LPG EXTRACTION PLANT
PROPOSED MODIFICATIONS TO EXTRACT ETHANE

WESFARMERS LPG PTY LTD

Report and Recommendations by the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 332 April 1988

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CONTENTS

i SUMMARY AND RECOMMENDATIONS

The Environmental Protection Authority has assessed a proposal by Wesfarmers LPG Pty Ltd to extend their LPG facility to extract ethane from natural gas.

The Authority has determined that the project is environmentally acceptable, and makes the following recommendations:

RECOMMENDATION 1

The Environmental Protection Authority concludes that the proposal to extend the LPG plant to extract ethane, as described in the Notice of Intent, is environmentally acceptable, and recommends that it could proceed, subject to:

. the commitments made by the proponent for the environmental management of the proposal, and listed in Appendix 1 of this Report; and

. the Authority's recommendations in this Assessment Report.

RECOMMENDATION 2

The Environmental Protection Authority recommends that the proponent submit proposals to the Authority for approval, for:

. construction stage impacts, before the commencement of construction, and

. commissioning stage impacts, before the commencement of commissioning.

RECOMMENDATION 3

The Environmental Protection Authority recommends that the proponent should submit a proposal for the management of air emissions for approval by the Authority before commissioning.

RECOMMENDATION 4

The Environmental Protection Authority recommends that the proponent should submit a proposal for spent solvent disposal for approval by the Authority before commissioning.

RECOMMENDATION 5

The Environmental Protection Authority recommends that the proponent should carry out a Hazard and Operability study and submit the results to the Authority before mechanical construction commences.

1. INTRODUCTION

Wesfarmers LPG Pty Ltd are currently constructing an LPG extraction facility at Kwinana, adjacent to Mason Road, and opposite the proposed site for the PICL proposal (see Figure 1). The facility is designed to extract 150 000 tonnes per annum of propane and butane, with the intention of returning the remaining gases, principally methane and ethane, to the natural gas pipeline for sale to traditional natural gas customers.

The supply of ethane is essential to the proposal put forward by Petrochemical Industries Company Limited (PICL), which is assessed in EPA Bulletin 331. North West Shelf gas contains approximately 6% of ethane, and represents the only natural source in Western Australia.

It is proposed to modify and extend the plant to enable up to 177 000 tonnes per annum of ethane to be extracted as well. Virtually no increase in risks and hazards on the LPG facility site is expected, as the principal risks are due to export and storage of ethane. Ethane will be exported via pipeline to refrigerated storage on the PICL site. The risks and hazards associated with the pipeline and the storage facility have been taken into account in the Technica Study of the Petrochemical Industries proposal. (Appendix 4 of the PICL Assessment Report (Bulletin 331)).

The proponents (Wesfarmers LPG Pty Ltd) have informed the Authority that the proposal is based on information supplied to them by the State Energy Commission of Western Australia (SECWA), and that modifications to the proposal may be required in the future. Any such modifications will have to be notified to the Authority for assessment.

The Authority determined (in September 1987) that a Notice of Intent was required for the project. A higher level of assessment was not warranted, given the assessment of the original LPG facility (Bulletin 257) and the fact that the principal risks and hazards associated with the extension of the plant are located on the PICL site. The Notice of Intent, would, however, have initial public exposure, as it was required to be bound in with the Environmental Review and Management Programme for the PICL proposal, given its close association with that proposal.

The advantages of the project accrue to both the proponent and to the State and the local community. Those accruing to the proponent include:

- further development of expertise;
- further strengthening of their financial position; and
- an opportunity to improve the profile of the company through involvement in the high technology PICL proposal.

The advantage accruing to the State includes the reduction of the natural gas surplus, with associated economic benefits.

Advantages accruing to the local community include employment and general economic stimulation.

If the project were not to go ahead the disadvantages would entail non-materialisation of the above benefits. The proposal is related to the Petrochemical Industries proposal. Should the latter project not go ahead for any reason, then this proposal would also lapse.

The Authority considers that the LPG facility is a clean facility, and any impacts can be readily managed. The Authority has reached the following conclusion, and recommends accordingly:

RECOMMENDATION 1

The Environmental Protection Authority concludes that the proposal to extend the LPG plant to extract ethane, as described in the Notice of Intent, is environmentally acceptable, and recommends that it could proceed, subject to:

- **the commitments made by the proponent for the environmental management of the proposal, and listed in Appendix 1 of this Report; and**
- **the Authority's recommendations in this Assessment Report.**

2. DESCRIPTION OF PROPOSAL

2.1 MAIN COMPONENTS

The proposal involves modifications to the plant as designed for extraction of propane and butane. The modifications consist of:

- inlet gas treatment;
- addition of recompression, possibly the duplication of existing unit or units;
- lowering of the operating pressure of absorber and conversion of operation to product de-methaniser;
- lowering of the operating pressure of de-ethaniser and conversion of operation to product de-ethaniser;
- addition of de-methaniser reflux equipment;
- addition of supplementary de-methaniser reflux heat exchange;
- addition of equipment for disposition of product ethane, either additional refrigeration or gas compression; and
- duplicate gas turbine generator for power supply.

The modifications are indicated in a schematic form in the process flow chart in Figure 1.

2.2 PROCESS DESCRIPTION

The process consists of the following stages:

- carbon dioxide removal (to prevent formation of carbon dioxide hydrate at the low temperatures required for ethane extraction);
- water removal (to prevent fouling, and formation of ice in the process);
- chilling;
- expansion through a high pressure separator - this cools the gas even further;

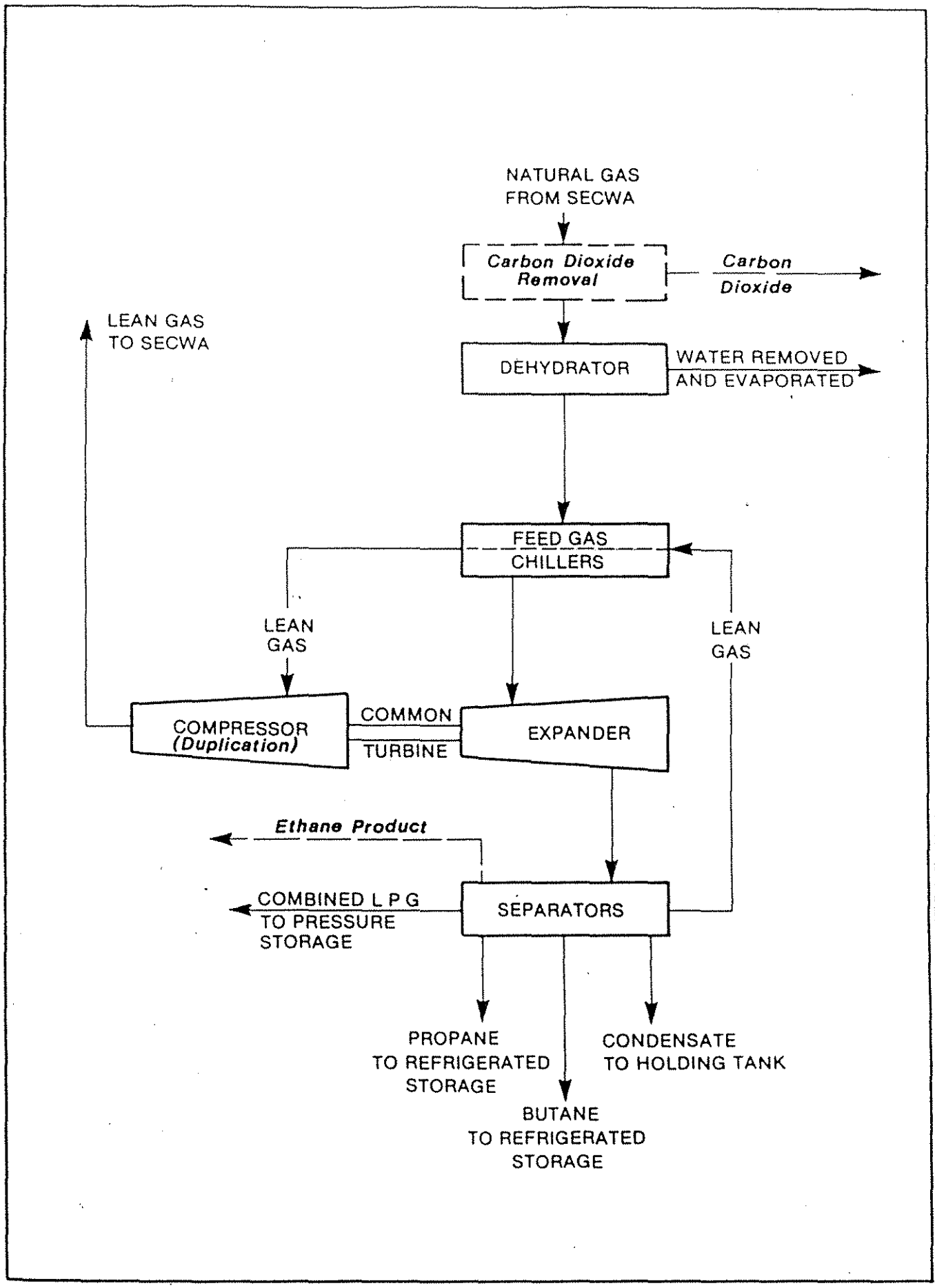

Figure 1. Modifications to extract ethane process flow chart.
(Source: Notice of Intent)

- separation by fractionation, which makes use of the different boiling points of the component gases; and

- compression of the resulting lean gas (ie after ethane, propane, butane and condensates have been extracted) and return to the natural gas line, after which it is odorised by SECWA.

The principal extensions to the original proposal involve removal of carbon dioxide (extraction of propane and butane does not involve temperatures low enough to form carbon dioxide hydrate), and modifications and additions to the equipment (as detailed in the Description of Proposal) to enable ethane separation and removal.

3. EXISTING ENVIRONMENT

The existing environment has been adequately described in the original LPG proposal, and the Notice of Intent for the extension of the plant to extract ethane.

The existing environment is not at issue in this proposal, as the factors involved (climate, landforms, soils and hydrology) are the same as in the original LPG proposal. No adverse effects from the plant extension are envisaged.

Matters of zoning (industrial) and surrounding land use are also not at issue.

4. REVIEW OF SUBMISSIONS

The Notice of Intent describing this proposal was bound in with the Environmental Review and Management Programme for the Petrochemical Industries Company Limited proposal. Only one of the submissions received dealt specifically with the extension of the LPG plant, and that was in relation to traffic impacts. Another submission was concerned that the location of the LPG plant was the determining factor in siting the proposed petrochemical plant.

Various submissions identified general issues which related to the location of the LPG plant and the petrochemical plant. These were:

- the need for long term planning for the Kwinana area, and the siting of WA's heavy industries;

- the inadequacy of Mason Road for access and evacuation in the event of an emergency, and the need for further studies of traffic impacts on the Mason Road/Rockingham Road intersection, and

- need for consultation with emergency services at a State level.

5. ASSESSMENT OF ENVIRONMENTAL IMPACTS

The principal environmental impacts generated by the modifications, over and above that of the original LPG proposal, are outlined below.

5.1 CONSTRUCTION AND COMMISSIONING STAGE IMPACTS

Impacts at the construction stage (principally dust and noise) will be similar to those in the original proposal, and are required to be managed in the same way for that proposal, and in a manner acceptable to the Authority.

A programme for the management of commissioning stage impacts is also seen as being essential.

RECOMMENDATION 2

The Environmental Protection Authority recommends that the proponent submit proposals to the Authority for approval, for:

- **construction stage impacts, before the commencement of construction, and**

- **commissioning stage impacts, before the commencement of commissioning.**

5.2 GROUNDWATER

The extra requirement for groundwater over and above the requirements of the original proposal, amounts to 1 m^3/h. The Authority does not consider that extraction of this quantity will have any significant environmental effect. The proponent should liaise directly with the Water Authority of Western Australia, in order to obtain the appropriate approvals.

5.3 ATMOSPHERIC EMISSIONS

Flue gases from the extra generation capacity including carbon dioxide, unburnt hydrocarbon fuel, carbon monoxide and nitrous oxide. Carbon dioxide is also stripped from the incoming natural gas and vented to atmosphere.

The hydrocarbon fuel is methane (ie natural gas after the removal of ethane, propane and butane). The quantity of unburnt methane (62 kg/day) will not have any adverse effects of the air quality in the region, or pose any flammability hazard. The nitrous oxide produced by the facility will not greatly affect the atmospheric levels in Kwinana, but is yet another source. The Notice of Intent states that the flue gas will contain 0.08 g/m^3 of nitrous oxide, which is about ten times that specified in the National Health and Medical Research Council (NHMRC) emission criteria. The Authority considers that even though the total amount of nitrous oxide emitted per day (680 kg) is not large, the proponent is required to bring the emissions down to a level consistent with accepted guidelines and standards.

As with the PICL proposal, the proponent will be required to comply with both the NHMRC air emission standards and the air quality guidelines promoted by the Victorian EPA. Should there be any inconsistency the stricter requirement shall apply.

RECOMMENDATION 3

The Environmental Protection Authority recommends that the proponent should submit a proposal for the management of air emissions for approval by the Authority before commissioning.

5.4 LIQUID WASTES

The requirement for stripping of carbon dioxide from the inlet gas stream will involve a solvent, either diethanolamine (DEA) or methyldiethanolamine (MDEA). A decision on the specific solvent has not yet been made, but the properties of each are very similar. Disposal of spent solvents must be in an appropriate manner. The proponents will be required to submit a proposal for solvent disposal to the EPA for approval before commencement of ethane production.

RECOMMENDATION 4

The Environmental Protection Authority recommends that the proponent should submit a proposal for spent solvent disposal for approval by the Authority before commissioning.

Stormwater run-off is to be channelled to a holding area where any contaminants, such as hydrocarbons, are to be removed. In the assessment of the original LPG proposal, the EPA noted that the proponent proposed to extract oil and grease from collected stormwater and use the water for emergency purposes. Should there be any change to this proposal, the company is to inform the EPA.

5.5 SOLID WASTES

No solid wastes will be produced by the modification. Commitments in the original LPG proposal regarding disposal of domestic solid wastes are relevant to this proposal, and are to be maintained.

5.6 ODOURS

Natural gas is not odorised with mercaptans upstream of the plant. Any sulphur based impurities are removed in the LPG plant prior to extraction of ethane. No further sources of odours will be encountered as a result of this modification.

5.7 RISKS AND HAZARDS

As noted, extra risks and hazards due to the modifications are not significant. The principal risks are due to the ethane pipeline to Petrochemical Industries, and the ethane storage (on the PICL site). The risks and hazards due to the pipeline and the storage have been taken into account in the preliminary risk assessment carried out for the PICL proposal. The proponent is to carry out a Hazard and Operability (HAZOP) study on the modifications at the detailed design stage.

RECOMMENDATION 5

The Environmental Protection Authority recommends that the proponent should carry out a Hazard and Operability study and submit the results to the Authority before mechanical construction commences.

6. NOISE, VISUAL AND TRAFFIC IMPACTS

6.1 NOISE IMPACTS

The proponent notes that extra noise will be generated by the modifications, particularly the gas turbines and generator. The Authority considers that the proponents must ensure that the noise levels do not exceed 85dB(A) within the plant, as given in their commitments for the original proposal.

6.2 VISUAL IMPACTS

The principal modification which would be clearly be seen would be a 30 m stack. Given that this proposal is contingent on the petrochemical proposal going ahead, and that the visual impact of the latter proposal will outweigh that of the LPG plant, the Authority considers that the extra visual impact is not significant.

6.3 TRAFFIC

The impact of this proposal on traffic, both in the construction stage and the operational stage are not expected to be significant. The petrochemical proposal will have a far greater impact. The assessment report on the latter proposal indicates the concerns that various agencies have expressed with regard to traffic patterns, and egress from, and access to, the area in the case of emergency. In the assessment of the PICL proposal, the Authority emphasised yet again the imperative need to develop a Kwinana Emergency Plan, as recommended by the Authority in its assessment of the ammonia-urea proposal (Bulletin 309), and as discussed in its assessment of the original LPG proposal (Bulletin 257).

7. ENVIRONMENTAL MANAGEMENT AND MONITORING

The proponent has made commitments to facilitate the management of potential environmental impacts (Appendix 1). With regard to monitoring, the proponent has made a commitment to regular safety audits.

8. CONCLUSIONS

The Environmental Protection Authority considers that the proposal to modify the LPG plant to produce ethane for Petrochemical Industries Company Limited can be managed so that it is environmentally acceptable. This is contingent on the proponent implementing all commitments, and subject to the Authority's recommendations.

The Environmental Protection Authority concludes that the proposed modifications to the LPG plant to extract ethane, are environmentally acceptable, subject to the recommendations in this Report and to the commitments given by the proponent, which are listed in Appendix 1.

APPENDIX

List of Proponent's Commitments

COMMITMENTS IN ETHANE NOI

3.3 (Spent solvents) would be disposed of in an approved manner.

The plant would incorporate the normal practice of treating run-off from bunded areas in order to remove hydrocarbon (lubricating oils etc).

3.5 The ethane pipeline (to the PICL plant) would be underground.

3.6 All construction materials and practices would strictly comply with relevant Australian or, where Australian codes did not exist, internationally accepted codes of practice relating to ethane extraction processes and facilities.

3.7 All personnel would be subject to an extensive hazards and operations programme designed to ensure safe operating practices. This programme would be formulated in accordance with the recommendations of the hazard and operability (HAZOP) study that the proponent would commission during the design phase.

In addition to on-site emergency facilities and practices outlined in the PER for the LPG extraction plant, liaison with other involved parties would ensure maximum workforce safety through the development of a management plan in response to both on-site and off-site emergencies.

5.1 Hazards in the plant would be addressed during the HAZOP analysis undertaken at the completion of the design phase.

5.3 Spent solvents would be disposed of in an approved manner.

Stormwater and washwater run-off would be channelled to a holding area where contaminants, such as hydrocarbons, would be removed for disposal off-site by truck in an approved manner.

Domestic solid wastes would be disposed of by sanitary landfill to the satisfaction of the local authorities. The ablution facilities provided in the LPG extraction plant would also be utilised by the ethane extraction operators.

5.6 The design of the modifications would comply with the requirements of the Noise Abatement (Neighbourhood Annoyance) Regulations 1979 (as amended) of the Environmental Protection Act 1986, where applicable to plant workforce noise levels.

Under no circumstances, due to the distances involved, would there by any noise impact on residential areas.

ENVIRONMENTAL MANAGEMENT

6.1 Introduction

If deemed necessary, discussions would be held between the proponent and the Kwinana Town Council to enable interaction between the two parties on issues pertaining to the modifications that were considered important. The cooperative relationship developed through the LPG extraction plant project would be

continued, particularly with regard to the preparation of contingency plans for environmental management.

6.2 Construction

... the proponent would take the necessary measures to ensure that noise and dust caused by construction activities were minimised. Appropriate noise suppression devices would be fitted to all machinery likely to exceed noise levels, as required by the relevant legislation. Dust suppression through regular watering would also be adopted.

All construction materials and practices would be in accordance with the relevant Australian or international codes.

6.3 Operation

- Ongoing control of dust would be implemented;
- Noise levels would be in accordance with statutory requirements;
- The ethane extraction components would undergo regular preventative maintenance;
- The modifications would be designed to the highest standards and operated and maintained accordingly in order to prevent any accidental release of materials into the environment;
- All waste products would be disposed of in an environmentally safe manner and in accordance with statutory authorities;
- Any odours emanating from the process would be strictly managed, and should a problem occur, appropriate remedial action would be taken in consultation with the local and State authorities;
- The proponent would liaise with the operators of the BP refinery and the proposed petrochemical plant in the preparation of contingency plans for users of Mason Road.
- The proponent would liaise with relevant government departments to formulate detailed contingency plans to ensure rapid remedial action in the event of an emergency;
- A hazards and operations programme would be commissioned and plant personnel would be trained in safe operating practices and emergency procedures; and
- The proponent would join and participate in the fire fighting cooperative already established by industrial operators in the Kwinana district.

6.4 Safety Features

The following safety features would be incorporated into the design and operation of the ethane extraction modifications and associated facilities:

- All components would comply with the relevant Australian design standards;

- Installation of all electrical, instrumentation and mechanical items would be in accordance with relevant codes; and

- A mechanism for a fail-safe mode would be installed, which would involve a strategy of automatic valving shut-down in the unlikely event of an emergency.

6.5 Monitoring

Regular safety audits would be conducted to monitor the effectiveness of the proponent's commitments to safeguard people and property, and to ensure that they were being competently executed.