# Assessment of Noise from CSG Pipeline Construction

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## ABSTRACT

The noise emissions from construction of gas and water pipelines is of interest to both government and individuals living nearby to the numerous coal seam gas (CSG) activities throughout Australia and particularly central Queensland. The construction of pipelines involves several crews working simultaneously on different activities and with different rates of progress in terms of kilometres completed per day. The noise emitted from each of these activities, from earthworks and trenching to welding are of significant interest as is the interaction between these activities, resulting in a potentially significant number of residences being affected, depending on the noise criteria. The typical activities associated with the construction of high pressure gas pipelines as well as gathering networks will be discussed along with the difficulties in modelling of these activities and determination of compliance with relevant noise criteria.

## INTRODUCTION

Throughout Australia and particularly central Queensland, the extraction of natural resources is continuing at a prodigeous rate. Recently, infrastructure devoted to the extraction of coal seam gas (CSG) is being rolled out at a frantic pace in order to cash in on the demand using readily accessable resources. In order to transport this extracted gas and water from the gas wells to treatment and compression facilities, significant amounts of gas and water pipelines are required. The noise associated with the construction of these pipelines is of considerable interest to the companies installing them, the regulatory bodies issueing environmental approvals for them and residences nearby to the proposed pipeline routes.

## TYPES OF PIPELINES

Several types of pipelines are associated with CSG activities: water pipes, high pressure (HP) gas pipelines (which are similar in construction to water pipelines) and low pressure gas pipelines.

High pressure pipelines are typically constructed using steel piping, requiring welding between each section of pipe. These types of pipelines are often referred to as sales gas pipelines as the gas under high pressure would travel through these pipelines from the area that is described as “upstream” (where the gas is extracted from the coal seams and compressed), to the “midstream” area where it might be refined, to the “downstream” area, where the gas is sold or exported.

Low pressure pipelines are used in the gathering network between CSG wellheads to a gas compression facility. These pipes are typically constructed of high density polyethene (HDPE) which can be installed into the ground from a roll of pipe. From the gas compression facility, a higher pressure pipeline may be used, though this may also be constructed of the same material.

The gathering pipeline has a significantly lower impact, due to the use of HDPE pipe, which can be layed out into a shallower trench from a roll of piping, requiring significantly less use of equipment for trenching, back-filling and welding. Instead, this type of pipeline construction includes a pipe-laying plough in combination with equipment for heat-welding the poly-pipe when joins are required.

## PIPELINE ACTIVITIES

The following activities are carried out consecutively during construction of the high pressure pipeline:

1. Survey, fencing and set up of temporary facilities;
2. Clear and grade of the right of way;
3. Blasting if required (including preparation);
4. Trenching, pipe stringing and bending;
5. Pipe welding and joint coating;
6. Non-Destructive Testing (NDT) inspection;
7. Backfilling and compaction;
8. Tie-ins, push sections and road crossing; and
9. Hydro-testing and rehabilitation.

This suite of activities is referred to as a spread.

For conventional pipeline laying (land clearing, trench digging and pipe placement) each crew works at the rate of between 1km and 4km per day depending on the terrain and size of pipe to be installed (e.g. if there are more trees, or the ground is very rocky, progress may be slower than otherwise). To enable the crews to work safely and efficiently there is often a delay between the arrival dates of each crew. Typically it will take up to 12 weeks for all the crews to pass through an area and complete their tasks. For a gathering pipeline, it would take less than 4 weeks for all crews to pass through an area.

Blasting may be required in areas of rock which cannot be removed by mechanical plant items.

## CONSTRUCTION SCHEDULING AND IMPLICATIONS

Typically pipeline construction occurs between 6:30 am and 6:30 pm, seven days per week, potentially starting and finishing with activities with negligible noise emissions such as toolbox meetings.

In Queensland (where the author calls home) this essentially means that there are not any significant day-time noise limits, with the exception of Sunday, due to the Section 440 of the Queensland Environmental Protection Act 1994. So what noise criteria are applicable? Are these criteria useable and able to be predicted?

Though there are no noise limits required during the day period from Monday to Saturday, it is highly recommended that the pipeline builder consult with the residents affected by the pipeline construction to provide a timeframe as to when the building activities will be completed as well as to provide a level of involvement in the process. To determine the residents which should be contacted requires noise criteria, indicating the level above which the residents' amenity is affected. A level of 55dBA $L_{Aeq,\ adj,\ 1hr}$ is suggested by the author for initial involvement where externally, speech intelligibility may begin to be adversely affected. A higher level of 65dBA $L_{Aeq,\ adj,\ 1hr}$ is suggested as a higher threshold above which a greater level of interaction and communication is recommended with the receptor, potentially arranging for alternate accommodation for the duration of the above-threshold works, dependant on the number of receptors affected and the anticipated noise levels.

## DIFFICULTIES WITH NOISE PREDICTIONS

Pipeline construction is by its nature transient, whereby construction teams completing specific activities move along the route, completing one aspect of construction (for example, clearing vegetation), prior to another team subsequently coming through and performing another activity (for example the removal of topsoil and excavation).

Variable distances between sources, even between consecutive days, results in significant complexity in determining the average noise level at any significant distance from the pipeline activities. The maximum noise level experienced at distances can relatively easily be calculated and tabulated, including the maximum noise level at each residence near to the pipeline easement for each stage of activity for the pipeline. The adjusted average noise level, or $L_{Aeq,\ adj}$, poses significant problems in its prediction. As this noise parameter is much more commonly applied in environmental approval conditions for construction of pipelines, the ability to predict this parameter is of particular interest.

The problem lies in the variability of distances between the different activities within the spread. The progress of each of the activities in the spread are not the same in general, nor is the progress of each group constant over consecutive days, hence the distances between activities is variable between days. This does not significantly affect the $L_{Amax}$ noise levels, but as the activities preceding and following an activity have a cumulative effect on the $L_{Aeq,\ adj}$ at receptor locations, the ability to predict this parameter is of great interest to the companies which have been contracted to build the pipelines as well as the final owner of the pipeline. The cumulative effect of successive phases of the construction is illustrated in Figure 1. From this figure the cumulative effects of successive activities, particularly in the first several clearing and earthworks phases, can be seen.

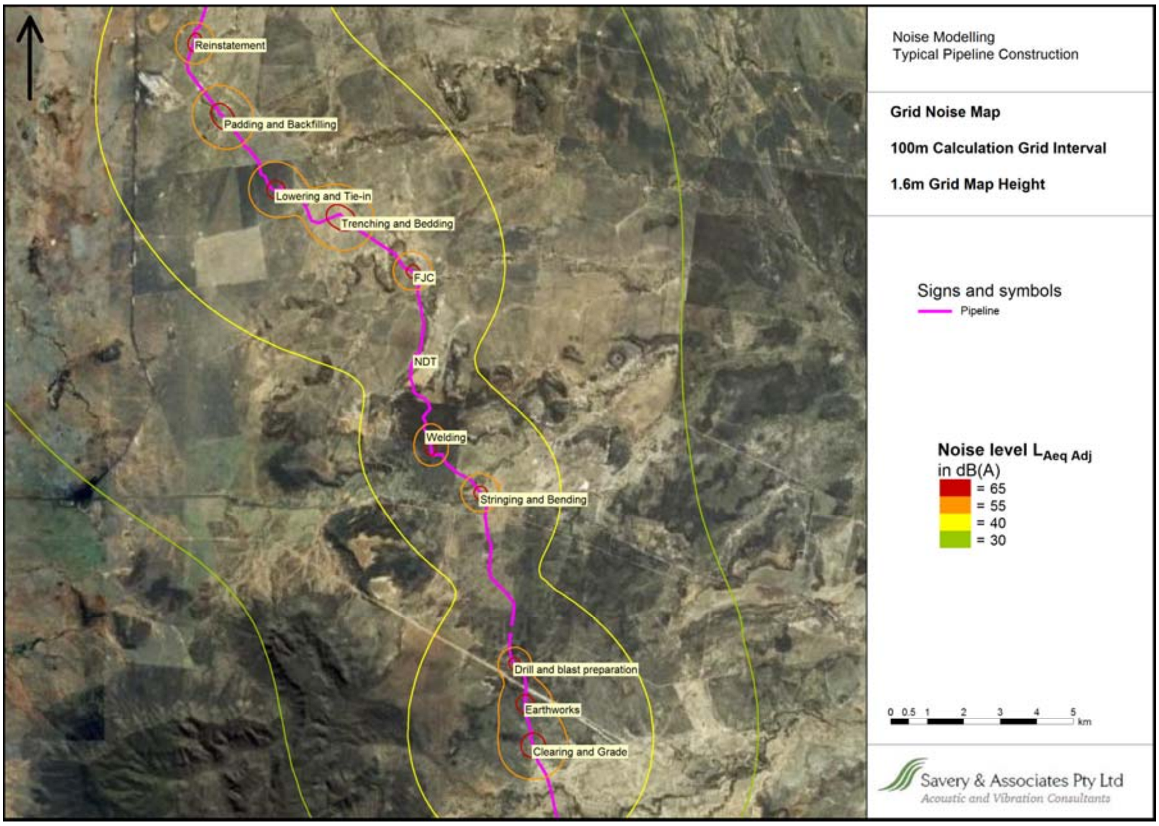


**Figure 1: Predicted noise emissions for typical HP pipeline construction spread**

As detailed and accurate day-to-day spread positions are generally unavailable for predictive purposes in the planningg stages of works, approximations must be made. In a highly critical area with significant and numerous receptors who are particularly opposed to the construction of the pipeline, daily calculations, performed using updated known positions of each activity of the spread may be deemed to be required.

## PROPOSED ITERATIVE METHOD

It is suggested that as a first step the maximum noise levels as each activity passes a receptor be determined through noise modelling, using a moving point source through a computer program such as SoundPLAN. The $L_{Aeq}$ parameter could also be calculated at each receptor based on the assumed constant speed of that particular activity, up to 4000m over 12hrs for a point source resulting in a speed of approximately 0.33km/hr or 0.1m/s.

Based on the predicted $L_{Amax}$ and $L_{Aeq}$ for each of the actitities, the receptors can be ranked in terms of the anticipated noise exposure to the pipeline construction activities. Based on the exposure to each activity on the spread, additional modelling of specific worst-case activities may be carried out for the residences which have been determined to be above the threshold. These residences would then have a greater level of interaction with staff on the ground and more information would be available to these residents to know the general programme and long they would be affected.

To ensure that the modelling relates well to reality, it is recommended that the noise levels of the specific equipment which is being used for the pipeline construction be measured during the early stages of construction (preferably in a more remote area) to determine the specific sound power levels of each item of equipment. If the measured sound power levels are significantly greater to that modelled, use of quieter equipment may still be possible, as the selection of particular equipment could significantly affect the noise emissions for each of the activities of the spread. This would also carry out a “reality check” for the assessment, as the predictions may have included a greater number of excavators, bulldozers or graders, than are actually used at any one time during the pipeline construction.

## CONCLUSIONS

Gas and water pipelines have different activities involved in their construction depending on the type of pipeline and consequently, have differences in their average and maximum noise emission levels and characteristics. These noise levels change as each activity comprising the pipeline construction spread moves past a single resident living near the pipeline route.

The difficulties in predicting and assessing the noise emissions from pipeline construction activites have been discussed, with an iterative prediction method suggested for use in assessment of these activities. It is anticipated that the use of this method would allow for meaningful noise predictions to be made, while the suggested noise criteria would provide guidance as to when residents would require particular attention and communication for an activity that is typically limited to the daytime period.

## REFERENCES

*Queensland Environmental Protection Act 1994* (updated 1 January 2009)