technical or environmental people at the site
- Area / National environmental managers
- Technical environmental personnel
- Relevant third party consultants with a good working knowledge of the site

Sites have generally been scored by between 4 and 8 individuals, and these scores averaged to get a single score for each effect for each site.

Calculation of Results

The final outcome for each site is that a score is computed for each environmental effect, as illustrated in Figure 3 below

Figure 3 – Example of Weighted Scores

	Site "X"
Visual Impacts	0.21
Habitat Impacts	0.07
Public Access and Resource	0.12
Redundant Infrastructure	0.05
Subsidence and stability	0.06
SponCom / Coal Fires	0.06
Land Contamination	0.02
Solid Waste Minimisation	0.00
Greenhouse Gas Emissions	0.00
Water Impacts	0.08
Air / Dust Impacts	0.19
Noise Impacts	0.19
Light Impacts	0.14
Blasting impacts	0.28
Formal Aspects	0.04
Weed and Pest Control	0.04

These scores are computed in the following way:

Average Site Score for the Effect	X	National Weighting for the effect	X	Site Specific Weighting for the effect

These scores are then aggregated to get a site score, and site scores aggregated to get a company score.

Population Data and Areas affected

The population data has been sourced from Statistics New Zealand 2001 Census data – 'Usually Resident Population Count' as at Census night (6 March 2001).

All topomaps used to establish the area within which the affected population lives were taken from MapWorld TopoMap NZ V2.0.61 mostly from the LINZ 1:500,000 topomap series. The geographic extent of population affected was choosen on a site by site basis, with consideration of major roadways, topography and peoples realistic 'exposure' to the site, either visually or by assessment of impacts, and with consideration of local community interest and reporting. In most cases the extent of population affected was within approximately 7km of the site, however this does vary significantly. We were also constrained by the irregular shapes and in many cases large size of the meshblocks that are covered by the smallest resolution of the census data.

Disturbed Land Areas

Disturbed land area boundaries have been determined through examination of aerial photography, which has been scaled and entered into the SENZ GIS system. The coverage of sites by high quality aerial photography has been ongoing over the 2003-2004 period resulting in an excellent baseline record.

Disturbed areas have been defined as:

- Open cast cuts
- Unrehabilitated waste stockpiles/dumps
- Coal stockpiles
- Coal processing area
- Buildings & other infrastructure
- Mine access and haul roads

These areas have been marked on aerial photographs and measured using ArcView GIS.

Economic Measures

The figures for tonnes of coal produced per mine are supplied by the SENZ financial team. For sites which do not produce coal directly, SENZ have adopted a weighting factor which equates dollars of operating costs to tonnes of coal produced.

Future Development of the Matrix and Scoring Process

As only the first year of data has been collected the comparative aspects of the matrix have yet to be fully tested. A major issue for the credibility and repeatability of the survey and scores is that the individuals scoring the sites understand the requirements and the standards sufficiently well that the scores are valid comparisons. The survey subject is inherently complex, requiring individuals to consider complex abstract concepts across long time scales such as "*What would X site be like today if there had not been any Solid Energy mining since 50+ years ago?*". This is difficult and quite unusual for most people. Some of this assessment requires knowledge of history that is frequently not well known by individuals.

Steps are going to be taken to improve and widen the definitions, and include visual aids and examples for following years in order to assist the people scoring sites, and increase comparability.

A further area that is being investigated is how best to get and incorporate feedback from internal and external stakeholders into the process in the hope that it will increase the usability and credibility of the published information.