DRAFT-REPORT

TNO-report

Deliverable D3.1 - requirements for the safety assessment for approval of HRS

TNO Built Environment and Geosciences

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HyApproval working group

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Netherlands Organization for Applied Scientific Research (TNO)

The Standard Conditions for Research Instructions given to TNO, as filed at the Registry of the District Court and the Chamber of Commerce in The Hague, shall apply to all instructions given to TNO.

1. Introduction and research objective

Hydrogen plays a significant role in the world's energy economy, but this role is almost exclusively as a raw material for the chemical industry; hydrogen is rarely used as a fuel - except in space programs. To become successful as a fuel for use in the utility and transportation sector an infrastructure, with a network of hydrogen refuelling stations (HRS), will need to be developed.
A widespread HRS network will require that layout, installation, approval and operation of HRSs are harmonised. This includes the development of compatible regulations, standards (e.g. minimum safety distances) and dimensions (e.g. the same couplings for dispensing the same type of fuel).

Within the sixth framework programme (priority 6.1.II) the Hy-Approval project was defined, intended to be a 24 month project, aimed at developing a handbook to facilitate the approval of hydrogen refuelling stations for road vehicles.

The handbook shall provide guidelines for facilitating the approval process and allowing (at an early stage) an "Approval in Principle" from relevant authorities and the identification of specific local issues that should be addressed. Consequently the document will be a *best practice* on how to help achieving approval at an early stage. The document will reflect the existing technical and regulatory environment, will be flexible and will allow updates as the market conditions change. These best practices are a.o. derived from existing experience and case studies gained through projects such as Clean Urban Transport for Europe (CUTE), Ecological City Transport System (ECTOS), European Integrated Hydrogen Project (EIHP), Clean Energy Partnership Berlin (CEP), Lombardia and Rhein-Main towards Zero Emission: Development and Demonstration of Infrastructure Systems for Hydrogen as an Alternative Motor Fuel (ZERO REGIO) and Safety of Hydrogen as an Energy Carrier (HySafe) as well as other consortium partner initiatives.

The project contains a number of work packages. The objective of work package 3 (WP3) is to identify the requirements of the authorities with respect to the *safety assessment* for the approval of an HRS in 5 EU member states and the USA. The 5 EU member states are: France, Germany, Italy, Spain and the Netherlands.

This report contains the summaries of the interviews with stakeholders in which the requirements were identified for the safety assessment for the approval of an HRS in the 6 countries mentioned above.

2. Applied method

As outlined in the description of work for WP3 identification of the safety requirements for approval of an HRS was done through interviews. For each country these interviews were carried out by local partners in WP3.
The following activities were performed:

1) Identify stakeholders to be interviewed
2) Prepare an interview protocol
3) Perform interviews
4) Report findings
5) prepare draft for harmonised safety assessment.

The interviews took place by visits, by phone or via correspondence. They were done in the period May –November 2006.
The interview protocol is shown in Annex I.

In the following chapters summaries of the interviews are presented. The analysis of the interviews resulting in conclusions and recommendations with respect to the HRS definitions and requirements will be presented in Deliverable 3.2.

3. Short summary of the interviews in the Netherlands.

All interviews (5 in number) have taken place in the Netherlands. Below is a summary of the results. The topics in the interview protocol are:

A	Interviewed stakeholders involved in the approval process
B	Required information by the authorities
C – D	External and occupational safety policy, regulations and technical standards
E - F	Methodologies and guidelines for the assessment of external (off-site) effects, damage and risks ; land use planning
G	Inspection
H	Emergency planning
I	Dissemination of the hyapproval handbook
J	Gaps

A. Stakeholders

The following stakeholders were interviewed:
Competent Authorities:
- Environmental & Building Department (DMB) of the city of Amsterdam.
- Amsterdam-North city council;

Inspection authority:
- VROM (Ministry of Housing Spatial Planning and the Environment

Owner:
- GVB (Municipal Transportation Company Amsterdam)

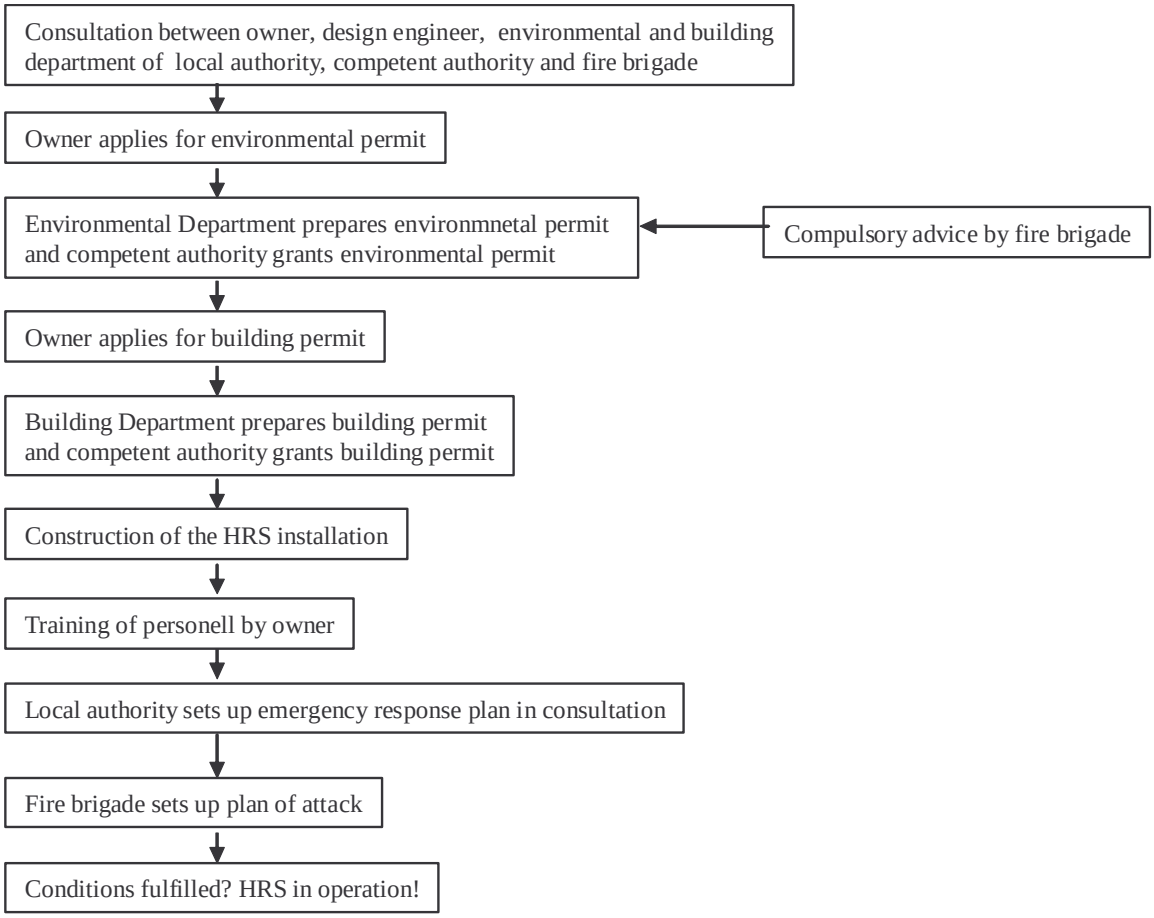
Fire brigade:
- Fire Brigade Amsterdam
- NIFV Netherlands Institute Physical Safety Nibra Arnhem

All these organisations were involved with the HRS that was built in Amsterdam as part of the EU sponsored CUTE (Clean Urban Transprot for Europe) program, an experimental application of hydrogen as a fuel source for public transport buses in 10 European cities. In Amsterdam the HRS was built at the site of the bus parking. Hydrogen is generated through electrolysis, stored and dispensed on site. Amsterdam has 3 H2 powered buses (fuel cells). Dedicated indoor parking positions were prepared with gas detectors and vent panels.

The approval process

The first step to be taken is to apply for the *environmental permit* by the (future) owner of the HRS, being GVB (= Municipal Transport Company) through DMB. DMB is an advisory body to the Amsterdam City Council, who prepares the required documents. Then the permit is granted by the Amsterdam-North City Council. If the environmental permit is granted the second step is to apply for the *building permit*, also through DMB. Often both permits are prepared more or less simultaneously. Fire Brigade offers compulsory advice to DMB. DMB and / or city council, may consult others, if they think this is required. VROM Inspection have the authority to ‘invite themselves’ which they did in the Amsterdam CUTE project and they called in the RIVM (National

Institute for Public Health and the Environment). Prime reason for this was the concern expressed by the owner of the neighbouring high pressure natural gas station.



flow chart: approval process Netherlands

B Required information

DMB primarily needs technical information: description of the HRS and its operation, Process Flow Diagrams, HRS lay-out, location and its surroundings (described in the quantitative risk analysis (QRA)), risk assessment studies, mitigating safety measures including explosion and fire protection, shut-off procedures
Fire brigade needs no technical details, but a short desciption of the processes and risk assessment studies; is especially interested in the effects and intervention measures.
City council only needs application form from DBM.
VROM inspection also needs this application form, and occasionally (if they want to) underlying technical documents.

C–D External and occupational safety policy, regulations and technical standards

External Safety Policy
External safety is part of the environment permit. No particular attention was paid to occupational health.

In NL the approval is based on risk, and a QRA must be done for each station.

Particular attention is paid to safety measures preventing / detecting H2 accumulation under shelters, roofs canopies etc.

Adequacy of measures was very much based on expert judgement, relying on the competence of the operator and the constructor/supplier of the installation.

Regulations and technical standards
No special regulations exist for H2. Therefore regulations for similar substances were used for the only Dutch HRS (CUTE project Amsterdam):
Compressed natural gas regulations in NL (CPR17, now PGS 25),
US NFPA 50A/B,
EIGA 15/96,
ISO 15916,
Seveso-related regulations, in particular for QRAs (BEVI, BRZO)

Also more general regulations were used, like the Pressure equipment Directive 97/23/EC, Machine guideline 89/392/EC, Low voltage guideline 93/68/EC, EM compatibility guideline 389/336/EC, ATEX, BAT

E-F Methodologies and guidelines for the assessment of external (off-site) effects, damage and risks; land-use planning

In NL a QRA will need to be done for each station. No specific guidelines exist for HRSs and until specific requirements for H2 are specified (as with LPG) this will be the case. The Dutch guidelines (as defined for Seveso establishments in CPR-18) will be leading, i.e. scenarios and failure frequencies, will be derived from this to determine

safety distances. Relevant distances are also used for land-use planning purposes, e.g. if risk criteria are not met, relocation will be necessary.

Authorities felt the guidelines and models used were adequate. If anything effect distances would be overestimated.

Also scenarios from HAZOP / FMEA type of studies are used for hazard assessments. These are particularly useful to determine required measures.

G Inspection

Again, no specific protocol exists. Fire brigade applies general checklist. Owner (GVB) does regular (once a week or so) visual checks. Also supplier of equipment does a weekly check. This, however, is primarily because of the novelty and the experimental character of the Amsterdam HRS. Also VROM will apply 'general' inspection techniques.
An inspection regime would have to be set in accordance with the risk imposed by the HRS. Technical reliability of the HRS is now determined by equipment supplier, and monitored by the software. Owner is alerted when replacements are due.
There is an increasing tendency in the Netherlands to have private notified bodies perform the obliged controls of the installation. However, such a notified body for HRS's does not exist yet.

H Emergency planning

Each environmental permit should have an emergency plan, which has to be practised once a year. Fire service defined a number of scenario's regarding the H_2 installation and made plans on how to combat a fire and/or rescue people for these types of scenario's (Plan of Attack). The requirements regarding accessibility of the location by the fire brigade may also affect the location of an HRS. Local Authorities together with public and emergency response services should make emergency response plans, taking into account danger zones. An Emergency Response Plan describe the role of all emergency response services, i.e. not only the the fire brigade, but also of the GHOR (Health Assistance in the event of Accidents and Disasters), the Police, the Municipality and other relevant response services.

I Dissemination of the hy-Approval handbook

All organisations would be in favour of and use a handbook if it would contain relevant information with respect to their particular problems: e.g. Competent Authority would like an overview of what (functions, buildings) can be allowed near HRSs; VROM inspection and DBM would like to see technical strandards (BAT, BREF),.Fire brigade would like an overview of intervention measures. If there is lack of knowledge on any of these aspects or there is no clarity about regulations and technical standards to be used, this may slow down the approval process.

J Gaps

It was mentioned that one important stakeholder. i.e. the public, was missing from out interview list!

4. Short summary of the interviews in Italy.

All interviews (7 in number) have taken place in Italy. Among these, two interview were in written form and five verbal ones. One written interview is still pending. Below is a summary of the results. The topics in the interview protocol are:

A	Interviewed stakeholders involved in the approval process
B	Required information by the authorities
C – D	External and occupational safety policy, regulations and technical standards
E - F	Methodologies and guidelines for the assessment of external (off-site) effects, damage and risks ; land use planning
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J	Gaps

A. Stakeholders

The following stakeholders were interviewed:
Competent Authorities:

- Single Counter for Business Activities of Mantova City Council
- Local Health Service (ASL, Azienda Sanitaria Locale) of Mantova
- Local Department of the Regional Environmental Protection Agency (ARPA, Agenzia Regionale Protezione ambiente) in Mantova

Fire brigade:

- Provincial Fire Brigades Headquarters in Mantova
- Lombardy Region's Fire Brigades Headquarters in Milan

All these organizations were involved with the HRS that is under construction in Mantova as part of the EU sponsored ZeroRegio program, an experimental application of hydrogen as a fuel source for cars in 2 European regions, i.e. Italy's Lombardy and Germany's Rhein-Main. The HRS in Mantova is part of public multifuel refueling station comprising also gasoline, diesel fuel and CNG. In a first phase, compressed gaseous hydrogen will be trucked in from a nearby SAPIO plant, then, in a second phase, hydrogen will be generated on site by catalytic partial oxidation of natural gas. Within the ZeroRegio program, the HRS in Mantova has to serve a fleet of three fuel cell cars.

Other competent authorities:

- ISPESL (High Institute for Prevention and Safety in the Working Place)

ISPESL is technical-scientific body in the National Health Service. Its role in the field of gaseous fuel refuelling stations comprises the approval of equipment in the scope of PED and ATEX Directives and the inspection of the correct installation of the pressure equipment. It is also a member in the committee with inspection authority on the "Seveso" directive. In the case of the ZeroRegio's HRS in Mantova, ISPESL did not participate in the "conference of services", where the issues of prevention and safety in

the working place were represented by ASL. However, it will be present at the start-up inspection.

Environmental agencies:

- Agency for Environmental Protection and Technical Services (APAT) in Rome

This body has had no direct involvement in HRS approval so far, but it provides technical advice and support to the Italian Ministry of the Environment and Territorial Protection that is responsible for the enforcement of the Seveso Directive in Italy

The approval process

The first step is to apply to the City Council for the HRS building permit, that has to be signed by the Mayor. The City Council takes care of the coordination between the applicant and the various authorities having jurisdiction on HRS: Region of Lombardy, Technical Revenue Office, Local Health Service (ASL, Azienda Sanitaria Locale), Regional Environmental Protection Agency (ARPA, Agenzia Regionale Protezione ambiente) and Mantova's Provincial Fire Brigades Headquarters.
After construction of the HRS, the second step is to apply to the City Council for the HRS operating licence.

With reference to the ZeroRegio's HRS in Mantova, the procedure to construct and operate a new HRS in Italy can be summarized in three different phases:

- Basic definition of the project design
- Application for the building permit
- Application for the operating licence

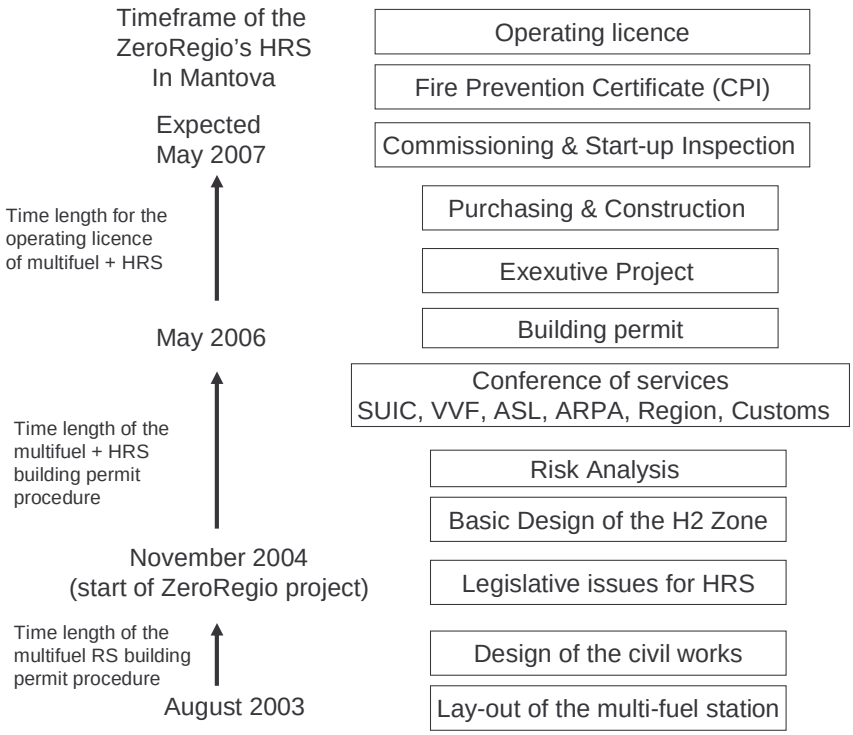

Figure 1 : Example of an approval flow chart for a new HRS in Italy

B Required information

Each authority having jurisdiction requires specific information in its area of responsibility. The City Council requires mainly drawings and lay-outs of the buildings and surroundings, in order to check conformity to the general plan of land use.
The Provincial Fire Brigades requires detailed information especially regarding the preventing and mitigating measures to address expected safety problems. A check list of the required documents is included in DPR (Decree of the President of the Republic) n. 37/1998 as Annex 1.

C–D External and occupational safety policy, regulations and technical standards

External Safety Policy

Due to the small amounts of dangerous substances involved, an external safety study is not legally required for an HRS, as for other low-to-medium risk activities.

In Italy the approval of a conventional refuelling station is based both on regulations and on risk. A QRA for each station is not required. However, being the first public HRS in Italy, a quantitative risk analysis as prescribed by the "High Risk Activities"

Seveso Directive was also considered in the approval procedure for the ZeroRegio's HRS in Mantova.

Regulations and technical standards
No special regulations exist for H2. Therefore regulations for similar substances, especially CNG, were used for the HRS in Mantova:
Compressed natural gas regulations in Italy:

- Ministry of Interior Decree DM 28 June 2002 Revision of DM 24 May 2002 "Fire protection regulation for the design, the construction and the operation of CNG Refueling station"
- Ministry of Interior Decree DM 16 November 1999 Modification of DM 24 November 1884 "Fire protection regulation for the transport, the distribution, the storage, and the use of natural gas with density not higher than 0.8"
- Ordinary Annex of GU (Official Journal for Italian laws) n. 12 of 15 January 1985 "CNG refuelling stations for automotive applications"

Other documents taken into consideration comprise:

- US NFPA 50A
- EIGA 15/96,
- ISO 15916,
- EU Directive 96/82/EC (Seveso II), as implemented by Decreto Legislativo n. 334 of 17/8/1999, in particular for QRAs

Also more general regulations were used, like the Pressure equipment Directive 97/23/EC, Machine guideline 89/392/EC, Low voltage guideline 93/68/EC, EM compatibility guideline 389/336/EC, ATEX

E-F Methodologies and guidelines for the assessment of external (off-site) effects, damage and risks; land-use planning

In Italy no QRA is to be carried out for a conventional refuelling station. The request of a QRA for a HRS is discretionary. It will remain so until specific requirements for HRS are specified by regulations.

Authorities felt that guidelines and safety distances applied to CNG refuelling stations were adequate also for HRS. Some site-specific safety provisions may be required.

The location of the HRS must be compliant with the City Council's general plan and zoning ordinance for ordinary refuelling stations and preferably CNG refuelling stations.

In case the HRS is located in an area comprising an high-risk activity, local authorities at the higher level than the City Council, i.e., the Province and/or the Region has to compile a risk analysis report of the whole area by putting together the information provided by each single activity in the area. This document must take into consideration also any planned future business or building activity in the area.
Anyway, there is no specific provision for HRS.

G Inspection

Again, no specific protocol exists for HRS inspections. General procedure for conventional or, better, CNG refuelling station will apply. Only the first inspection during the plant start-up will be carried out by all inspecting bodies simultaneously. The fire brigades will make an inspection every three year.

H Emergency planning

The owner of the HRS as to provide an internal emergency plan to the City Council in order to obtain the operating licence.
External emergency plan for HRS are similar to ordinary and CNG refuelling stations.

I Dissemination of the HyApproval handbook

All organisations would be in favour of and use a handbook if it would contain relevant information with respect to their field of responsibility. Some authorities expressed their expectation that the handbook should contain a set of guidelines shared between all bodies involved in authorization process. The suggested ways to disseminate the handbook comprise posting it on the Internet, sending a promotional letter by ordinary mail to prospective interested people, communication to professional societies, e.g. Engineers' Societies and trade associations, e.g. Industrial Associations. These latter might then alert their members through their news bulletins. Fire Brigades' executives suggested the publication of articles about the handbook or extracts of the handbook in journals specialized in safety issues, in particular in "Obiettivo Sicurezza" (Target: Safety), i.e., the Official Journal of The Italian Fire Brigades. According to some interviewee the formal recognition of the handbook by Italian authorities would greatly help its dissemination and its acceptance among the Italian organisations and bodies most concerned in the HRS approval process. One interviewee expressed some concern about the linguistic barrier and wished a version of the Handbook in Italian language to be available.

J Gaps

No gaps in the topics covered by this questionnaire was mentioned.

5. Short summary of the interviews in Spain.

All interviews (3 in number) have taken place in Spain (Madrid and Barcelona). Below is a summary of the results. The topics in the interview protocol are:

A	Interviewed stakeholders involved in the approval process
B	Required information by the authorities
C – D	External and occupational safety policy, regulations and technical standards
E - F	Methodologies and guidelines for the assessment of external (off-site) effects, damage and risks; land use planning
G	Inspection
H	Emergency planning
I	Dissemination of the HyApproval handbook
J	Gaps

A. Stakeholders

The following stakeholders were interviewed:
Inspection authority:
- Secretaría de Industria (Department of Industry, Government of Cataluña)

Owner:
- TMB (Municipal Transportation Company Barcelona)
- EMT (Municipal Transportation Company Madrid)

All these organizations were involved with the two HRS that were built in Barcelona and Madrid as part of the EU sponsored CUTE (Clean Urban Transport for Europe) program, an experimental application of hydrogen as a fuel source for public transport buses in 10 European cities. In Barcelona, as well as in Madrid, the two HRS were built at the site of the bus parking.
In Barcelona, hydrogen is generated through electrolysis, stored and dispensed on site. In Madrid, hydrogen is generated through reforming of natural gas and also stored and dispensed on site.
Both of them, Madrid and Barcelona, have 3 H2 powered buses (fuel cells) each one.

The approval process

The process has been different depending on the city.
Barcelona: The first step to be taken is to inform the owner of the land (Consorcio Zona Franca) where TMB is located, then to apply for the *environmental permit* by the (future) owner of the HRS (TMB= Municipal Transport Company) through BOVIS LEND LEASE. BOVIS is an engineering working for BP Solar which was the company that made the Gas Station.
Once the permit from the environmental side was granted, then they had to apply for the *building permit*, also through BOVIS. Often both permits are prepared more or less simultaneously, but the permissions were given temporarily due to the nature of the installation. The building permit is given by the City Council but with the positive approval of Industry Department of the Generalitat.

In this City, Fire Brigade was not consulted in the approval process.

Madrid: First step is to apply for the environmental permit as well as the building permit. Both permission were also given temporarily and duly extended yearly. The engineering in charge of this task was Air Liquide. In that case, also the permission was obtained once the Industry Department of the local government was consulted. In Madrid, Fire Brigade obliged to EMT to install a big tank of water in order to extinguish any possible fire.

B Required information

BOVIS, in Barcelona, primarily needs technical information from BP: description of the HRS and its operation, Process Flow Diagrams, HRS lay-out, location and its surroundings, mitigating safety measures including explosion and fire protection, shut-off procedures
Air Liquide, in Madrid, did not need further information because they built the HRS. But all the mentioned information above was also given to the Industry Department.
Fire brigade needs no technical details, but a short description of the processes and risk assessment studies; is especially interested in the effects and intervention measures. In both cities, Fire Brigade were informed about the shut off valves in the buses and different intervention procedures. This information was given in the two Municipal Transportation Companies.
City council only needs application form from the engineering in charge of the approval process (both cities).
Industry Department needs this application form, and occasionally underlying technical documents are required.

C–D External and occupational safety policy, regulations and technical standards

External Safety Policy
External safety is part of the environment permit. No particular attention was paid to occupational health. In Barcelona some measures related to the visual impact were taken.

In Spain the approval is based on the approach of an HRS to a standard Refuelling Station taking into account the pressure reservoirs normative.

Particular attention is paid to safety measures preventing / detecting H2 leakages in closed areas.

Adequacy of measures was very much based on the competence of the operator and the constructor/supplier of the installation. In that case, both constructors (Air Liquide and BP) have a wide experience managing hydrogen installations.

Regulations and technical standards
No special regulations exist for H2. Therefore regulations for similar substances were used for the two Spanish HRS (CUTE projects Barcelona and Madrid):

Compressed natural gas regulations in Spain NL (Real Decreto 2486/1994),
ITC MIE-APQ-5: “Almacenamiento y utilización de botellas y botellones de gases comprimidos, licuados y disueltos a presión”,
ISO/TR 15916:2004 “consideraciones básicas para la seguridad de los sistemas de hidrógeno”,
Seveso-related regulations,

Also more general regulations were used, like the Pressure equipment Directive 97/23/EC, Machine guideline 89/392/EC, Low voltage guideline 93/68/EC, EM compatibility guideline 389/336/EC, ATEX, BAT

E-F Methodologies and guidelines for the assessment of external (off-site) effects, damage and risks; land-use planning

In Spain no QRA will need to be done for each station. No specific guidelines exist for HRSs and until specific requirements for H2 are specified the existing normative for compressed natural gas is used, taking into account the special characteristics of H2.

Authorities felt the guidelines and models used were adequate because in both cases the HRS were not public ones, but into special installations in the buses stations.

G Inspection

Again, no specific protocol exists. Fire brigade applies general checklist. Owner (EMT and TMB) does visual checks but without high regularity. Also supplier of equipment does 6 monthly check or, at least, the time suggested for the devices manufacturer. This, however, is primarily because of the novelty and the experimental character of the Madrid and Barcelona HRS.
An inspection regime would have to be set in accordance with the risk imposed by the HRS. Technical reliability of the HRS is now determined by equipment supplier (Air Liquide and BP). Owner is alerted when replacements are due.

H Emergency planning

It does not exist a specific emergency plan for the two HRS in Spain. There are general Emergency plans belonging to the whole bus installations, which have to be practised once a year. The requirements regarding accessibility of the location by the fire brigade may also affect the location of an HRS. Fire Brigade only were informed about the security in vehicles.

I Dissemination of the Hy-Approval handbook

All organisations would be in favour of and use a handbook if it would contain relevant information with respect to their particular problems: e.g. Competent Authority would

like an overview of what (functions, buildings) can be allowed near HRSs; Industry Department would like to see technical standards. Fire brigade would like an overview of intervention measures. If there is lack of knowledge on any of these aspects or there is no clarity about regulations and technical standards to be used, this may slow down the approval process.

J Gaps

As well as NL, also in Spain was mentioned that the public was missing from out interview.

6. Short summary of the interviews in France.

All interviews (4 in number) have taken place in France. Below is a summary of the results. The topics in the interview protocol are:

A	Interviewed stakeholders involved in the approval process
B	Required information by the authorities
C – D	External and occupational safety policy, regulations and technical standards
E - F	Methodologies and guidelines for the assessment of external (off-site) effects, damage and risks ; land use planning
G	Inspection
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I	Dissemination of the Hyapproval handbook
J	Gaps

A. Stakeholders

The following stakeholders were interviewed:
Competent Authorities:

Mr. Christophe EMIEL
Ministère de l'Ecologie et du Développement Durable
Direction de la prévention des pollutions et des risques
Service de l'environnement Industriel
20, avenue de Ségur
F - 75302 PARIS 07-SP

TEL +33-1-42-19-14-14
FAX +33-1.42.19.13.93
Christophe.emiel@ecologie.gouv.fr
http://www.ecologie.gouv.fr

Inspection authority:

Inspection authority (DRIRE) has not accepted to answer to our questionnaire. However, Mr Christophe EMIEL coordinates the DRIRE activities related to hydrogen installations and classified sites in general.

Owner:

No Hydrogen refueling station owner in France

Fire brigade:

- Civil security
  Mr Eric PHILIP
  Risques Technologies et Risques Chimiques
  Direction de la Défense et de la Sécurité Civiles
  Adresse Postale :
  Place Beauvau

F - 75800 PARIS
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Coordination of H2 founded projects in France

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All these organizations are involved in the approval of ICPE (Installation Classées pour la Protection de l'Environnement). It was quite difficult for the people interviewed to give clear answers to the question listed in the interview protocols. In most of the cases the answers were quite open. The recent application of LOI BACHELOT in France voted after the Toulouse AZF explosion and enforced since September 2005 added some confusion in the answers given.
There is however in the current nomenclature sufficient chapters to cover hydrogen refueling stations :
Circulaire du 24 mai 1976 relative aux dépôts d'**hydrogène** liquide :
http://aida.ineris.fr/textes/circulaires/text0365.htm

Arrêté type - Rubrique n° 1416 : Stockage ou emploi de l'**hydrogène** :
http://aida.ineris.fr/textes/nomenclature/at1416.htm

Loi Bachelot, arrêté du 29 septembre 2005 :
http://aida.ineris.fr/textes/arretes/text3804.htm

The approval process
The approval process is pretty straight forward and is not specific to hydrogen refueling station but to any "ICPE".
In the case of hydrogen, only the quantity of hydrogen is important : for installation comprising less than 100kg of hydrogen, no formality is needed. In the case of installation comprising between 100 and 1000 kg, a simple declaration to DRIRE is enough. For more than 1000 kg, an authorization from DRIRE must be obtained. The delay to

get an authorization is usually more than 18 months. In case there is production of hydrogen the approval route is to go thru an authorization.
In any case, the owner of the refueling station has one single entry point with the governmental services : the local DRIRE under the supervision of the préfet of département..

B Required information for authorization / declaration

In case of declaration, the following information is required by DRIRE :

- Declaration of installation of pressurized equipment (art. 15 § 1er et 19 de l'arrêté du 15 mars 2000 modifié),
- Description of the installation and of the elements important for safety
- Implementation drawing, scale 1:25000
- Plot plan, scale 1:500 with safety aeras (ATEX zoning and aeras forbidden for public and vegetation

In case of authorisation is required, the following information will be required by DRIRE :

- description of the HRS and its operation,
- components, pipelines, Process Flow Diagrams,
- HRS lay-out
- location and its surroundings
- hazard identification studies
- risk assessment studies
- mitigating safety measures including explosion and fire protection
- shut-off procedures
- impact study on environment in day to day use.

The official procedure for authorization is available here :
http://www.drire.gouv.fr/environnement/proc_aut.html
In case of SEVESO site, requirements from the directive are added to these points

C–D External and occupational safety policy, regulations and technical standards

The approach in France has changed following the application of Loi Bachelot : Article 4 of loi bachelot introduces the probability of occurrence of an accident, the consequences the kinetics and the gravity of the accident must be evaluated. Therefore all risks must be studied and listed, all consequences must be described, and it is the responsibility of the owner to demonstrate that the mitigation measures taken makes the risk acceptable.
As no equivalent of purple book exists, the DRIRE might require that the evaluation of the risk by the owner of the site be validated by a third party even if article 2 of loi Bachelot includes the possible reference to existing databases or sites.
The acceptability of a risk as per law is given by the following table :

Classe de probabilité / Type d'appréciation	E	D	C	B	A
qualitative[1] (les définitions entre guillemets ne sont valables que si le nombre d'installations et le retour d'expérience sont suffisants)[2]	« événement possible mais extrêmement peu probable » : *n'est pas impossible au vu des connaissances actuelles, mais non rencontré au niveau mondial sur un très grand nombre d'années installations..*	« événement très improbable » : *s'est déjà produit dans ce secteur d'activité mais a fait l'objet de mesures correctives réduisant significativement sa probabilité.*	« événement improbable » : *un événement similaire déjà rencontré dans le secteur d'activité ou dans ce type d'organisation au niveau mondial, sans que les éventuelles corrections intervenues depuis apportent une garantie de réduction significative de sa probabilité.*	« événement probable» : *s'est produit et/ou peut se produire pendant la durée de vie de l'installation.*	« événement courant » : *s'est produit sur le site considéré et/ou peut se produire à plusieurs reprises pendant la durée de vie de l'installations, malgré d'éventuelles mesures correctives.*
semi-quantitative	**Cette échelle est intermédiaire entre les échelles qualitative et quantitative, et permet de tenir compte des mesures de maîtrise des risques mises en place, conformément à l'article 4 du présent arrêté**				
Quantitative (par unité et par an)		10^{-5}	10^{-4}	10^{-3}	10^{-2}

E-F Methodologies and guidelines for the assessment of external (off-site) effects, damage and risks; land-use planning

Once again, the evaluation of off site effects, damage and risks is the responsibility of the owner and must be done with both quantitative and qualitative methods with a risk based approach but without commonly accepted methods or software.
Although most of the interviewees seem to be quite open to new processes and projects, with a clear goal not to kill new developments (in most of the case we see multiple choice answers in the questionnaire), it is not obvious that such broadmindedness would have to be validated in a real life project as each aspect is subject to interpretation of the local inspector. It is clearly for this reason that despite the efforts made, no DRIRE inspector has accepted to answer the questionnaire.
Offsite effects are quantified as per the following table :

NIVEAU DE GRAVITÉ des conséquences	ZONE DÉLIMITÉE PAR LE SEUIL des effets létaux significatifs	ZONE DÉLIMITÉE PAR LE SEUIL des effets létaux	ZONE DÉLIMITÉE PAR LE SEUIL des effets irréversibles sur la vie humaine
Désastreux.	Plus de 10 personnes exposées (1).	Plus de 100 personnes exposées.	Plus de 1 000 personnes exposées.
Catastrophique.	Moins de 10 personnes exposées.	Entre 10 et 100 personnes.	Entre 100 et 1 000 personnes exposées.
Important.	Au plus 1 personne exposée.	Entre 1 et 10 personnes exposées.	Entre 10 et 100 personnes exposées.
Sérieux.	Aucune personne exposée.	Au plus 1 personne exposée.	Moins de 10 personnes exposées.
Modéré.	Pas de zone de létalité hors de l'établissement		Présence humaine exposée à des effets irréversibles inférieure à « une personne ».
(1) Personne exposée : en tenant compte le cas échéant des mesures constructives visant à protéger les personnes contre certains effets et la possibilité de mise à l'abri des personnes en cas d'occurrence d'un phénomène dangereux si la cinétique de ce dernier et de la propagation de ses effets le permettent.			

G Inspection

Inspection of ICPE in France is clearly organized and not delegated to private notified bodies (except for pressure vessels). The protocol for inspection is available (in french) at the following address : http://www.drire.gouv.fr/environnement/controle.html
It is under the responsibility of the DRIRE under the sole authority of the Préfet.
In France, 850 inspectors are in charge of 63200 installations subject to authorization.
In case of request from the préfet combined inspections by veterinary (in case of refuelling station in a supermarket when food is sold), DRIRE, and fire brigades can be done.

H Emergency planning

Emergency planning is organized by the “sécurité civile” which coordinates the actions of the delocalized fire brigades (department level)
In case of Hydrogen refuelling station a dedicated plan (part of ORSEC ORganisation des SECours) would be made describing

- availability of evacuation infrastructure
- accessibility for fire brigades
- protection of fire brigade
- meeting points
- escape routes

The aim of the ORSEC is to

1- Fight the effects of the accident
2- Protect the inhabitants
3- Manage the effects on the immediate surroundings

No formal link is done between emergency planning and site inspections, even if combined inspection can be made.

I Dissemination of the Hy-Approval handbook

All organisations would be in favour of and use a handbook if it would contain relevant information with respect to their particular problems
There is also within the state department a clear need for such a document as a reference document which could list the best practices and some practical studies.

J Gaps

Gaps identified are the ones already included in the current law : the classification of the risks is based on the quantity of hydrogen stored on site, regardless of the pressure, type of tanks and location of the tanks. The risks associated to non classical technical solution (buried storages for instance) would also be interesting to develop.

7. Short Summary of the Interviews in the United States.

Interviews (six in number) have taken place in the United States. Below is a summary of the results. The topics in the interview protocol are:

A	Interviewed stakeholders involved in the approval process
B	Required information by the authorities
C – D	External and occupational safety policy, regulations and technical standards
E - F	Methodologies and guidelines for the assessment of external (off-site) effects, damage and risks ; land use planning
G	Inspection
H	Emergency planning
I	Dissemination of the Hyapproval handbook
J	Gaps

A. Stakeholders

Permitting of Hydrogen Fueling Stations (HFS)in the United States is not done by the Federal Government. It is done in the states. The following states were queried: New York (NY), Michigan (MI), Florida (FL), California (CA), Nevada (NV) and the District of Columbia (DC). The permitting process is performed in the individual states in any of **three modes**, depending upon the state:

(1) Entirely at the state level: MI, DC
(2) Collaboratively involving the state and the local government where the project is to be sited: NY, CA
(3) Entirely at the local government level: FL, NV

The following stakeholders were interviewed (depending upon the state):
Competent Authorities:

- Office of the State Fire Marshal/ Office of the Fire Marshal in the Authority Having Jurisdiction (AHJ)
- Department of Environmental Quality (State level)
- State Division of Code Enforcement (NY)
- California Air Resources Board (CA)

Inspection authority:

- Office of the State Fire Marshal/ Office of the Fire Marshal in the Authority Having Jurisdiction (AHJ)

As mentioned above, the organizations involved depend upon the specific states where projects are to be sited. Whether or not the hydrogen is shipped to the facility or generated on site does not, in general, impact the permitting process with respect to the entities involved.

The approval process
In general, the first steps to be taken are to: (i) establish which government agencies will be involved in the permitting/approval process; (ii) notify those agencies regarding

the intention to construct and operate a fueling station and determine what their requirements are; and (iii) determine requirements for community relations efforts – to facilitate community acceptance of the project. ***Failure to address community concerns and issues has delayed implementation of projects for which approval had been granted.***

B Required information

In general, the state and/or local government agencies involved in the permitting/approval process require the following information to work through the process;

(1) Technical description of the project, including design drawings and schematics, listing of system components, site sketches showing locations of tank systems with respect to buildings and property lines, etc.
(2) Description of safety systems, including fire suppression and control
(3) Listing of applicable codes and standards documents
(4) Environment impact assessments, as applicable
(5) Proposed emergency operational procedures
(6) Hazardous materials issues, if applicable

C–D External and occupational safety policy, regulations and technical standards

External Safety Policy

External safety was determined to be an important issue in all three of the permitting/approval modes. Uniformly, the issue is addressed using adopted national codes and standards or adopted codes and standards that have been modified by the states and/or state regulations

In addition, there were cases where safety policies were formulated based on experience with CNG.

In those cases where the state has primary jurisdiction, in general, the local government can establish more stringent safety requires, following state rules for doing so.

No systematic attention was paid to occupational safety. The approach for addressing it is via vendor training programs.

It cannot be generalized whether particular attention has been paid to specific safety measures such as preventing / detecting hydrogen accumulation under shelters, roofs canopies, etc. The permitting authorities follow the applicable codes, standards and regulations in effect in their jurisdictions.

Adequacy of measures was very much based on expert judgement, relying on the competence of the operator and the constructor/supplier of the installation.

Regulations and technical standards

The following codes and standards have been used in the permitting/approval process:
NFPA 52

NFPA 55 (created by combining NFPA 50A and 50B)
NFPA 30A
NFPA 70
NFPA 57
ASME BPV Code, Section VIII, Div.I and Section IX
State Regulations (in the cases of New York, Florida, and Michigan)

E-F Methodologies and guidelines for the assessment of external (off-site) effects, damage and risks; land-use planning

In general, states or local governments do not perform quantitative risk assessments nor do they require them of project developers. However, in the United States, it is very common for project developers themselves to perform quantitative and/or qualitative risk assessments and/or FMEAs.

Permitting authorities rely on applicable codes and standards and/or state regulations for determining the adequacy of safety distances.

G Inspection

In general, while the states are involved (at least in part) in the permitting/approval process, they are not involved in conducting periodic (i.e., annual or unannounced) inspections of hydrogen fueling stations. Uniformly, this is the responsibility of the local fire marshal and/or fire department. Local fire protection authorities, in general, have the authority to cite project operators for violations of safety regulations or shut down a facility if they believe that there is an imminent fire safety hazard.

In nearly all projects, the operators and/or vendors have documented, systematic inspection protocols.

H Emergency planning

In general, development of an emergency action plan and emergency operating procedures are requirements, regardless of the governmental permitting/approval agency.

In general, there are no uniform requirements across the states for conducting annual tests of emergency plans. In addition, it is not clear that there are mandatory requirements across all states for direct communication links between the local fire departments and fueling stations.

I Dissemination of the Hy-Approval handbook

None of the states involved in the survey were familiar with Hy-Approval or a proposed Hy-Approval Handbook. Currently, their focus is on national codes and standards documents.

J Gaps

As mentioned above, permitting authorities (as well as project developers) are aware of the importance of the local community being involved – up front and in the beginning – in the permitting/approval process.

8. Germany (different format)

Generally it can be said that in Germany all necessary procedures and regulations are in place to approve HRS.

Responsible bodies

The approval of HRS in Germany has been executed for a number of HRS already. Most of the processes are regulated and the official …

A. Gewerbeaufsichtsamt (Bavaria)

The "Gewerbeaufsichtsamt" is the proper authority, supervising the commercial and industrial undertakings in Germany regarding occupational safety and health. The "Länder" as well as the "Bund" have delegated some of their responsibilities. The "Gewerbeaufsicht" is responsible for Administration, permission and prohibition of all registered commercial activities.

B. „Behörde für Soziales, Familie, Gesundheit und Verbraucherschutz" (Hamburg)

This authority is specially in Hamburg (Hamburg is a Bundesland on its own) responsible for the certification of all necessary paperwork before the erection of a HRS in Hamburg. Their main task is the protection of health of the inhabitants of Hamburg by ensuring a safe operation of installed industrial equipment especially in the public area. The "Amt für Arbeitsschutz (safety of workers)" is also a sub-activity of them.

C. "Regierungspräsidium Darmstadt, Abteilung Arbeitsschutz (Frankfurt)" (Hessen)

Like the other authorities before, also the Regierungspräsidium in Darmstadt is referring to the "Arbeitsschutz (safety of workers) when they are dealing with the certification of a HRS. Especially the §13 of the "Betriebssicherheitsverordnung (safety of operations)" is relevant and only after the successful proof of a safe operability of the planned HRS the permission for its operation is given.

Approval flow chart

Proceeding in the Permitting Procedure

1. Reconciliation Talk

   - After conclusion of a contract and development of a plant concept but prior to the permitting procedure, it is advised to hold a reconciliation talk with all involved parties onsite: competent permitting authority, applicant or his/her assignee (e.g. energy supply company), if applicable planning office, accredited supervisory board, equipment manufacturer, lower building inspection, petroleum company, fire brigade

   Discussion topics:

   - Description of overall conceptual layout
   - Determination of site of installation

- Determination of proceeding with the responsible permitting authority, e.g. commercial inspectorate

2. Compilation of Indispensable Application Documents for the Expert Statement on the Permitting Procedure[1]
   - Description and operating instructions of the natural gas refuelling station (dispensing unit)
   - Official/ certified layout plan of installation
   - Plant layout and general arrangement drawing
   - Installation plan, facilities and components
   - Piping and instrumentation scheme
   - Equipment and materials list
   - Listing of measuring and control systems
   - Locking plan
   - If already possible hazard appraisal and explosion protection document according to the regulation on industrial safety (BetrSichV)

3. Finalisation of the Permitting Application
   - Signature of the application by the applicant or an assignee
   - Forwarding of the application to the accredited supervisory board for the issuance of an expert statement

4. Approval by Customs Office
   - Permission for the distribution of natural gas for fuel uses by the distributor (e.g. petroleum company)

5. Issuance of an Expert Statement
   - by an accredited supervisory board, forming the basis for the permission by the competent permitting authority

6. Approval According to the Building Laws by the Lower Building Inspection
   - Comprehensiveness differs from one lower building inspection to the other, in case of doubt file request for clarification to authority

7. Permission Through the Competent Permitting Authority

[1] additional documents will be required latest during the examination according Topic 9

- Submission of the documents including the expert statement and if applicable the hazard appraisal together with the explosion protection document in requested number of copies
- Possible shortening of the procedure through simultaneous submission of the applications at the lower building inspection and the permitting authority

8. Erection of the Plant

Erection of plant with surveillance of construction (e.g. checking of HP-pipework)

9. Document for the examination of the plant before start-up
    - Permission answer of the responsible permission authority
    - Necessary documents and documents for pressure equipment and subgroups according to the PED (Pressure Equipment Directive) (conformity explanation, Manuals, Specifications)
    - Other necessary documents in accordance with European guidelines (Machine-guidline, ATEX, EMC, …)
    - Evaluation on endangerment according to “Betriebssicherheitsverordnung” and Ex.-protection documentation
    - Electrical connection (wiring-) diagrams
    - Action-plan of the fire brigade and safety response plan

10. Verification before the first start-up
    - Verification of the completeness of all documentation and its correctness (proofs, certifications)
    - Verification if installed plant and documentation match each other
    - Verification of correctness of installation (e.g. checking leak-tightness)
    - Verification of correct placing of the single units
    - Verification of the electric safety features and their functionality
    - Verification of the ex.-protection with potential-equalisation and flash-protection

11. Permission for the start-up of the plant and its operation
    - The certificate of the verification of the permitting authority and the weight and measures office is the basis for the permission

12. Determination of the inspection validity periods for the entire plant and components according to §15,1 (Betriebssicherheitsverordnung) by the operator on the basis of:

- safety relevant evaluation (can be a component of the endangerment evaluation)
- predefinition of to be fulfilled requirements

13. Evaluation of the definition of inspection periods by the permitting authority for the entire installation and parts of the installation according to §15,1 by the accredited supervisory board

14. Information on the inspection periods to be submitted to the relevant permitting authority.

I. Annex I - Interview Protocol

Below the interview protocol is shown, as used in all 6 countries is shown:

Questions to authorities involved in the approval procedure of hydrogen refuelling stations (HRS).

1. Introduction / General questions regarding existing HRS's.
The technology at the hydrogen station has to be specified because there are different approaches to the safety measures according to whether hydrogen is produced from natural gas or through electrolysis.
(note: some questions under 1. 1 until 1. 8 exclude each other)

1.	**Some characteristics of the HRS**	
1. 1	Is the H2 trucked-in CGH2 or LH2?	□ CGH2 □ LH2 □ not applicable
1. 2	Is it on-site reforming?	□ yes □ no if yes specify: □ natural gas □ methanol water □ kerosene □ coke oven gas □ naphta □ LPG □ □ desulphurised ed gasoline □ other ……..(specify)
1. 3	If applicable: is the feedstock supplied by pipe-line as per existing u/g lines?	□ pipeline above ground pipeline underground □ not applicable
1. 4	Is it on-site electrolysis?	□ yes □ no
1. 5	Is it a stand-alone site or combined with an ex-isting refuelling station?	□ stand-alone □ combined
1. 6	a. Is LH2 dispensed? b. Specific measures for LH2?	□ yes □ no if yes specify:
1. 7	At what pressure is the H2 dispensed: at 350 or 700 bar or a combination of all?	□ 350 bar □ 700 bar □ other ……..(specify)
1. 8	Specific rules or limits to how high the pressure can be in hydrogen tanks?	□ yes □ no if yes specify:
	Please enter other specifications ……..	

The questionnaire below is partly based upon questionnaires in the framework of other studies.[1] These questions have to be answered by the competent authorities in France, Italy, Spain, Germany, USA and the Netherlands.

[1] Shape Risk and

The role of the competent authorities varies and the elements under A until J may be identified. *It depends of the responsibility of the respondent which questions can be answered by the interviewee.*

A. the responsibility and liability of all stakeholders involved in the approval process
B. the required information by the authorities
C. the external and occupational safety policy concerning hydrogen
D. the assessment criteria for the technical systems of the HRS (to be provided by the HyApproval handbook)
E. availability of methodologies and guidelines for the assessment of external (off-site) effects, damage and risks
F. the issue external safety (off-site safety) and land use planning
G. the inspection protocol
H. the emergency planning
I. dissemination of the hyapproval handbook
J. gaps

A.	**Responsibility and liability of the stakeholders**	
A. 1	Stakeholders □ competent authority □ owner □ inspection authority □ fire brigade □ notified bodies for approval of equipment and assemblies of equipment. □ other, ……	Name: Visiting address: Post address: Contact person:
A. 2	a. Role of interviewee in the approval process in terms of responsibility and liability	Specify……
	b. Main stages in the approval process - sequence of the approval steps	Specify……
A. 3	Do the stakeholders communicate • to coordinate the requirements, • to determine the location of the HRS, • to discuss the milestones in the process • with notified bodies involved in approval of equipment and assemblies of equipment • with similar/other authorities to	 □ yes □ no □ yes □ no □ yes □ no □ yes □ no □ yes □ no

	ask for assistance?	
B.	**Required information by the authorities**	
B. 4	What information is required by the authorities in order to start the approval procedure?	□ description of the HRS and its operation, □ components, pipelines, Process Flow Diagrams, □ HRS lay-out □ location and its surroundings □ hazard identification studies □ risk assessment studies □ mitigating safety measures including explosion and fire protection □ shut-off procedures □ other, ……
C.	**External and occupational safety policy**	
C. 5	a. Are external and occupational safety issues concerning hydrogen refuelling stations (HRS) implemented in legislation?	□ yes □ no if no, go to C. 6 if yes, specify directive numbers
	b. has the authority any experience with hydrogen production/storage/transport etc.?	□ yes □ no if yes, specify
C. 6	If no specific legislation is available, please describe how external and occupational safety are considered in practice (are comparable processes for other compressed gaseous fuels like e.g. CNG in place and applied analogously to hydrogen?).	
C. 7	Is external safety linked to environmental/exploitation permit application procedures?	□ yes □ no if yes, specify
C. 8	Will the approval approach be: • Based on rules which mean that the licence to operate is given if the installation fullfills the requirements of those rules? • Risk based: for every new HRS installation, the whole approval process has to be followed and a QRA has to be performed? • Based on a deterministic approach (e.g. worst case, worst credible case scenarios)?	□ yes □ no □ yes □ no □ yes □ no

C. 9	Experience in the approval process: Were there any items/aspects either of technical or administrative nature that were particular/ exceptional/new in the approval process?	□ yes of technical nature, specify □ yes of administrative/ managerial nature, specify □ no
C.10	Will new legislation in the field of external safety be implemented in the near future and will it affect HRS's?	□ yes □ no if yes, specify
C.11	a. Was occupational safety considered during the approval process? b. Was the labour inspectorate involved? c. Were there any conflicts of interest between environmental and occupational issues?	□ yes □ no □ yes □ no □ yes □ no if yes, specify
D.	**Regulations and technical standards available**	
	The handbook will present the best practices for hydrogen refuelling stations as well as the regulations, codes and standards (RCS) affecting design, installation, operation and maintenance of a hydrogen refuelling station. Consequently the handbook will try to provide the answer to the following questions for future HRS's.	
D.12	Which mandatory regulations and technical standards defines the acceptability of existing (and planned) HRS installations?	□ apparatus according Pressure Equipment Directive Guideline 97/23/EC □ Machinery Guideline 89/392/EC □ Low voltage Guideline 93/68/EC □ Electro Magnetic Compatibility Guideline 89/336/EC □ Explosion safe e quipment according EX-Zone 1 at locations where H2 is present in apparatus en pipelines □ Best Available Technology (BAT) □ □ □
D.13	What kind of techniques/methods have been/are used to determine if technical systems meet the requirements?	
D.14	How do you determine if the measures taken are adequate?	

E	**Methodologies and Guidelines for the Assessment of External Effects, Damage and Risks**	
E.15	Does the approval process require the execution of a risk analysis in all circumstances?	□ yes, in all circumstances □ no, only if the production capacity exceeds ……. kg/h □ no, only ……. (specify)
E.16	Give an indication of the characteristics of the risk assessment • Qualitative versus quantitative analysis;	□ qualitative □ quantitative □ SAFETI □ RISKCURVES □ SAVE-II □ ……
	• Use of specific methodologies/software models/etc.;	
	• Are the models suited for calculations with Hydrogen?	□ yes □ no □ overestimation because …….. □ other ……..
	• Consequence (deterministic approach) based? Risk based? • Guidelines for scenario selection, assessment of damage/ probabilities of scenario occurrence/risks (individual risk contours, societal risks, …)	□ consequence based □ risk based □ CPR-18 Guideline □ worst case, worst credible case (specify) □ …… (specify) □ …… (specify)
	• Taking into account existing/planned mitigating measures;	□ yes □ no
	• Taking into account the implementation of management systems on safety and/or environment (e.g. OHSAS18000, ISO14001, etc…);	□ yes □ no
E.17	a. Are safety distances applied, either within the establishment (for instance hazardous area classification) or outside the establishment (for instance risk contours) applied, or both? b. Is the ALARP[1] principle applicable?	□ inside yes □ inside no □ outside yes □ outside no □ yes □ no
F.	**External safety and land-use planning**	

[1] ALARP: As Low as Reasonably Practicable.

F.18	a. Is external safety linked to land-use planning? b. Is it applicable to HRS?	□ yes □ no □ yes □ no
F.19	Is there a policy to avoid the establishment of HRS's and similar activities in populated areas?	□ yes □ no please provide examples.
G.	**Enforcement auditing or inspection**	
G.20	Which documents should be available at the establishment, in the operation phase?	□ licence to operate from the competent authorities □ documents for pressure equipment according PED Directive 97/23/EC □ ATEX-documents Directive 94/9/EC □ Machinery directive 98/37/EC □ documents according any other EC directive: please specify □ hazard assessment studies □ electrical switch plans □ Interlock system □ alarming and emergency plan □ other …… □ □
G.21	Description of (expected) inspection protocol	□ inspection of documentation on completeness and accuracy, □ correctness of the installation and assembly (for instance leakage inspection), □ inspection set-up according to regulations, □ inspection of electric facilities/provisions, □ inspection of explosion protection measures □ ……. □ …… □ …….
G.22	Is it advisable to combine inspections regarding the enforcement of regulations by the various inspection bodies? For instance combined inspection by the labour inspection and environmental inspection?	□ yes □ no
G.23	a. How frequent would a hydrogen station have accomplish an inspection and which criteria should be applied after first permit	Every ... month / year

	period? b.Are there criteria set by inspectors that they would demand as evidence for continuous safe operation?	☐ yes ☐ no if yes, specify
H.	**Emergency planning**	
H.24	Are emergency situations incorporated in land-use planning?	☐ availability of evacuation infrastructure ☐ accessibility for fire brigades ☐ …….. ☐ no
H.25	Referring to possible accident scenario's what kind of preparations should be taken by the various stakeholders and the emergency response organisations in particular? (e.g. ambulance, fire fighting organisation, police, municipality)	
I.	**Dissemination of the handbook**	
I.26	Would you use the Hyapproval handbook for future approval procedures of HRS's?	☐ yes ☐ no
I.27	What would in your country be the way to disseminate the handbook under the organisations/bodies most concerned in the hydrogen approval process?	
J.	**Gaps**	
J.28	Are there any gaps/subjects missing in this table that are important in the approval process?	☐ yes ☐ no if yes, specify