Request is for ENA to take over this document and develop in consultation with the biomethane industry, shippers and other stakeholders

EMIB Discussion Note Biomethane Entry Facility Technical Specification

January~~December~~ 2012~~1~~

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1 Background

The EMIB working group has considered options for design of the grid Entry Facility (also known as Biomethane to Grid plant) which best meets the needs of applicable regulations and project economics. The agreed way forward is that:~~:~~

- The GDN will specify plant functionality required and advise the plant provider in the NEA. This will be a "Entry Facility Technical Specification" (EFTS) common across all Biomethane injection sites for all GDNs
  - Gas quality monitoring for GS(M)R
  - Energy measurement for Ofgem Gas Thermal Energy Regulations (G(TE)R)
  - Pressure control
  - *Odorant addition for GS(M)R*
- The Delivery Facility Operator (DFO, the biomethane producer) will warrant in the NEA that they will comply with the EFTS and will not inject gas into the GDN grid that does not comply with the NEA specification
- The EFTS will include provision of data into its telemetry system
- The GDN will retain ownership and operating responsibility for the Telemetry and ROV (also HPMIS?) at the plant outlet in order to prevent flow of off-specification plant reaching the network

Note - it is also possible that some~~the~~ GDNs will provide the odorant system which would not be in the EFTS in such cases

This document sets out a discussion draft EFTS for review by GDNs .and other industry participants in the EMIB group

This is the second version of this document with changes made following discussion at EMIB Technical Sub-group on 11th January 2012.

The request is that this REA document is adopted by the ENA and taken forward by ENA in consultation with the biomethane industry, shippers and other interested parties

Note – there was no discussion at the 11th January 2012 EMIB Technical sub-group re possible odourisation insurance scheme (Section 6)

2 Fundamental Principles

The GDN requires assurance that its obligations under GS(M)R and G(TE)R will be met even when it does not directly control the plant used to achieve compliances.

This assurance will be provided in a number of ways:

1. Fundamental requirements (e.g. gas that does not comply with GS(M)R will not be injecte into the gas grid, CV measurement devices to be Ofgem approved, meter to comply with IGEM standard~~)~~))

2. Technical data from DFO (e.g. HAZOP of the proposed Entry Facility plant and PFDs that show gas flows to Entry Facility plant, to grid, to flare, back to inlet of biogas clean-up and upgrading plant)

3. The DFO shall have 4 levels of security for gas quality control:

    - First level is basic plant design that prevents off spec gas bypassing the biogas clean-up and upgrading plant
    - Second level is gas quality monitoring of flows out of the biogas clean-up and upgrading plant (prior to propane enrichment)
    - Third level is monitoring of final Biomethane gas quality (prior to odorant addition)
    - Forth level is relay of all readings to GDN System Control in real time
    - Appendix 1 shows a schematic with these 4 levels of security

4. The DFO shall have 4 levels of security for odorant addition:

    - Measurement of odorant flow-rate and correlation against Biomethane flow-rate with low flow and high flow alarms
    - Measurement of odorant pump stroking frequency and correlation against Biomethane flow-rate
    - Low alarm and shut-off for low odorant levels
    - Test points downstream of odorant injection system to allow testing by ‘calibrated noses’

- Appendix 2 shows a typical schematic of an odorant system with these levels of security

5. Contractual – warranties in NEA with financial liabilities/insurance for failures that incur costs to the DFO

OUTSTANDING ISSUES:

a) **DOES THE GDN HAVE A LEGAL OBLIGATION TO ADD THE ODORANT THEMSELVES OR CAN IT BE ADDD AS A CONTRACTUAL REQUIREMENT IN NEA? ~~NG BELIEVES THAT IT CAN BE DONE VIA CONTRACT~~**
b) **REA BELIEVES IT IS COMPLICATED AND EXPENSIVE TO HAVE ODORANT AS PART OF GDN PLANT – CAN THIS BE QUANTIFIED AND WHO FUNDS ANY ADDITIONAL COSTS? (~~ADITIONAL COMPUTER REQUIRED)~~**
c) **GIVEN THE BIOMETHANE IS ENRICHED TO FWACV, DOES THE BIOMETHANEB ENERGY FLOW NEED TO BE PART OF THE OVERALL FWACV CALCULATION?**
d) **CAN THE ENERGY FLOW TO DNCC VIA TELEMETRY BE USED BY XOSERVE (AVOIDING NEED FOR HPMIS) – NG LOOKING AT THIS FOR LTS POWER STATIONS**

3 Main Plant Components

The table in Appendix 3 shows the main items of equipment and responsibility. More details are provided below

3.1 Provided by the DFO

The DFO will provide live telemetry feed of values defined by GDN Risk Assessment (refer to section 4 below) to make key values of gas composition, pressure and flow visible at the GDN control centre.

The DFO's plant must include the following:

1. Upstream diverter valve at plant inlet designed to route non-compliant gas to other site use and prevent off-specification gas flowing towards the BtG module
2. Manual isolation valves at inlet and outlet for maintenance etc
3. Filtration to [500] microns
4. Flow Metering to IGE/GM/8
5. Ofgem approved calorific value measurement and associated software (see separate paper to EMIB)
6. Odourisation plant with multi-level safeguards to ensure compliance:
    a. Metering of odorant flow with low and high flow alarms (check – is actual measurement of odorant flow part of the Didcot facility?)
    b. Monitoring of odorant pump stroking
    c. Low level alarm and shut off on odorant tank
    d. Facility for GDN to test for smell
7. Pressure control compliant with IGE/TD/13
8. System to ensure addition of propane to meet the FWACV
9. Computer that monitors compliance and ensures that no 'out of specification' gas can enter the GDN's network

3.2 Provided by the GDN

The GDN will always retain the ability to close the ROV, stopping flow into the network. This can be done by on-site controls and if necessary by remote control action. In addition, the key items of GDN Provided plant are:

1. Telemetry interface to GDN SCADA system to provide real-time data to System Control
    a. The GDN will specify the format of data required to allow the DFO to procure a compliant plant (including flow and CV data and all continuously monitored data)

2. ROV at plant outlet, operated automatically by gas quality excursion recorded in gas analysis plant (Item 9 in 3.1 above), or by remote signal from GDN control centre

3.3 Plant Location

The ROV owned by the GDN and Telemetry (and HPMIS?) will be located in a lockable compartment in the Entry Facility plant housing. The DFO will provide an appropriate electricity supply into this housing (as defined by GDN)

The GDN will have sole and unhindered access to this compartment.

Note - it may be possible for the GDN's who provide the odorant system to also have the odorant within this or another compartment

Right of access for the GDN to the Telemetry and ROV will be granted under NEA

4 Risk Assessment

The DFO will provide a HAZOP report and PFDs for the biogas clean-up and upgrading plant and Entry Facility~~BtG~~ plant. This will demonstrate that there is not a physical path for off spec gas to bypass the clean up and upgrading plant and gas quality monitoring (note – there will be a path to recycle off-spec gas to inlet of biogas clean-up and upgrading but a combination of non return valves and pressure will ensure it is physically impossible for raw biogas to bypass the clean up and upgrading plant).

The DFO will provide likely values for gas composition in the source biogas.

The DFO will contribute to the GDN's risk assessment process.

For the purpose of biomethane gas quality measurement, the GDN will perform a Risk Assessment to an appropriate standard (such as the National Grid GQ/8 standard which National Grid has agreed to make freely available)~~IGE/GQ/8~~. The GDN will assess components and if necessary specific site issues and define:

- Which gas quality parameters are required to be measured by instrumentation
- Which gas properties are measured on line, and which by sampling, at what interval
- Which measurements are required for a defined period after first commissioning, with the expectation that after a proving period they can be discontinued
- "aware" and "action" values for measured parameters

Note – significant change in feedstock (eg agricultural feedstock AD taking commercial food waste would require revised risk assessment and may change monitoring scheme)

The GDN will define the actions required in regard to measured values which are outside specified limits:

- Those requiring immediate cessation of flow e.g. H2S concentration, Wobbe
- Those requiring on-going monitoring over a short period e.g. O2 level, water dewpoint, CV (envisaged that short duration excursion say 30 minutes may be acceptable if meets FWACV over the day)

The resultant measurement protocol is summarized in Section 7.

5 Entry Facility Design Approval

5.1 Entry Facility Plant

The DFO will provide a technical review of the design and construction showing compliance with the EFTS including:

- Gas quality analysis instrumentation, including design performance, accuracy and response time
- Confirmation of compliance with Ofgem CV/energy requirements
- Confirmation of compliance with IGEM metering requirements
- Details of Odorant system design ~~(*NG have an internal policy document GQ2 that may be helpful)*~~
- Engineering standards applied
- Telemetry interface and communication protocol adopted ~~(*NG believe NTS minimum connection documents may be helpful)*~~
-

The GDN will be able to ask questions based on the technical review and the DFO will make the necessary changes as agreed.

Note – the GDN will not advise re expected level of reliability unless this impacts on the risk of off-spec gas going to the grid. The GDNs prime concern will be to ensure that the monitoring and shut down systems will operate reliably and that no out of specification gas is able to enter the GDN network.

6 Entry Facility Plant Commissioning

The EFTS shall set out the commissioning tests that the Entry Facility plant has to pass before bBiomethane can flow to the grid. These will include such things as:

- Testing gas quality monitoring
- Testing shut-down systems
- Testing alarms
- Testing odourisation system
- Testing propane system
- Testing telemetry

Details of this to be developed, it is envisaged that a Testing Schedule will be in the NEA

7 Operational Reporting

The DFO shall maintain operational records and recorded data in electronic format for a period of not less than 7 years.

The DFO shall make available their records for reasonable inspection by the GDN to support audits, technical investigations, fault finding, incident investigation and regulatory enquiry.

The GDN shall be entitled to visit the plant and inspect the Entry Facility plant to ensure compliance with the NEA requirements. GDN shall give a minimum of 24 hours notice for such an inspection by itself or its agent.

The DFO could possibly make available to the GDN a Monthly Summary Report containing the following:

- Biomethane to grid volumes
- Propane volumes added
- Odorant consumed
- Maintenance performed on Entry Facility
- Report of any technical issues re Entry Facility

~~8 NEA Principles~~

~~8.1 Capacity~~

~~The GDN will state the max allowable export capacity of the Biomethane connection (ie capacity in grid). May have summer level and winter level~~

~~8.2 Ownership~~

~~Plant ownership and operating responsibility will be defined~~

~~8.3 Local Operating Procedures~~

~~Local Operating Procedures (LOPS) for communications, standard notifications, data transmissions. This will include arrangements for emergency conditions and data transfer (including FWACV target notification from GDN to DFO)~~

~~8.4 Standards of Service~~

~~Standards of service for GDN response to faults (ROV, telemetry, possibly odorant)~~

~~8.5 Access~~

~~Arrangements for access to site~~

~~8.6 DFO Responsibilities and Liabilities~~

~~See Appendix 3 which sets out what can go wrong and the consequences.~~

~~The DFO will undertake to meet its obligations under contract as defined in the NEA.~~

~~To be discussed:~~

~~The DFO will provide insurance arrangements such that costs that may be incurred by the GDN as a result of fault arising in the BtG plant can be recovered without risk.~~

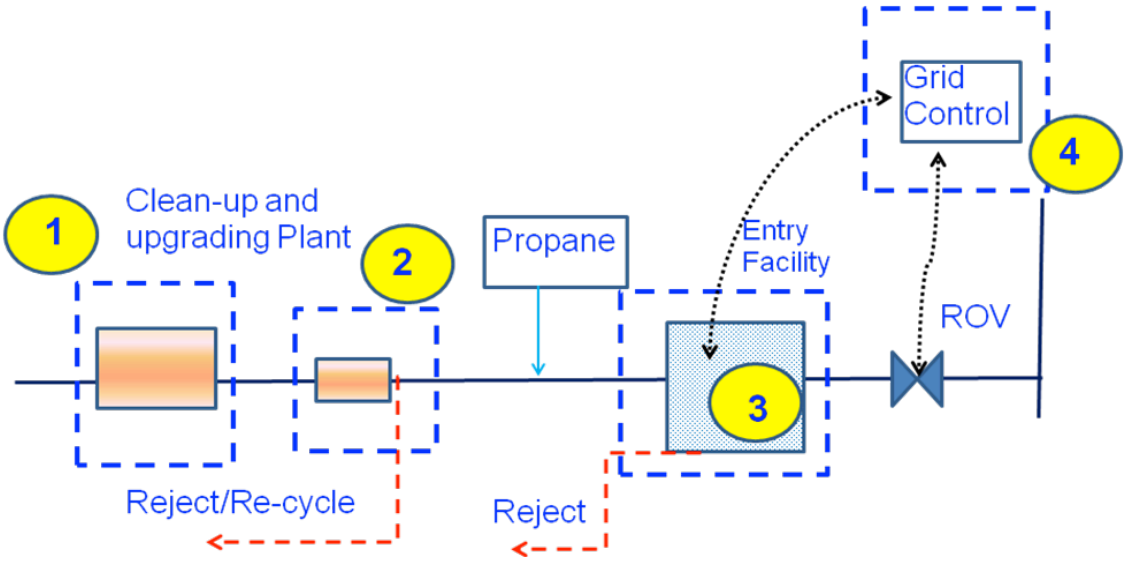
~~9~~8 Measurement Protocol

Composition Value	Biomethane to Grid	Monitoring Regime
CH_4	Around 90%	**Continuous- measured**
C_2+ (apart from propane)	0	N/A
C3 (propane)	Around 10% (molar)	Continuous measured
CO_2	< 4% (molar)	2 x per year

H_2	< 0.1% (molar)	2 x per year
N_2	< 5% (molar)	2 x per year
O_2	< 1% (molar)	Continuous measured
H_2S (mg/m3)	< 5 mg/m^3	Continuous measured
Total sulphur (mg/m3)	< 50 mg/m^3	2 x per year
Other Contaminants - the following are possible contaminants that may be present in the biogas and will be monitored in the biomethane	The gas shall not contain solid, liquid or gaseous material that may interfere with the integrity or operation of the NG network, pipeline infrastructure or any gas appliance.	
NH_3	TBC	2 x per year
Siloxanes	< ~~50~~ 1 mg/m3 (total)	2 x per year
Organo halides	< 1.5 mg/m3	2 x per year
Radioactivity	< 5 Becquerels/g	2 x per year
Volatile organic compounds	< 10 mg/m3 (total)	2 x per year
Biological colonies	< 100 colonies/m3	2 x per year
Hydrocarbon dewpoint	Not more than -2 °C at any pressure up to 85 barg	2 x per year
Water dewpoint	Not more than -10 °C at 7 barg	Continuous measured
Wobbe Number	In the range 47.20 to 51.41 MJ/m3	Continuous - calculated
Incomplete Combustion Factor (ICF)	Not more than 0.48	N/A
Soot Index (SI)	Not more than 0.60	N/A
Gross calorific value	In the range 36.9 to 42.3 MJ/m3 – typically around 39.5 MJ/m3	Continuous measured
Pressure	The delivery pressure shall be the pressure required to deliver gas at the Delivery Point into the GDNs Entry Facility at any time taking into account the back pressure of the System at the Delivery Point as the same shall vary from time to time.	

Note – above based on EMIB GQ/8 Risk Assessment and Didcot (siloxanes spec believed to be 5 mg/m3)

Appendix 1 Plant Layout Schematic

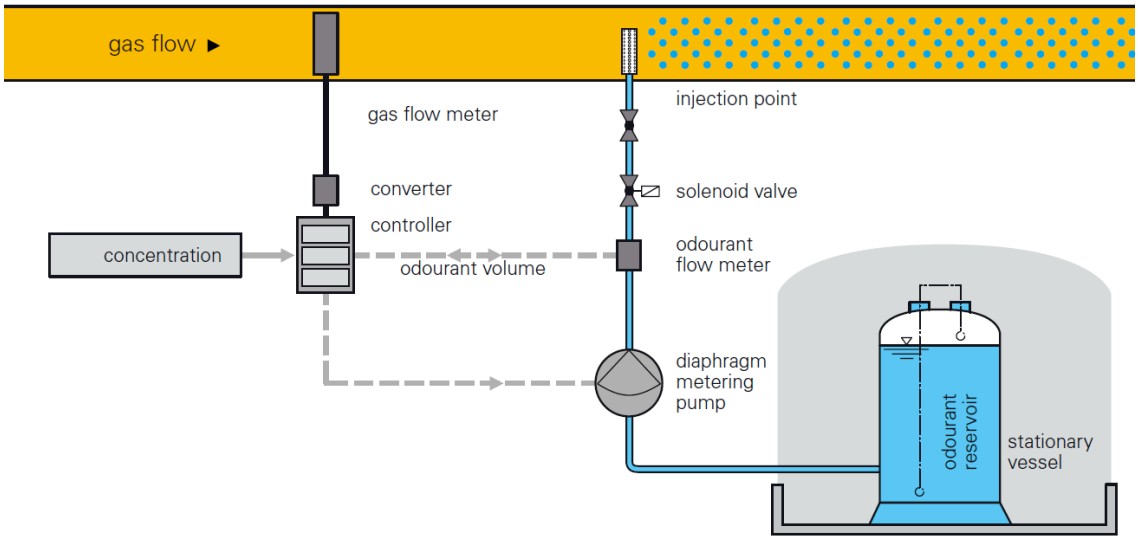


Entry Facility - gas sampling and network protection – 4 systems in series to give GS(M)R assurance

1. Upgrade plant removes CO2, H2S, siloxanes, water
2. Upgrade plant gas quality instrumentation measures and rejects/recycles to plant inlet or flare
3. Entry Facility instrumentation rejects to plant or flare
4. Grid control intervention upon alarm conditions if other 3 systems have failed

Note:
There will be a path to recycle off-spec gas to inlet of biogas clean-up and upgrading but a combination of non return valves and pressure (downstream will typically be at 2 – 7 bar, upstream at <500 mbar) will ensure it is physically impossible for raw biogas to bypass the clean up and upgrading plant).

Appendix 2 Engineering Standards



Key safeguards:

- Odorant pump is running
- Odorant flow meter shows flow of odorant with high/low flow rate alarms
- Odorant in the vessel above alarm levels

If there is indication of failure to add the appropriate level of odorant then the injection of biomethane is stopped automatically by computer

Note:

The REA proposes having an odorant flow-meter to directly measure flow of odorant and allow adjustments to be made. This comes as a standard part of Biomethane odorisation systems. It is believed that the odorant flow at Didcot is not directly measured

Appendix 3 Entry Facility Plant Options Matrix

Entry Facility Options Matrix		Asset Owner	Where is start of Network?	G17	Pressure Control	Gas Quality Monitoring	Energy Measurement	Odorant System	Final ROV	Telemetry	Data Transfer
Existing Model		GDN	At the ROV	All plant	IGEM TD/13	As EMIB (based on GQ/8)	Fiscal Standard Meter CV to Ofgem standard	Full system with safe-guards	GDN asset	Full links with GDN system control	HPMIS
New Model Option 1	**ROV + Telemetry**	GDN	At the ROV	ROV only	N/A	N/A	N/A	N/A	GDN asset	Valve control automatic and by GDN system control	HPMIS
	BtG Plant	Delivery Facility Operator	Upstream not part of network	N/A as not in network	IGEM TD/13	As EMIB (based on GQ/8)	Fiscal Standard Meter CV to Ofgem standard	Full system with safe-guards	N/A	Pass data to GDN system control	N/A
New Model Option 2 (includes odorant)	**ROV + Telemetry + Odorant**	GDN	At the ROV	ROV + Odorant	N/A	N/A	N/A	Full system with safeguards	GDN asset	Valve control automatic and by GDN system control	HPMIS
	BtG Plant	Delivery Facility Operator	Upstream not part of network	N/A as not in network	IGEM TD/13	As EMIB (based on GQ/8)	Fiscal Standard Meter CV to Ofgem standard	N/A	N/A	Pass data to GDN system control	N/A

Appendix 4 Engineering Standards

Whilst there are many standards, the only ones proposed to be applied to the design of the Entry Facility system are as follows:

IGE/TD/13 Pressure regulating installations for Distribution and Transmission systems

IGE/SR/25 Hazardous area classifications of Natural Gas Installations

IGE/GM/8 Meter Installations parts 1 and 2

T/GQ/8 National Grid standard for Risk Assessments applying to Gas Composition (Note – this is a National Grid document that NG has agreed can be shared)

Appendix 5 Plant Fault Protection Summary

Plant	Potential Risk	Protection	Comments
Pressure control	Under or over pressurization of network.	Regulator design A-M-S to TD/13	May elect to include standby stream for added security.
High H2S	GS(M)R Breach	Biomethane analysis by Instruments in (1) Upgrade plant and (2) BtG plant	ROV immediately closed by automatic system or by remote control action. Staff can be mobilized to site to manually close ROV if required. Issue is safety
Odorant High	Increased PREs reported in local network, potential costs	Plant has in built odorant flow meter, can be directly alarmed via telemetry Pump strokes can be linked to BM flow rate to enable software alarm	Two instrument failures required to cause incorrect odourisation to be hidden. Issue is costs, which could be secured through appropriate insurance arrangements – see Appendix 4.
Oxygen High	GS(M)R Breach	On line monitoring by dedicated instrument	Issue is safety, but could tolerate short duration excursions of defined length with HSE agreement
Odorant Low	Incorrect dosage, possibility of non-reported actual PREs	As above. Also established procedures for reaction to odorant failure	Issue is Safety
Telemetry	Loss of remote visibility at GDN control centre, no alarms generated	Site automatic closure of ROV if telemetry fails	Financial issues from loss of BM export for duration of fault
Flow Metering	Incorrect measurement for revenue purposes	Upstream filtration, inspection frequency	Could consider duplicate stream for large sites where value justifies
CV Measurement	Non-compliance with FWA regulations, financial penalty under FWA charging mechanism	Usage of Ofgem approved instrumentation	Issue is commercial
Filtration failure	Gas contamination, risk to regulator components, risk to meter performance	Upstream filtration in Gas Upgrade plant. Filter DP alarm.	Could consider duplicate stream for large sites where value justifies

Appendix 6 Discussion: (Odourisation) Insurance Scheme

The principal aim of the NEA is to provide a framework for securing necessary GDN compliance with UNC provisions, including the treatment of quality and specification of gas delivered to the GDN system entry point. In addition, the UNC provides for the recovery of (some) GDN expenses which may be incurred as a consequence of out of specification gas delivered by the shipper at the GDN entry point.

It is recognised however that, while the UNC incorporates a regime for the recovery of some costs, this regime may not provide sufficient security to GNDs in respect of biomethane embedded entry systems. The issue of cost apportionment for embedded entry is currently the subject of a UNC Modification (MOD0391).

In the meantime, concerns have been raised regarding gas odourisation at embedded entry points in those circumstance were the odourisation plant (and responsibility for odourisation) vests in the DFO. Specifically that the risk of failure increases if GDN do not own and operate the plant, and that the consequential rectification costs, for over-odourisation in particular, will exceed the provisions set out in the UNC.

The NEA should provide sufficient surety between DFO and GDN that operational risks such as these are minimised. For example through adequately specifying and procuring plant and operational regimes suitably validated by the GDN such that the risk profile remains consistent regardless of plant ownership.

But biomethane embedded entry is an innovative and evolving feature of the UK gas market and further security to deal with these new relationships may be appropriate in the interim. For example DFOs could (collectively) provide an insurance package to cover GDN/shipper risk and costs for the consequences of over-odourisation by the DFO.

However, these costs would need to be evaluated against certain probability profiles so that meaningful insurance premium can be set. GDN would need to provide the source data to expedite that analysis. The following options are envisaged and need to be assessed further; comments are welcome:

Over-odourisation fault condition remedies			
	Option	**For**	**Against**
1	**Existing UNC regime prevails with liabilities recovered by the GDN and risk mitigated through appropriate mechanism in NEA**	▪ Use existing contractual arrangements ▪ Risk is the same regardless of who owns plant ▪ Cost allowance through MOD0391?	▪ Risk unknown ▪ GDN feeling of lack of control ▪ No cost sharing for benefit received
2	**Party who causes failure takes the full cost of rectification**	▪ Clarity of responsibilities	▪ No cost sharing for benefit received ▪ Liability burden falls heavier on small market entrant ▪ Impedes innovation ▪ Potential barrier to entry ▪ Competition issues
3	**UNC Liability Sharing Proportion clauses invoked** This recognises the legitimate cost/benefit of various operators in the transportation supply chain	▪ Liability share based on proportion of asset (value)	▪ UNC Modification (include in 0391?) ▪ Designed for IGT CSEP so may not be appropriate
4	**DFO Insurance Scheme** ▪ Simple annual per site premium ▪ Risk based premium (GDN data needed) ▪ Self-administered (through ENA?) ▪ Self-insured (limit cost) ▪ Intrinsic risk mitigation achieved through regular inspection	▪ Least cost alternative ▪ Risk based ▪ Cost sharing ▪ Simple to implement ▪ GDN confidence	▪ May be unnecessary cost as risk unknown or adequately mitigated (NEA) ▪ UNC liabilities mean duplication of securities