

Bridgend, Gannochy & Kinnoull Community Council
www.bgk.org.uk
Chairman – Graham Fleming, Secretary – Deirdre Beaton
c/o GO@L, 1 Bowerswell Road, Perth PH2 7DL
bgkcc@hotmail.co.uk

Scott Mackenzie
Directorate of Planning and Environmental Appeals
The Scottish Government
4 The Courtyard
Callendar Business Park
Falkirk FK1 1XR

16 September 2012

Dear Mr. Mackenzie,

Planning Permission Appeal DPEA Ref: PPA-340-2068

Relocation of existing recycling centre and formation of a waste to energy facility (Approval of Matters in Conditions); Doug Holden Scrap Merchants, Shore Road, Perth, PH2 8BH

Procedure Notice 2 FURTHER WRITTEN SUBMISSIONS

Matter 1: Carbon Monoxide

Introduction

My name is Dave Beattie. I was requested by Bridgend, Gannochy and Kinnoull Community Council to write this report on community risk associated with the production of Carbon Monoxide at the proposed Shore Road Development.

I am a professional Chemical Engineer who has recently retired after 40 years service with one of the world's largest petrochemical companies. During my tenure I have held senior technical, planning and research positions and my last eight years included the role of technical advisor to the Safety Committee of the company's largest chemical complex. I am well versed in the risk and safety culture of the major chemical companies and am familiar with giving safety advice on major developments.

I am very familiar with gasification technology having had a key role in the start up and shake down (ironing out problems and surprises) of the first gasification plant to be built in the Asia-Pacific region.

I find myself very surprised and concerned when a new player in the chemical industry proposes to build a plant producing hazardous gases in a city centre location and no one asks the question, "What is the risk to the community?"

HSE respond that it is outside their remit since no hazardous materials are being stored. SEPA claim that this is "a safety issue" and that their role is to worry about

the environment and the local authority doesn't understand the issue and has decided not to seek advice.

I am further surprised when the reporter appointed to handle the appeal process then asks whether the risks to the community are a matter that the appeal process should address. Given that this matter has never been dealt with, or owned, by any party throughout the period that this proposal has been under review, I have to ask "When is the appropriate time to address this issue?" We are presently looking at the very last chance.

Whilst no one has accepted ownership of the risk, no one with any technical know-how has denied its existence. I would ask the reporter, after having read all the submissions on this issue, ***"Have I read credible information that persuades me that the risk to the community is zero or close enough to zero to be neglected?"*** If the answer to this question is "No" then it is imperative you apply HSE's ALARP principle which is detailed in my report and which I **repeat below:**

"Our policy is that the precautionary principle should be invoked where: there is good reason, based on empirical evidence or plausible causal hypothesis, to believe that serious harm might occur, even if the likelihood of harm is remote."

Please find below my report.

Yours faithfully,

Dave Beattie

Copies to:

Grundon Waste Management Limited (c/o RPS Planning & Development)
Perth & Kinross Council
Scottish Environmental Protection Agency
Scottish Prison Service

Proposed Shore Road Development PPA-340-2068

Concerns arising from the proposed production of large volumes of poisonous carbon monoxide gas at the site and the consequences of a large leak of process gas into the community.

Summary:

What is now proposed for the Shore Road site is a chemical factory, rather than a waste burning plant.

We have identified that the proposed plant will produce large volumes of highly poisonous carbon monoxide gas as well as significantly greater volumes of highly flammable hydrogen gas.

We know from review of the technical literature as well as from the personal experience of one of our members that a substantial leak of gas from chemical plants is a highly credible, though reasonably infrequent event. We also know from technical literature that a credible leak of carbon monoxide and hydrogen can give rise to toxic and flammable conditions at some distance from the boundary of the plant.

Well established protections are essentially mandatory for plant personnel, but no protection whatsoever can be provided to the prison, nearby housing and people on the South Inch.

The Appellant claims to have conducted a risk analysis but we have shown that this is very misleading and doesn't provide any measure of the risk or clear guidance on how to effect maximum mitigation of the risk to the community. We further demonstrate that a simple risk analysis which is widely used in the chemical industry shows that the risk presented by the proposed development is greater than would normally be accepted in the industry.

We have identified a number of reasons why we believe that this facility will be more subject to hazards than mainstream chemical plants. And, most importantly, we have shown that HSE's ALARP principle for risk reduction has not been applied to this proposal. We strongly believe that the safety concerns we have raised are material planning considerations.

What is proposed at Shore Road is a Chemical Plant.

The initial Shore Road proposal was for an incinerator that burned waste. The heat from the combustion would be used to generate steam which would drive turbine generators. This system would provide both electrical power and low-grade heat.

The Appellant's new proposal is for a fluidised reactor bed which will be electrically excited to produce electrically charged substances (ions). By closely managing the amount of air supplied to the reaction, the ions will stabilise in the form of gases. This is a chemical process to generate gases from solids. The generated gases will be highly flammable and toxic. These gases will be thermally expanded through gas engines to provide power for electrical generators. This is a chemical plant and the technology which is proposed has been widely practised in the chemical industry for a dozen years.

However, although the principle is widely established this particular version is unique. It is not common to form plasma (gaseous ions) in this process. Also, normal practice is to use feedstock of constant, known quality, a property that cannot reasonably be expected from waste. So this process, in many ways, is novel and there is neither an operating history, nor trained operators in this technology.

This is clearly a chemical factory.

Large Volumes of toxic flammable gases will be produced by this chemical process

A number of gases will be formed in the chemical plant. The predominant gases will be hydrogen and carbon monoxide. Although, in addition, there will be poisonous hydrogen sulphide formed which will be removed in the process clean-up step.

The Appellant has provided no detail of the plant feedstock, so we are compelled to make estimates of the volumes of gas that will be formed. **A conservative, engineering estimate is that carbon monoxide will be formed and transported through the process at a rate of 3000 litres per second and that hydrogen formation and transportation will be at least an order of magnitude higher**

In the chemical industry, this gas combination is normally referred to as syngas.

Hydrogen is highly flammable and, in confined spaces, will combine explosively with air. Carbon Monoxide is also flammable but also very poisonous. Carbon monoxide combines with haemoglobin in the blood and prevents the absorption of oxygen. Small concentrations of carbon monoxide can be fatal in a short time. 0.3% (3 parts in 1000) Carbon monoxide in air will prove fatal in 30 minutes.

Leaks of Syngas are not uncommon

Leaks in the chemical industry are not usually reported externally. It has also been the practice in the last 30 years to locate chemical facilities remote from the community. (Following the Bhopal incident). In Singapore the entire new chemical industry has been located on an artificial island (Jurong Island) so as not to impact in any way upon the Singaporean community.

When the chemical facilities were developed at Mossmorran in Fife, the inhabitants of the village of Mossmorran were re-housed and the village razed so as to ensure that the chemical plants would not impact upon any community. There are many reports in the media of Chemical Companies in the US buying out and moving local communities such that there is no significant population near to a chemical plant. Thus modern practice by responsible chemical companies has been to build the facilities either remote from habitation or with a significant buffer zone between the chemical plant and any community, Thus it would be unusual to hear reports of leaks from modern chemical plants causing distress to a nearby community.

However, this doesn't mean that chemical facilities don't have uncontrolled leaks and loss of containment. Pierorazio et al (AIChE Sept 2010) reports incidents of syngas leaks (mainly associated with ammonia processes which are similar to gasification plants in their front end process) which have found their way into insurance claims. He cites 392 such claims which suggest there are insurance records to support 392 incidences of syngas releases that resulted in claimable damage. It is likely that most of these claims are from within the industry and there is no report or breakdown showing any community damage.

However, what Pierorazio clearly establishes is that in well run, well regulated chemical industry leaks of gas do occur.

Recommended protection for employees cannot be afforded to people on the other side of the walls.

Syngas is highly poisonous. At least the carbon monoxide portion of it is.

The IFC (April 30th 2007) and also Intelligent Energy-Europe (Altener Dec 9th 2009) have documented safety guidelines for syngas and gasification processes. Both documents strongly recommend that plant personnel are protected in two ways from poisonous carbon monoxide:

- 1) All operating and maintenance personnel should carry personal monitors which alarm in the presence of carbon monoxide.
- 2) All occupied buildings should be pressurised such that any gas leak cannot enter the building against the pressure gradient.

These practices are reported from most, if not all, currently operating gasification plants. (E.g. Kangaroo Island in Australia and Jurong Island in Singapore have such personnel protection to name but two)

Similar protection could and should be provided at Shore Road. But on the other side of the walls, in the South Inch and the prison, there will be no such protection for the

community. The Shore Road site provides no buffer zone and there is no space for any toxic gases to dissipate before they reach public or prison land.

It is possible for a process leak to result in toxic/flammable gases to be present in the public domain.

Syngas can vary in composition depending upon the process. The lightest, most buoyant syngas will be predominantly hydrogen. The densest and least buoyant gas will have higher concentrations of carbon monoxide. This latter gas will concentrate closer to the ground over a longer distance than the lighter hydrogen- rich gases.

Pierorazio et al (AIChE Sept 2010) modelled a leak from a two inch orifice. To get a conservative view, he assumed that the leaking gas was 100% hydrogen. This gas is 7% of air density, whereas carbon monoxide is very similar density to air.

Pierorazio's determination showed that there would be a flammable concentration of hydrogen at a distance of 480 feet from the leak source at an elevation of 10 feet from the ground.

Clearly, a similar syngas leak would present a fire risk and a toxicity risk in the public or prison domain for significant distances outside the plant. Whilst this type of event would (hopefully) not be a frequent occurrence, it is not possible to reduce its probability of such to zero.

The Appellant has not conducted a proper risk analysis

Grundon has presented a Bow Tie Diagram. This is a scheme that shows what could be put in place to address identified hazards. This is one way of deciding how to minimise hazards when the plant is built. In itself, the Bow Tie Diagram neither identifies nor eliminates all hazards. Indeed, any chemical engineer or practitioner in the field will tell you that it is impossible to eliminate or even identify all the hazards. The best definition of the responsibility of a chemical engineer is "the management of hazards."

A risk, as defined by Health and Safety is the product of two components. One component is the consequences of an event, or the hazard. The second component is the probability of the event occurring. The result is expressed as a likelihood of death or injury expressed as a probability. Like one in a million chances of death in one year. The Appellant's risk assessment fails to arrive at a numerical risk.

Chemical engineers on approaching a new proposal will normally use a risk matrix to look at the suitability of a proposed location. **Figure 1**, below, shows a risk matrix.

The X-Axis shows the likelihood of a hazard occurring. The Y-Axis shows the consequences of the event. Everyone will argue, and we hope correctly, that in any year there is a low probability of a major gas release occurring. Nothing, REPEAT

nothing can be done to reduce this probability to zero. However, if or when such an event occurs, the consequences will be horrendous at Shore Road since we have clearly shown above the potential of such an event to spill over into the prison and the South Inch.

	Major impact on community	Shore Road		
<u>CONSEQUENCES</u>	Minor community impact			
	No impact on community			
		Low Probability	Med Probability	High Probability
		<u>EVENT</u>		

Figure 1

It would be very unusual, indeed, for a chemical engineer to endorse a facility finding itself in the Red or Amber zones of a risk matrix. The amber zone is the fate of a nuclear installation. No matter where it is built, there is the potential for serious community consequences. Thus nuclear facilities are always built in the amber zone of the risk matrix and because of this inherent risk, the industry is, and needs to be, strongly regulated.

If the Appellant's facility was built at a location remote from a community, as is proposed for the Binn Farm facility, then the proposal would appear in a yellow square. An acceptable zone.

The Appellant's proposal fails the first, simple risk test that any worthy chemical engineer would apply in deciding upon a location for a chemical plant. The proposal introduces an unacceptable, yet easily mitigated risk. By moving the plant to a location where the public cannot be impacted, the resultant residual risk would become tolerable.

The facilities are more vulnerable to hazards than typical plants.

The Shore Road proposal involves new, untested technology on a feedstock of, essentially, uncontrolled quality. It is common that new technologies have unforeseen difficulties and teething problems. This will normally result in frequent shutdown and start-up of the plant. Unfortunately, plant accidents almost always occur during shut downs and start-ups.

Up until now, the Appellant has been engaged in waste management and waste burning. This will be their first venture into the chemical industry. They enter without the safety culture and awareness of established chemical companies. Their technology is new and unproven. There are no operators who are already trained in the process and there is no history of previous problems from which lessons may be learned.

The major deficiency, though, is that the plant will operate without a flare. A flare is an elevated stack with a pilot flame that is ever-lit. Any gas release from a safety valve or equipment being prepared for maintenance will be safely routed to the flare. The presence of a flare brings comfort and assurance to the operator of a chemical plant and ensures that any toxic, flammable gases that need to escape from the process can do so safely and surely with no impact on the operations or the community. (Apart from the visible impact of a burning flare).

The Appellant has elected not to build a flare. They are surely concerned that the presence of an ever-flickering flame could disturb the community.

In its place they are proposing to build a much more complicated oxidiser system. This will do the job of a flare but not with any similar level of reliability. A number of actions need to be aligned each time the oxidiser is called upon to operate. There is more opportunity for something to fail or things to go wrong.

For the reasons mentioned above, we would be concerned that the Shore Road facility would not be capable of reaching industry standard in control and safety.

The Appellant has not applied the ALARP principle

ALARP is HSE'S term for As Low as Reasonably Practicable. HSE's documentation states:

"In essence, making sure a risk has been reduced ALARP is about weighing the risk against the sacrifice needed to further reduce it. The decision is weighted in favour of health and safety because the presumption is that the duty-holder should implement the risk reduction measure. To avoid having to make this sacrifice, the duty-holder must be able to show that it would be grossly disproportionate to the benefits of risk reduction that would be achieved. Thus, the process is not one of balancing the costs and benefits of measures but, rather, of adopting measures except where they are ruled out because they involve grossly disproportionate sacrifices."

HSE goes on to state:

"Our policy is that the precautionary principle should be invoked where: here is good reason, based on empirical evidence or plausible causal hypothesis, to

believe that serious harm might occur, even if the likelihood of harm is remote”

In this case, the sacrifice required to significantly reduce the risk is to build the plant at another location. At the present time when no expenditure has been made to prepare the Shore Road site, the sacrifice to identify another, more suitable site is trivial. Unfortunately, at no stage during this protracted debate with the Appellant have they been prepared to look at, or discuss a more suitable location that has provision for a buffer from the community.

Our reading of the ALARP principle is that it has not been applied in this case. This is, in our view, a serious omission and grounds to refuse the application.

HSE’s position

We are disappointed that current legislation excludes the Health and Safety Executive from commenting on this proposal since HSE will only engage where large volumes of hazardous materials are **stored at the site**.

Further, we are concerned that there is no point in the future where a risk assessment by an independent body will take place. SEPA does not look at safety risks and although HSE requires that a safety plan is drawn up before operations can begin, this “plan” does not look at risk. It looks at the adequacy of fire fighting equipment and escape routes etc. HSE’s major future role will be to look at the safety of the employees, not the community.

It is bizarre, in our view, that current legislation allows a venture such as this to proceed without any official view being taken on the safety and suitability of the selected site. We believe that if the planning process fails to consider the specific risks that we have identified then the process will have failed in its responsibility to the community. At no point in the determination of this application has the question been asked; “What is the impact of this proposal on the safety of the community?”

Conclusion

We believe that we have demonstrated that the Appellant proposes to build a chemical plant and that the plant will produce large volumes of toxic/flammable gases. We have shown that historically a large number of leaks occur from chemical plants and we have provided documented evidence of numerous syngas leaks from processes. We have also shown that it is possible that a credible syngas leak will present a fire risk as well as risk of poisoning in the public or prison domain outside the plant. We have shown that best practice calls for operators and plant personnel to be protected by CO monitors and pressurised buildings. It would be nonsense to

thus protect the plant staff and ignore the public and the prison personnel on the other side of the walls.

We have shown the simple risk matrix used by professional chemical engineers and shown that the Appellant's proposal fails this simple test. We have given reasons why we believe this particular proposal will present higher than usual risks and we've drawn attention to our concerns about the absence of a flare. Finally, when we look at HSE's statements associated with ALARP, it seems obvious that the Appellant has failed to apply this principle

Material Planning Considerations and Recommendations

The concerns we have highlighted above are material planning matters.

Planning Aid for Scotland clearly states that "Adverse Safety Impact" is a material consideration for determining a planning application.

Handling of hazardous materials is a material planning consideration and the appeal process must consider the safety aspects of handling hazardous materials. The appeal should be refused on the grounds that the Appellant cannot take adequate steps to ensure the safe handling of hazardous materials on this specific site.

Public perception of fear is also a material planning consideration. In our view, the Appellant has failed to allay real and genuine public fear that an escape of hazardous materials would not be injurious to their health and well being. The appeal should be refused on the grounds that inadequate steps have been taken by the Appellant to ensure public safety.