



**QUESTIONNAIRE REPORT ON  
HYDROGENERATORS FIRE PROTECTION UPDATE  
STUDY OF THE GROUP 6 - CONSULTING'S ANSWERS  
(March 2010)**

**Convener: Alexander Gromow (BR)**

**PLEASE READ THIS FIRST:**

This version of this paper was prepared for a CARE - *Computer Aided Reading* by means of “hyperlinks” that allow a fast and easy navigation throughout the pages either from the text part or the corresponding annexes.

We encourage you to take advantage of this possibility. The “hyperlinks” are marked by bold underlined text areas (**to activate the hyperlink on WORD version** hold the Control “CTRL” key down then press the left mouse button – pointing at the desired link – **on PDF version** – less precise – just click on the link):

a)- On the Index part the number of the question is the “hyperlink” that leads to the corresponding question.

b)- On the end of each question you find the following “Hyperlink”

[Back to Index] [Go to Annex]

That leads either back to the Index or to the corresponding annex.

c)- On the Annex Part you find at the end of each table the “hyperlink”:

[Back to Question]

That makes easy to come back to the corresponding question.

As you can see all efforts were made to ensure an easy and quick reading of this document. Now it's your turn...

**NOTE:** Before passing to the next step it is necessary to explain that the following research groups could not be considered in this work:

|   | <b>Group</b>   | <b>Answers received</b> |
|---|--|-------------------------|
| 4 | Erection, Commissioning, Refurbishment, Maintenance. | 4                       |
| 5 | Research Centers and Universities                    | 2                       |

The **Group 4 - Erection, Commissioning, Refurbishment, Maintenance**, had 4 answers and 3 of them confirmed not to have you dealt with hydro generators that were damaged by fire; thus they could not fulfill the requirements to participate in this work.

One Company from New Zealand, coded EMP015, did work on machines damaged by fire and answered with yes to the question: "In your experience, have you dealt with hydro generators that were damaged by fire?" Since they also fulfilled the questionnaire as Users their answer as Refurbishment Company did rely to some of its Group 1's answers. As a general statement and answering to the exploratory question "If yes, please indicate the tasks you were involved with and list some basic machine data of the equipment itself" they informed the following: "*Decide the solution/repair method, produce any specification required and supervise the repair work and project management. Obviously in the earlier days also did all tasks to show workers how I wanted thinks done. The most recent machines were 45MVA - 4 parrallel circuit lap wound units, that had been resin injected, to fill internal voids and prolong the life. The two units before that were 120MW units with epoxy windings, but had unusual endwinding taping system that was suspectable to moisture absortion. The 1984 unit was a 36MW wave wound unit with an epoxy winding and polyester caps.*" It was not possible to derive any conclusion on the Group 4 that ended not being considered in this work.

The **Group 5 - Research Centers and Universities** had 2 answers but none of the Research Centers did participate in any survey made specifically concerning the flammability of existing materials nowadays used in hydro generators manufacture. And therefore they did not meet the basic criteria to be of interest to this survey, that was to pursue any available testing made on modern insulating components do check their behavior towards fire. The intention was to check the statements Manufacturers use to make concerning the non flammability conditions of their products. In fact there may be differences between the insulation material components as raw materials and the final product, for instance stator bars, considering the handling during manufacture an erection works; but this aspect could not be checked this time.

**G** - This is the fifth step of this task that got answers of 9 Consulting Companies that contributed with their valuable participation concerning the **Group 6 – Consulting Companies**. Considering the possibility that the Consulting Companies invited to participate were not acquainted with the CIGRÉ's type of survey the following text was included to this group's questionnaire:

QUOTE

*This questionnaire is an UPDATE in which this particular section is dedicated to the **Consulting Companies** that usually issue at least the project specification for the Generator Fire Protection. As already stated before in our opinion from the fire protection standpoint, the generator and its housing have to be considered as a whole in the design when fire extinguishing is to be installed, in order to guarantee the system's functionality and efficiency integrated in the concept of the power plant as a whole. With these questions we intend to get valuable information from the particular stand point of the **Consulting Companies** in order to compose a picture as complete as possible of the subject we are dealing with to see if the opinions do converge or not to the same point.*

UNQUOTE

We include herewith for the sake of better understanding all answers to the corresponding questionnaire's questions related to this group. We include herewith for the sake of better understanding all answers related to this group, including those already shown in the first part of this task, as commented in the 2008 Paris Biannual Meeting. We will follow the item numbering of the first part as well as the item numbers of the original Questionnaire (with the numbering correction made in some items) with the prefix "G". The index of this part of the GFP UPDATE is as follows:

## **G 6 - Questionnaire with focus on Consulting Companies.**

[G 6.1](#) - Is your company specialized in the design of the Generator Fire Protection?

[G 6.1.1](#) - Should you work specifically with the Generator Fire Protection Equipment (not as a power plant designer) in which moment of the power plant's project are you normally engaged by your customer?

[G 6.2](#) - There are the factors (or reasons) that lead your clients to order a Generator Fire Protection project from your company. According to your experience, considering these factors, who decides if the generators have to be equipped with Generator Fire Protection?

[G 6.3](#) - If the choice is yours do you have a preferred extinguishing method?

[G 6.3.1](#) - If you have the choice, which is the extinguishing media you usually chose for:

[G 6.4](#) - From your experience, which is the type of generator fire extinguishing method more frequently used nowadays?

[G 6.4.1](#) - Do you recognize any change towards the former trend (status quo) in fire protection systems your country?

[G 6.5](#) - Are there standards recommending generator fire protection in your country?

[G 6.5.1](#) - If yes, which standards are these?

[G 6.5.2](#) - If not which standards do you follow in your work?

[G 6.5.2.1](#) - Are there critical items in the application of these Standards that require special attention?

[G 6.5.3](#) - Considering the existence of the recently launched standards (for instance NFPA 851), is there a need of any additional specific international standard on generator fire protection?

[G 6.5.4](#) - What is the state of the art in the detection in accordance to your experience?

[G 6.5.4.1](#) - Which are the types of detection devices you normally use and/or recommend?

[G 6.5.4.2](#) - Do you recommend any specific detection and control system to minimize unwanted fire extinguishing system operation (here is meant the unwanted release of the extinguishing media)?

[G 6.6](#) - Do you usually cooperate with the generator manufacturer on the Generating Fire Protection Question?

[G 6.7](#) - Do you usually cooperate with fire protection equipment manufacturer on the Generating Fire Protection Question?

[G 6.8](#) - Do you work also on refurbishment of Fire Protection Equipment on hydro generating plants?

[G 6.9](#) - Do you follow you projects during erection and commissioning phases?

[G 6.10](#) - In your opinion is a Generator Fire Protection installation required nowadays?

[G 6.11](#) - According to your opinion, is there any question that is missing in this part of the questionnaire?

Now passing to the detailed discussion of each item, not forgetting that the pertinent tables with the statistical records of all items are shown in the corresponding annex, we have:

**G 6.1 -**

6.1 - Is your company specialized in the design of the Generator Fire Protection:

- Isolated (only the equipment itself)
- Integrated in the power plant design
- Whole power plant design including the Generator Fire Protection

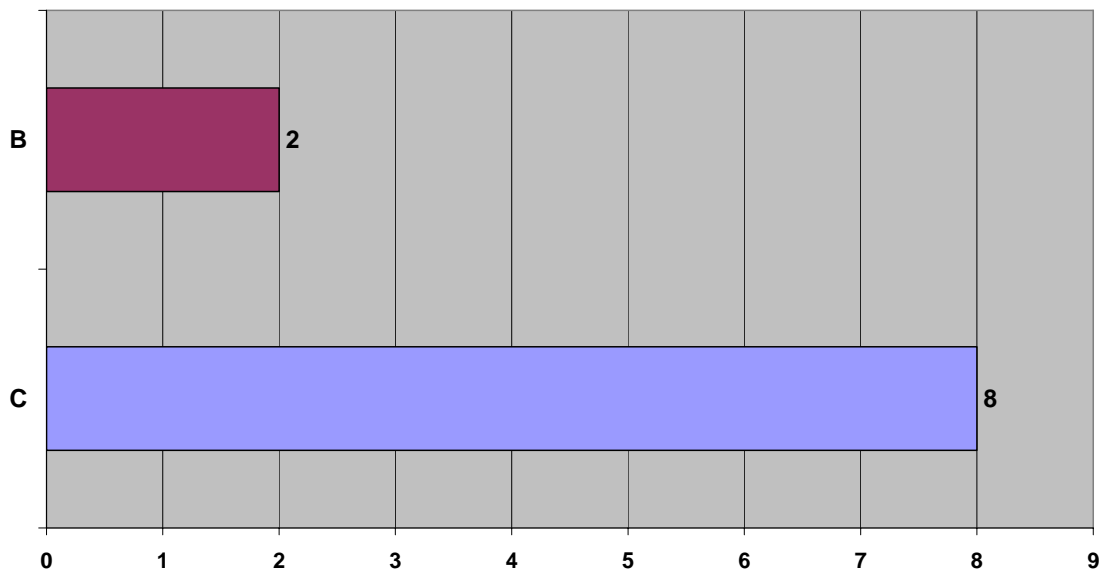
Any comment on that?

The check- box part of this combined question offered 3 alternatives, as follows, a categorization was made in order to allow a graph to be made (long alternative names):

| Category | Description  |
|----------|--|
| A        | Isolated (only the equipment itself)                             |
| B        | Integrated in the power plant design                             |
| C        | Whole power plant design including the Generator Fire Protection |

The statistics showed the following graph:

**6.1 - Is your company specialized in the design of the Generator Fire Protection?**



The German Consultant coded EMP030 ticked the categories “B” and “C” therefore the sum of votes is 10. The alternative “A” was not marked.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

Open question analysis results (Any comment on that?): in this case we got three comments, as follows:

-The English Consultant coded EMP035, explained that: “*Mott MacDonald are involved in carrying out feasibility studies and preparing performance specifications for hydro power plant.*”

-The Swedish Consultant coded EMP041, explained that: “*Our Company does not design GFP’s. Generally the whole power plant layout is supported*”

-The Swedish Consultant coded EMP049, explained that: “Fire extinguishing systems are normally only used for old generator types (Bitumen) and oil-filled transformers in underground position. Fire detection systems and evacuation of fire gases are installed in the plant.”

[\[Back to Index\]](#) [\[Go to Annex\]](#)

**G 6.1.1 -**

6.1.1 - Should you work specifically with the Generator Fire Protection Equipment (not as a power plant designer) in which moment of the power plant's project are you normally engaged by your customer:

- bid stage (in order to get the data for the Generator Fire Detection's specs)
- after the generator supplier was already defined
- in a stage when your expertise will be taken in to consideration in the whole project including the required civil work for the proper adaptation and safe function of the Generator Fire Protection
- None of the above, please specify:

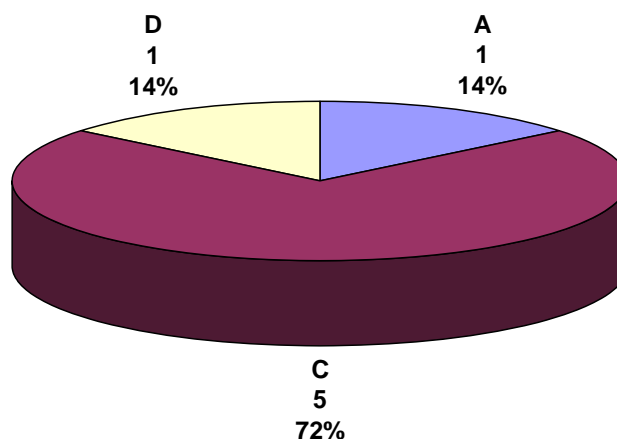
Any comment on that?

The check- box part of this combined question offered 4 alternatives, as follows, a categorization was made in order to allow a graph to be made (long alternative names):

| Category | Description  |
|----------|--|
| A        | Bid stage (in order to get the data for the Generator Fire Detection's specs)  |
| B        | After the generator supplier was already defined   |
| C        | In a stage when your expertise will be taken in to consideration in the whole project including the required civil work for the proper adaptation and safe function of the Generator Fire Protection |
| D        | None of the above, please specify:   |

The statistics showed the following graph:

**6.1.1 - Should you work specifically with the Generator Fire Protection Equipment (not as a power plant designer) in which moment of the power plant's project are you normally engaged by your customer:**



In this case two Consulting Companies did not make a selection.

Open question 1 analysis results (None of the above, please specify:) This exploratory question was answered only by the English Consulting coded EMP035 that did mark the alternative "" on the check-box part with "none of the above" and now answers to the request to specify it: *"Mott MacDonald would not normally work with generator fire protection specifically. Our involvement would be within the overall generator specification and our involvement would commence in a general way during a feasibility study and then in more detail"*

Open question 2 analysis results (Any comment on that?) This exploratory question got no answers.

**G 6.2 -**

6.2) There are the factors (or reasons) that lead your clients to order a Generator Fire Protection project from your company. According to your experience, considering these factors, who decides if the generators have to be equipped with Generator Fire Protection?

- The customer that place the order to you (not necessarily the final user – it may be the integrator)

- The insurance companies that demand it towards the final user in order to cover the power plant's risk

- The final user that may earn financial advantages towards the insurer by installing such a protection and requires it either directly or via integrator.

- Power plant workers Labor Union Demands towards the final users

- Final users' own internal philosophy

- You are asked to give an advice/opinion

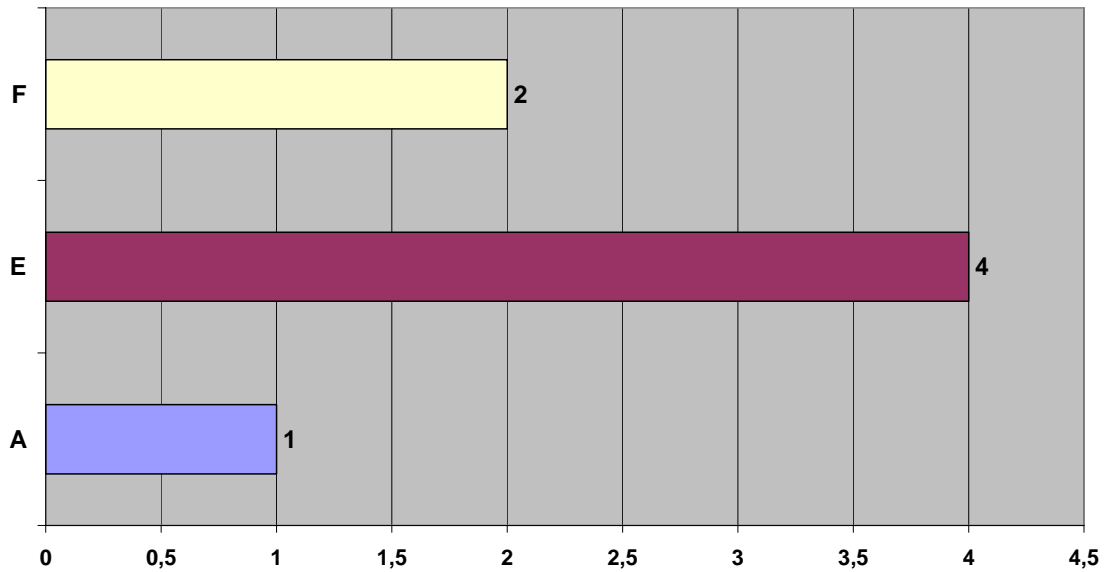
Any comment on that?

The check- box part of this combined question offered 6 alternatives, as follows, a categorization was made in order to allow a graph to be made (long alternative names):

| Category | Description  |
|----------|--|
| A        | The customer that place the order to you (not necessarily the final user – it may be the integrator)   |
| B        | The insurance companies that demand it towards the final user in order to cover the power plant's risk   |
| C        | The final user that may earn financial advantages towards the insurer by installing such a protection and requires it either directly or via integrator. |
| D        | Power plant workers Labor Union Demands towards the final users  |
| E        | Final users' own internal philosophy   |
| F        | You are asked to give an advice/opinion  |

The statistics showed the following graph, in which only the categories A, E and F were selected by the involved Consulting:

**6.2 - According to your experience, considering these factors, who decides if the generators have to be equipped with GFP?**



From the Consulting point o view it is more often that the use of GFP depends upon the “Final users’ own internal philosophy”.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

Open question analysis results (Any comment on that?): in this case we got three comments, as follows:

-The Swiss Consultant coded EMP011, explained that: “*Our Consulting Company, the Colenco Power Engineering, will not be ordered to supply the Generator Fire Protection System (GFPS). Generally, GFPS is a substantial part in the Specification and Delivery of the Generator.*”

-The English Consultant coded EMP035, explained that: “*Our recommendations on generator fire protection would be based on our own experience and the client/end users’ previous experience.*”

-The Swedish Consultant coded EMP041, explained that: “*We do not supply GFP’s. Generally the GFP’s purchaser decides if a generator has to be equipped with GFP.*”

[\[Back to Index\]](#) [\[Go to Annex\]](#)

**G 6.3 -**

6.3) If the choice is yours do you have a preferred extinguishing method?

- Yes

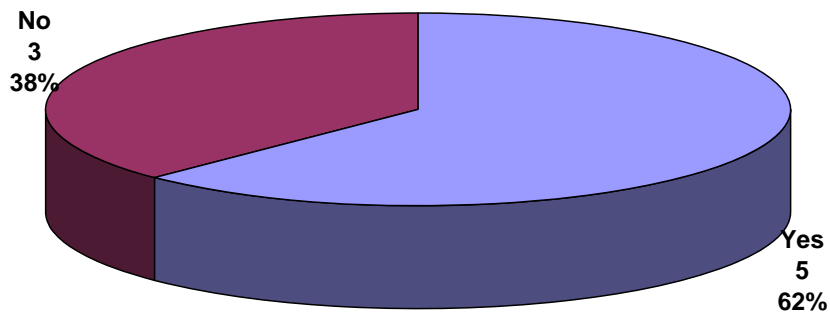
- No

If yes please indicate which:

If no, please indicate how you determine the extinguishing media for each particular case:

The check-box question analysis resulted in the following graphic:

**6.3 - If the choice is yours do you have a preferred extinguishing method?**



The majority of Consulting have a preferred extinguishing method, and this will be explored in the open question part, that is divided in two.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

Open question 1 analysis results (If yes please indicate which):

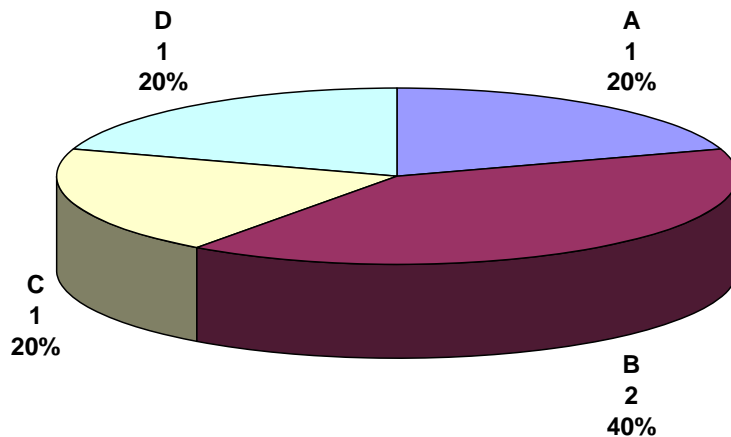
The answers received allowed to categorize and the result is the following:

| G 6.3 - If the choice is yours do you have a preferred extinguishing method? If yes please indicate which: |                             |          |
|--|-----------------------------|----------|
| Categories   | Legend                      | Quantity |
| A  | Inert gas (like Inergen)    | 1        |
| B  | Water                       | 2        |
| C  | CO2 or Inergen              | 1        |
| D  | Type according to Standards | 1        |
| E  | Blank                       | 4        |
| <b>Total of answered questions</b>   |                             | <b>9</b> |

The following graphic shows the result (the four blank answers were not considered):



**6.3 - If the choice is yours do you have a preferred extinguishing method?  
If yes please indicate which:**



[\[Back to Index\]](#) [\[Go to Annex\]](#)

Open question 2 analysis results (If no, please indicate how you determine the extinguishing media for each particular case): we got three answers whereas two from Sweden have the same text:

| G 6.3 - If the choice is yours do you have a preferred extinguishing method?<br>If no, please indicate how you determine the extinguishing media for each particular case: |  |
|--|--|
| EMP035 (United Kingdom)  | Most of the recent projects have been CO <sub>2</sub> generator fire protection. CO <sub>2</sub> was generally chosen because of previous client experience. |
| EMP059 (Sweden)  | With modern generators / windings that don't maintain fire, we usually don't install extinguishing facilities.   |
| EMP041 (Sweden)  | With modern generators / windings that don't maintain fire, we usually don't install extinguishing facilities.   |

Considering only the different answers we see a tie between CO<sub>2</sub> and Water.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

**G 6.3.1 –**

6.3.1) – If you have the choice, which is the extinguishing media you usually chose for:

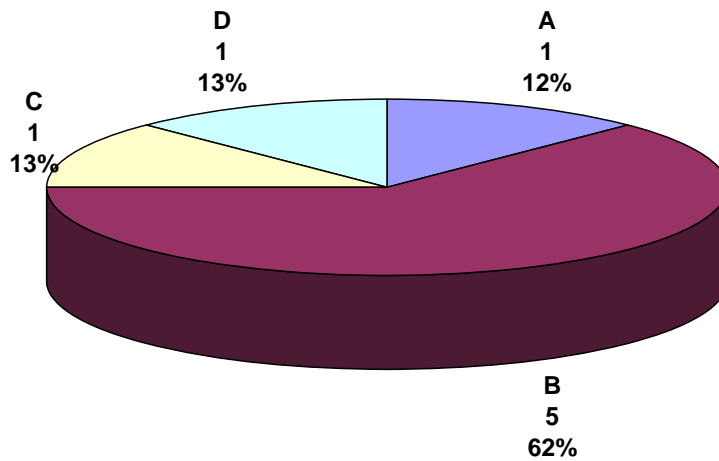
- a) Above water power plants (open-air):
- b) Cavern type power plants:

This pure open question is composed by two alternatives considering the local of installation of the power plant:

Open question 1 analysis - Above water power plants (open-air): the result of the categorized study can be seen on the graphic below (complete details on the corresponding annex):

| 6.3.1 - If you have the choice, which is the extinguishing media you usually chose for: above water power plants (open-air): |                         |          |
|--|-------------------------|----------|
| Categories   | Legend                  | Quantity |
| A  | Water, CO2 or inert gas | 1        |
| B  | Water                   | 5        |
| C  | CO2                     | 1        |
| D  | None                    | 1        |
| E  | Blank                   | 1        |
| <b>Total of answered questions</b>   |                         | <b>9</b> |

**6.3.1 - If you have the choice, which is the extinguishing media you usually chose for: above water power plants (open-air):**



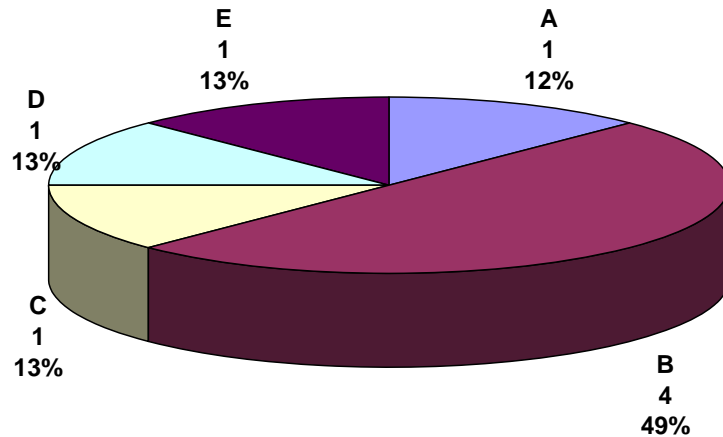
[\[Back to Index\]](#) [\[Go to Annex\]](#)

Open question 2 analysis - Cavern type power plants; the categorized study resulted as follows:

| 6.3.1 - If you have the choice, which is the extinguishing media you usually chose for: Cavern type power plants: |                       |          |
|---|-----------------------|----------|
| Categories  | Legend                | Quantity |
| A   | Water, CO2 or Inergen | 1        |
| B   | Water                 | 4        |
| C   | Inert gas             | 1        |
| D   | CO2                   | 1        |
| E   | None                  | 1        |
| F   | Blank                 | 1        |
| <b>Total of answered questions</b>  |                       | <b>9</b> |

The following graphic gives a visual display of the result:

**6.3.1 - If you have the choice, which is the extinguishing media you usually chose for: Cavern type power plants:**



Conclusion of this item: in either one of the alternatives the preference was Water.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

**G 6.4 -**

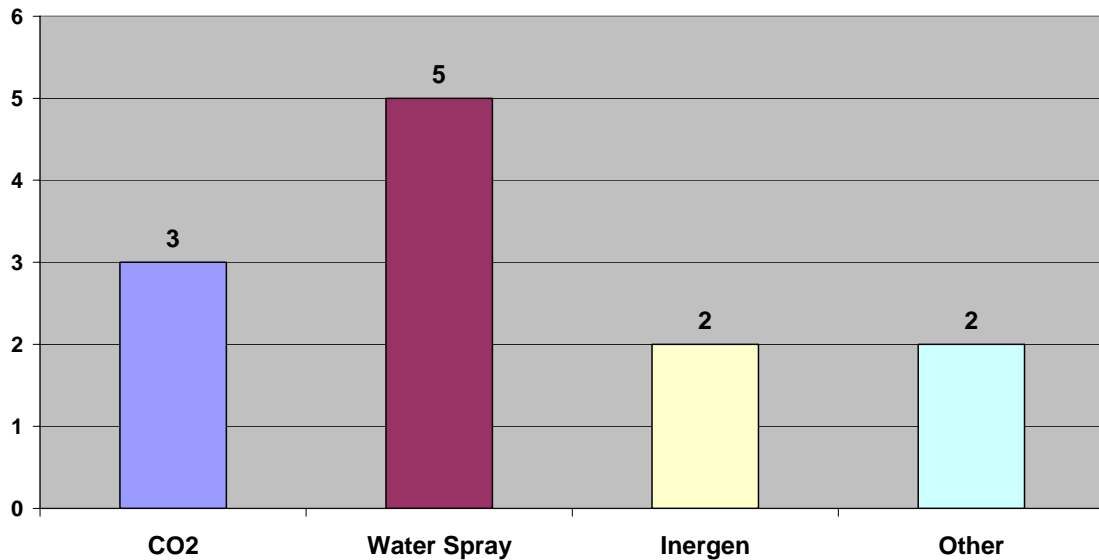
6.4) From your experience, which is the type of generator fire extinguishing method more frequently used nowadays?

- CO<sub>2</sub>
- Water Spray
- Inergen
- Other

If other please specify:

The check-box part of his question can be analyzed with the following graphic:

**6.4) From your experience, which is the type of generator fire extinguishing method more frequently used nowadays?**



This result shows two extinguishing medias that are gaining importance which are Water and Inergen. Three Consulting checked two alternatives each, therefore the total number of 12 alternatives checked in this case.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

Open question analysis (If other please specify), the answers can be seen below:

|                 |                            |
|-----------------|----------------------------|
| EMP042 (Norway) | For new installation, None |
| EMP049 (Sweden) | CO2 only on old generators |

[\[Back to Index\]](#) [\[Go to Annex\]](#)

#### G 6.4.1 -

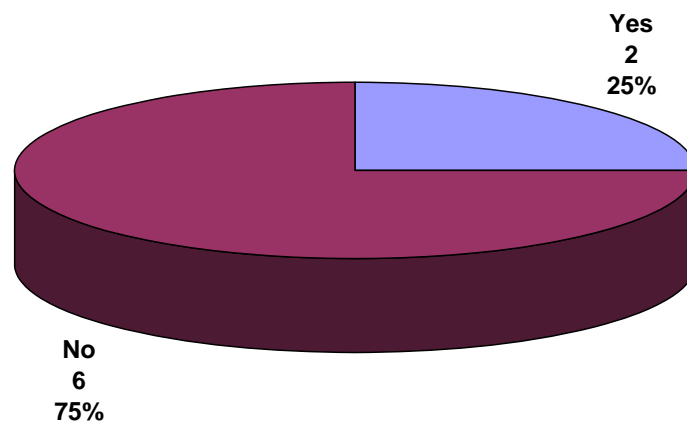
6.4.1) Do you recognize any change towards the former trend (status quo) in fire protection systems your country?

- Yes  - No

If yes, please state it here:

The check box part of this question resulted in the following graphic:

**6.4.1 - Do you recognize any change towards the former trend (status quo) in fire protection systems your country?**



This result shows that from the Consulting point of view there is no change in the former trend on GFP in the corresponding countries. There was one blank answer not considered in the graphic above.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

Open question analysis (If yes, please state it here); since there were two answers "Yes" here we present the corresponding statements:

-The Swiss Consultant coded EMP011, explained that: "*There are more and more inert gas fire protection systems.*" In fact this survey shows the advance of Inergen as extinguishing media in Waterpower applications.

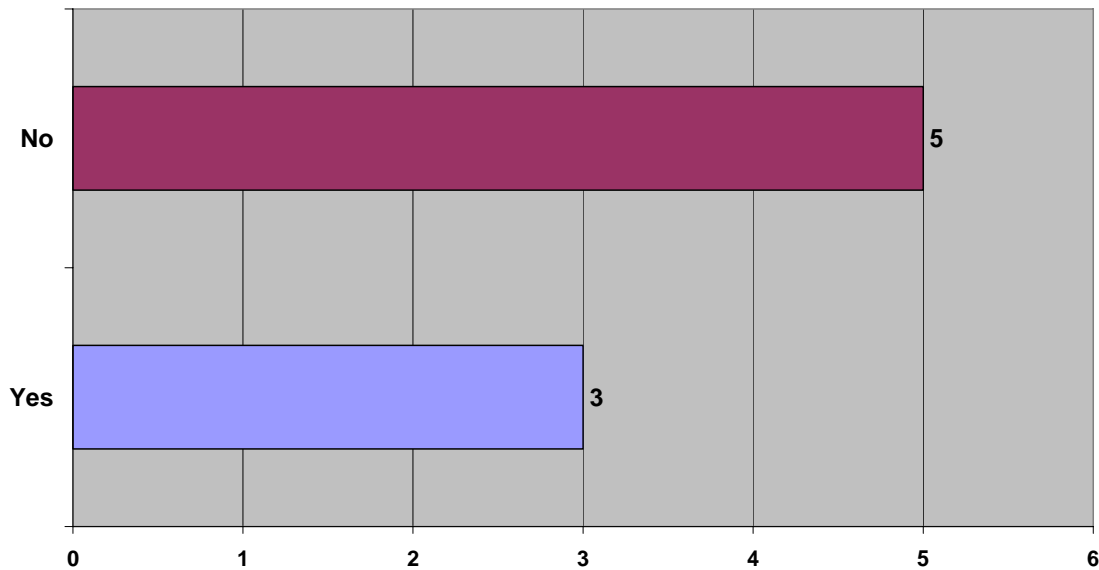
-The Chinese Consultant coded EMP021, explained that: "*We considering and investigating the application scope of the fire protection system for generator in our country.*" The result of this investigation will be very interesting, considering the importance of the Chinese waterpower sector.

**G 6.5 -**

6.5) Are there standards recommending generator fire protection in your country?  
 - Yes  - No

This is a pure check-box question that resulted in the following graphic:

**6.5 - Are there standards recommending generator fire protection in your country?**



This question was explored deeper in the following two open questions. There was one blank answer not considered in the graphic above.

**G 6.5.1 -**

6.5.1) If yes, which standards are these?

In this pure open question we got the following contributions:

- The Chinese Consultant coded EMP021, explained that they have: “GB50219 for water and GB50193 for CO2 gas.” In China there are country own Standards.
- The English Consultant coded EMP035, explained that they have: “**NFPA**” But this cannot be accepted in this case because the question pursues to find out where do countries own Standards exist.
- The Swedish Consultant coded EMP041, explained that: “SS-EN” In Sweden there are country own Standards too.

**G 6.5.2 -**

6.5.2) If not which standards do you follow in your work?

In this pure open question we got the following contributions:

-The Swiss Consultant coded EMP011, explained that they use the: “General standard for fire protection in buildings called ‘Brandschutzvorschriften’” (that stands for Fire Protection Norms).

-The English Consultant coded EMP014, explained that they use the: “NFPA 851”

-The German Consultant coded EMP030, explained that they use the: “NFPA, IEC, VDE, DIN”.

-The Swedish Consultant coded EMP049, explained that they use the: “Provisions and recommendations issued by the National Board of Housing, Building and Planning.”.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

### G 6.5.2.1 -

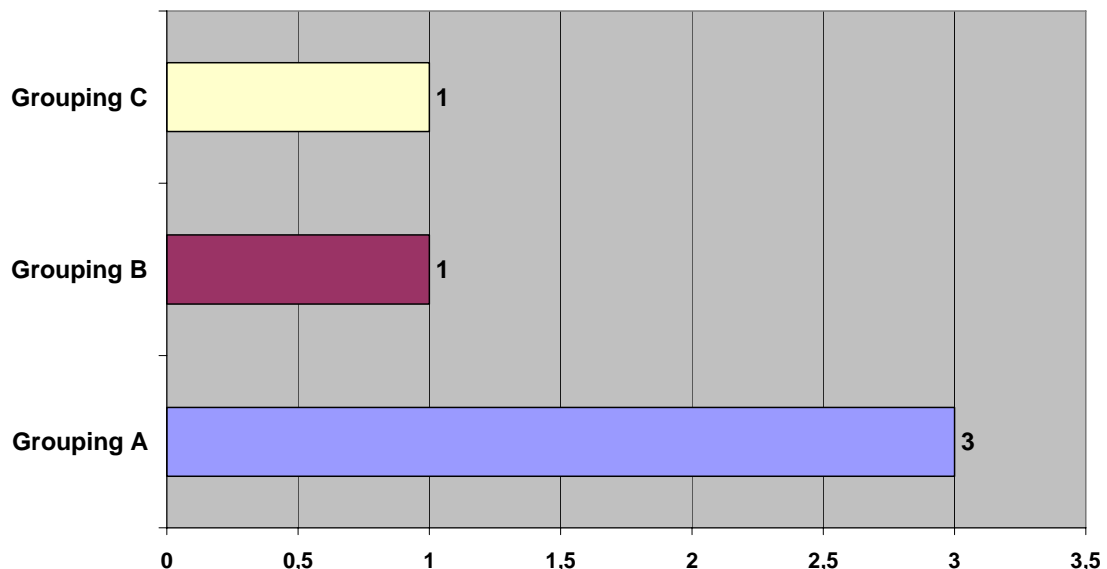
6.5.2.1) Are there critical items in the application of these Standards that require special attention?

This pure open question was categorized according to the following table:

| 6.5.2.1) Are there critical items in the application of these Standards that require special attention? |  |          |
|---|--|----------|
| Categories  | Legend                                   | Quantity |
| Grouping A  | No critical items                        | 3        |
| Grouping B  | Bearings inside generator enclosure      | 1        |
| Grouping C  | Local insurance practice and regulations | 1        |
| Grouping D  | Blank                                    | 4        |
| <b>Total of answered questions</b>  |  | <b>9</b> |

We got the following graphic:

**6.5.2.1 - Are there critical items in the application of these Standards that require special attention?**



In this case the “No concern” group had 3 votes which is the majority. There were four blank answers that were not considered in the graphic above. The two concerns we had are the following:

|                         |  |
|-------------------------|--|
| EMP014 (United Kingdom) | Bearings inside the generator enclosure. |
| EMP041 (Sweden)         | Local insurance practice and regulations |

**G 6.5.3 -**

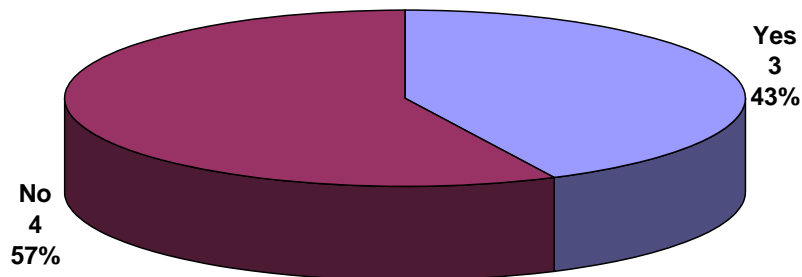
6.5.3) Considering the existence of the recently launched standards (for instance NFPA 851), is there a need of any additional specific international standard on generator fire protection?

- Yes  - No

Any additional comment? Please state here:

The result of the check-box part of this question can be seen in the graphic below:

**6.5.3 - Is there a need of any additional specific international standard on generator fire protection?**



Open question analysis (Any additional comment? Please state here); we reproduce the received statement as follows:

-The Chinese Consultant coded EMP021, explained that: *“Based on the actual situation and practice, much many customers and manufacturers put forward the necessity of installation of fire extinguishing equipment, so we propose to make a report regarding the availability and scope applied for fire protection in power plant.”*

**G 6.5.4 -**

6.5.4) What is the state of the art in the detection in accordance to your experience?

- Smoke

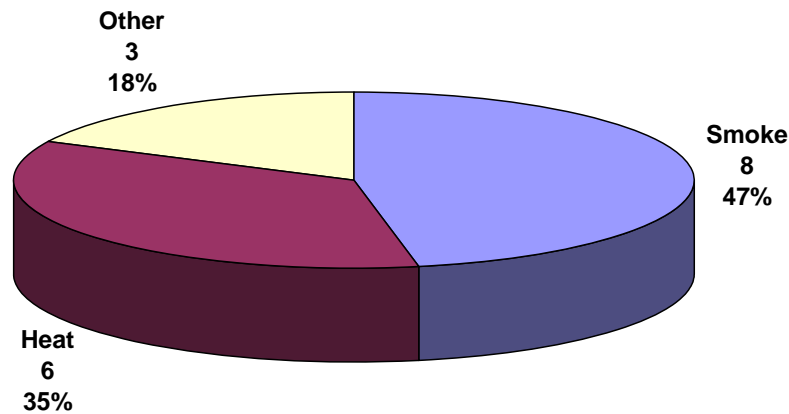
- Heat

- Flame

- Other – please describe:

Some Consulting did check more than one alternative, resulting in 17 marked items, and the corresponding graphic is the following:

**6.5.4 - What is the state of the art in the detection in accordance to your experience?**



[\[Back to Index\]](#) [\[Go to Annex\]](#)

Open question analysis (Other – please describe) in this case we got the same statement of the Swedish Consulting coded EMP0 and EMP0 as follows: “*Aspirating smoke detection system*”. This is a new application of WESDA (or similar) systems to hydrogenerators. The results are showing to be very good, this may be a new tendency.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

**G 6.5.4.1 -**

6.5.4.1) Which are the types of detection devices you normally use and/or recommend?

This is a pure open question and the answers are as follows:

| Company              | Result  |
|----------------------|---|
|                      | Answer  |
| EMP011 (Switzerland) | We require the application, however, neither recommend nor favorize certain types of detection devices. |
| EMP021 (China)       | Normally we use smoke detector with ionization type and heat detector with temperature fixation type.   |
| EMP042 (Norway)      | Smoke/heat  |
| EMP049 (Sweden)      | Smoke detectors   |

The answer of the Swiss Consultant shows a typical Consulting statement, because it shows a neutral position.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

**G 6.5.4.2 -**



6.5.4.2) Do you recommend any specific detection and control system to minimize unwanted fire extinguishing system operation (here is meant the unwanted release of the extinguishing media)?

This is a pure open question and the answers are as follows:

| Company                 | Result  |
|-------------------------|---|
|                         | Answer  |
| EMP011 (Switzerland)    | We require the application, however, neither recommend nor favorize certain types of detection devices.   |
| EMP014 (United Kingdom) | Heat  |
| EMP021 (China)          | We have a closed relationship with the manufacturers, research centers and the design institute. As a result, an agreement is reached to minimize unwanted fire extinguishing system operation as stated in clause 1.11 [The fire extinguishing system will be released in case of: a) Some of settling smoke detectors actuated; b)Some of settling heat detectors actuated; c) Differential and or neutral protection already tripped off; d) Circuit breaker of high voltage side of main transformer and de-escalation breaker already tripped off.]. |
| EMP042 (Norway)         | None  |

The comment from the Chinese Consulting refers to the comment given in the item 1.11 of the Group 1 Users [How do you prevent unwanted (unnecessary-accidental) release of generator fire extinguishing system?], which was: “*The fire extinguishing system will be released in case of: a)Some of settling smoke detectors actuated; b)Some of settling heat detectors actuated; c)Differential and or neutral protection already tripped off; d)Circuit braeker of high votage side of main transformer and deescalation breaker already tripped off.*”

[\[Back to Index\]](#) [\[Go to Annex\]](#)

## G 6.6 -

6.6) Do you usually cooperate with the generator manufacturer on the Generating Fire Protection Question?

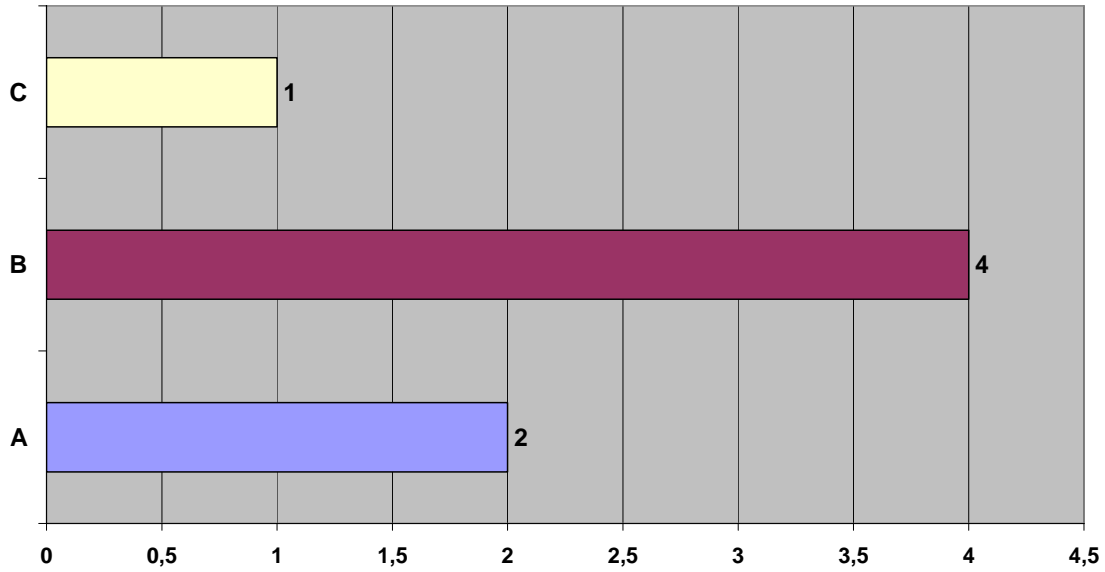
- Yes, there is a cooperation and joint work  
 - No, our work ends with the issue of the specifications  
 - It depends from case to case, please specify:

The check-box part of this combined question offered 3 alternatives, as follows, a categorization was made in order to allow a graph to be made (long alternative names):

| Category | Description  |
|----------|--|
| A        | Yes, there is a cooperation and joint work             |
| B        | No, our work ends with the issue of the specifications |
| C        | It depends from case to case, please specify           |

The statistics showed the following graph:

**6.6 - Do you usually cooperate with the generator manufacturer on the Generating Fire Protection Question?**



There were two blank answers that were not considered in the graphic above.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

Open question analysis (It depends from case to case, please specify) this alternative showed the following result:

|                         |  |
|-------------------------|--|
| EMP035 (United Kingdom) | In our performance specifications the fire protection system is usually included within the generator specification. |
|-------------------------|--|

[\[Back to Index\]](#) [\[Go to Annex\]](#)

**G 6.7 -**

|  |
|--|
| <p>6.7) Do you usually cooperate with fire protection equipment manufacturer on the Generating Fire Protection Question?</p> <p><input type="checkbox"/> - Yes, there is a cooperation and joint work</p> <p><input type="checkbox"/> - No, our work ends with the issue of the specifications</p> <p><input type="checkbox"/> - It depends from case to case, please specify:</p> |
|--|

The check-box part of this combined question offered 3 alternatives, as follows, a categorization was made in order to allow a graph to be made (long alternative names):

| Category | Description  |
|----------|--|
| A        | Yes, there is a cooperation and joint work             |
| B        | No, our work ends with the issue of the specifications |
| C        | It depends from case to case, please specify           |

The statistics showed the following table:

| Result Answer  | Category | Quantity |
|--|----------|----------|
| Yes, there is a cooperation and joint work             | A        | 4        |
| No, our work ends with the issue of the specifications | B        | 4        |

There was one blank answer that was not considered in the statistics above. As we can see the type of work depends upon each particular Consulting Company.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

Open question analysis (It depends from case to case, please specify) no answer was given to this exploratory question.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

### G 6.8 -

6.8) Do you work also on refurbishment of Fire Protection Equipment on hydro generating plants?

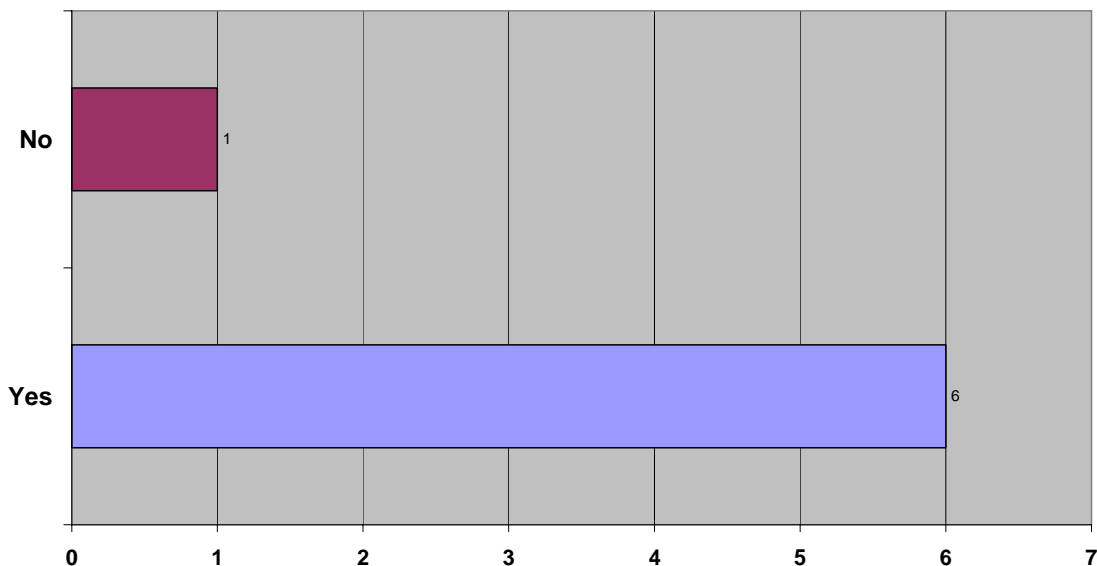
- Yes

- No

Do you have any comment on this issue you would share with us?

The Check-box part of this question resulted in the following graphic:

**6.8 - Do you work also on refurbishment of Fire Protection Equipment on hydro generating plants?**



There were two blank answers that were not considered in the graphic above.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

Open question analysis (Do you have any comment on this issue you would share with us?) no answer was given to this exploratory question.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

### G 6.9 -

6.9) Do you follow you projects during erection and commissioning phrases?

- Yes

- No

If yes, can you tell us what are the most frequent problems you had to face in the case of the Fire Protection Equipment?

In the check-box part of this question the answer “Yes” was unanimous.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

Open question analysis (If yes, can you tell us what are the most frequent problems you had to face in the case of the Fire Protection Equipment?) in this case we got the following answers:

| Company         | Result   |
|-----------------|--|
|                 | Answer   |
| EMP021 (China)  | The performance of test at site for fire protection equipment. |
| EMP042 (Norway) | None   |

The observation made by the Chinese Consultant is very actual, because the testing of the GFP and the adjusting of the smoke and temperature sensors is a very complicated task, The testing of a extinguishing media deployment is very often bound with costs and additional work (dry out of the unit should the media be water).

[\[Back to Index\]](#) [\[Go to Annex\]](#)

### G 6.10 -

6.10) In your opinion is a Generator Fire Protection installation required nowadays?

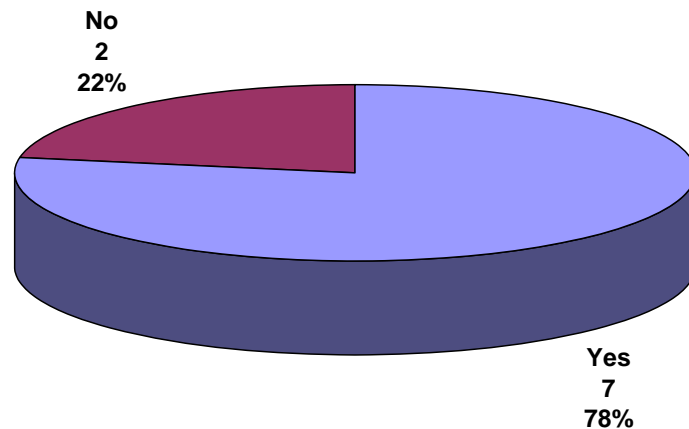
- Yes

- No

Do you have any comment on this issue you would share with us?

The answers to this very important check-box question resulted in the graphic below:

**6.10 - In your opinion is a Generator Fire Protection installation required nowadays?**



The majority of the participant Consulting Companies agrees to the importance of the use of GFP nowadays.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

Open question analysis (Do you have any comment on this issue you would share with us?); the additional explanations received are the following:

| Company         | Result  |
|-----------------|---|
|                 | Answer  |
| EMP021 (China)  | "yes" is for the big and huge machines, and "no" is for small and medium size machines.                                 |
| EMP049 (Sweden) | Only fire detectors on modern epoxy type generators. Older Bitumen type generators still need fire extinguishing system |

This question is part of the questions that allow a comparison between Users, Manufacturers and Consultants.

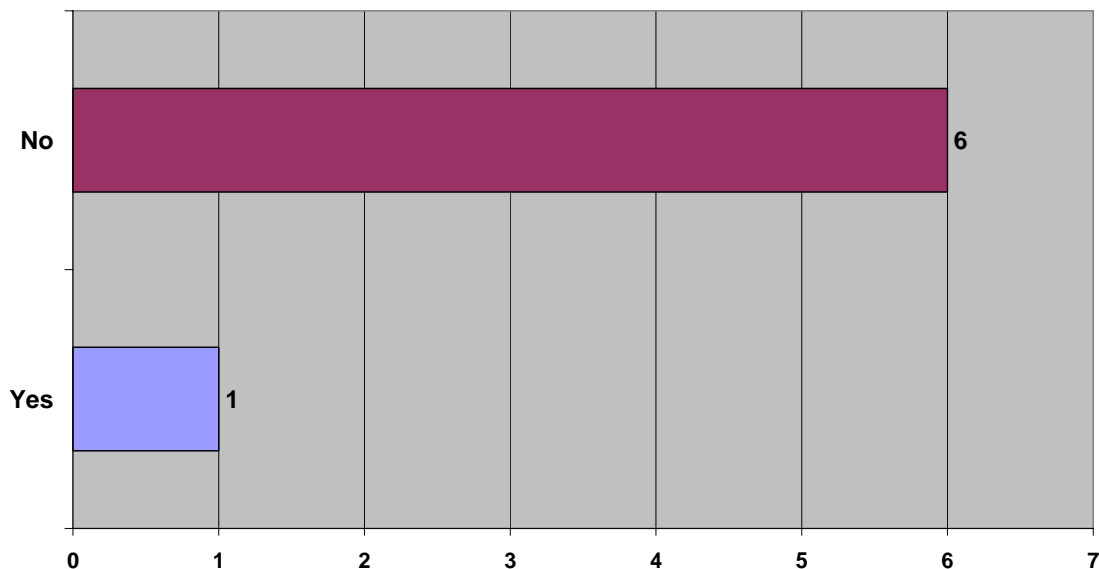
[\[Back to Index\]](#) [\[Go to Annex\]](#)

**G 6.11 -**

|   |
|---|
| <p>6.11) According to your opinion, is there any question that is missing in this part of the questionnaire?<br/> <input type="checkbox"/> - Yes <input type="checkbox"/> - No<br/>         If yes, please state it here:</p> |
|---|

The check-box part of this question resulted in the following graphic:

**6.11 - According to your opinion, is there any question that is missing in this part of the questionnaire?**



It is important to point out that one Consulting informed that there is something to be surveyed the next time. The question got two blank answers that were not considered in the graphic above.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

Open question analysis (If yes, please state it here) and the suggestion to be pursued further on is the following: But unfortunately none of the Swedish Consulting Company, coded EMP049, that answered “Yes” in the check-box part of this question, did not expressed its concern about a missing item on the questionnaire.

[\[Back to Index\]](#) [\[Go to Annex\]](#)

Annexes G - The original complete statistical tables that support the item G of this Work:

G 6.1 Check-Box

| Question  | Company                 | Result   | Category |
|---|-------------------------|--|----------|
|   |                         | Answer   |          |
| <b>6.1) Is your company specialized in the design of the Generator Fire Protection:</b> | EMP011 (Switzerland)    | Whole power plant design including the Generator Fire Protection | C        |
|   | EMP014 (United Kingdom) | Whole power plant design including the Generator Fire Protection | C        |
|   | EMP021 (China)          | Whole power plant design including the Generator Fire Protection | C        |
|   | EMP030 (Germany)        | Integrated in the power plant design                             | B        |
|   | EMP030 (Germany)        | Whole power plant design including the Generator Fire Protection | C        |
|   | EMP035 (United Kingdom) | Whole power plant design including the Generator Fire Protection | C        |
|   | EMP059 (Sweden)         | Whole power plant design including the Generator Fire Protection | C        |
|   | EMP041 (Sweden)         | Whole power plant design including the Generator Fire Protection | C        |
|   | EMP042 (Norway)         | Integrated in the power plant design                             | B        |
|   | EMP049 (Sweden)         | Whole power plant design including the Generator Fire Protection | C        |

[\[Back to Question\]](#)

G 6.1 Open question

| <b>6.1) Is your company specialized in the design of the Generator Fire Protection:</b> |                         |   |
|---|-------------------------|---|
| Question  | Company                 | Result  |
|   |                         | Answer  |
| <b>Any comment on that?</b>   | EMP011 (Switzerland)    | Blank   |
|   | EMP014 (United Kingdom) | Blank   |
|   | EMP021 (China)          | Blank   |
|   | EMP030 (Germany)        | Blank   |
|   | EMP035 (United Kingdom) | Mott MacDonald are involved in carrying out feasibility studies and preparing performance specifications for hydro power plant. |
|   | EMP059 (Sweden)         | Blank   |
|   | EMP041 (Sweden)         | Our company does not design GFP's. Generally the whole power plant layout is supported.   |
|   | EMP042 (Norway)         | Blank   |

|  |                 |  |
|--|-----------------|--|
|  | EMP049 (Sweden) | Fire extinguishing systems are normally only used for old generator types (Bitumen) and oil-filled transformers in underground position. Fire detection systems and evacuation of fire gases are installed in the plant. |
|--|-----------------|--|

[\[Back to Question\]](#)

G 6.1.1 Check-Box

| Question  | Company                 | Result   | Category |
|---|-------------------------|--|----------|
|   |                         | Answer   |          |
| <b>6.1.1) Should you work specifically with the Generator Fire Protection Equipment (not as a power plant designer) in which moment of the power plant's project are you normally engaged by your customer:</b> | EMP011 (Switzerland)    | bid stage (in order to get the data for the Generator Fire Detection's specs)  | A        |
|   | EMP014 (United Kingdom) | Blank  | -        |
|   | EMP021 (China)          | in a stage when your expertise will be taken in to consideration in the whole project including the required civil work for the proper adaptation and safe function of the Generator Fire Protection | C        |
|   | EMP030 (Germany)        | in a stage when your expertise will be taken in to consideration in the whole project including the required civil work for the proper adaptation and safe function of the Generator Fire Protection | C        |
|   | EMP035 (United Kingdom) | None of the above  | D        |
|   | EMP059 (Sweden)         | in a stage when your expertise will be taken in to consideration in the whole project including the required civil work for the proper adaptation and safe function of the Generator Fire Protection | C        |
|   | EMP041 (Sweden)         | in a stage when your expertise will be taken in to consideration in the whole project including the required civil work for the proper adaptation and safe function of the Generator Fire Protection | C        |
|   | EMP042 (Norway)         | in a stage when your expertise will be taken in to consideration in the whole project including the required civil work for the proper adaptation and safe function of the Generator Fire Protection | C        |
|   | EMP049 (Sweden)         | Blank  | -        |

[\[Back to Question\]](#)

G 6.1.1 Open question 1

| <b>6.1.1) Should you work specifically with the Generator Fire Protection Equipment (not as a power plant designer) in which moment of the power plant's project are you normally engaged by your customer:</b> |         |        |  |
|---|---------|--------|--|
| Question  | Company | Result |  |
|   |         | Answer |  |

|                                    |                         |  |
|------------------------------------|-------------------------|--|
| None of the above, please specify: | EMP011 (Switzerland)    | Blank  |
|                                    | EMP014 (United Kingdom) | Blank  |
|                                    | EMP021 (China)          | Blank  |
|                                    | EMP030 (Germany)        | Blank  |
|                                    | EMP035 (United Kingdom) | Mott MacDonald would not normally work with generator fire protection specifically. Our involvement would be within the overall generator specification and our involvement would commence in a general way during a feasibility study and then in more detail |
|                                    | EMP059 (Sweden)         | Blank  |
|                                    | EMP041 (Sweden)         | Blank  |
|                                    | EMP042 (Norway)         | Blank  |
|                                    | EMP049 (Sweden)         | Blank  |

[\[Back to Question\]](#)

G 6.1.1 Open question 2

| 6.1.1) Should you work specifically with the Generator Fire Protection Equipment (not as a power plant designer) in which moment of the power plant's project are you normally engaged by your customer: |                         |                |
|--|-------------------------|----------------|
| Question   | Company                 | Result         |
|  |                         | Answer         |
| Any comment on that?   | EMP011 (Switzerland)    | Blank          |
|  | EMP014 (United Kingdom) | Blank          |
|  | EMP021 (China)          | Blank          |
|  | EMP030 (Germany)        | Blank          |
|  | EMP035 (United Kingdom) | Blank          |
|  | EMP059 (Sweden)         | Blank          |
|  | EMP041 (Sweden)         | Blank          |
|  | EMP042 (Norway)         | Blank          |
|  | EMP049 (Sweden)         | Not applicable |

[\[Back to Question\]](#)

G 6.2 Check-Box

| Question  | Company                 | Result   | Category |
|---|-------------------------|--|----------|
|   |                         | Answer   |          |
| 6.2) There are the factors (or reasons) that lead your clients to order a Generator Fire Protection project from your company. According to your experience, considering these factors, who decides if the generators have to be equipped with Generator Fire Protection? | EMP011 (Switzerland)    | Em Branco  | -        |
|   | EMP014 (United Kingdom) | You are asked to give an advice/opinion  | F        |
|   | EMP021 (China)          | Final users' own internal philosophy   | E        |
|   | EMP030 (Germany)        | Em Branco  | -        |
|   | EMP035 (United Kingdom) | You are asked to give an advice/opinion  | F        |
|   | EMP059 (Sweden)         | Final users' own internal philosophy   | E        |
|   | EMP041 (Sweden)         | Final users' own internal philosophy   | E        |
|   | EMP042 (Norway)         | The customer that place the order to you (not necessarily the final user - it may be the integrator) | A        |
|   | EMP049 (Sweden)         | Final users' own internal philosophy   | E        |



[\[Back to Question\]](#)

**G 6.2 Open question**

**6.2) There are the factors (or reasons) that lead your clients to order a Generator Fire Protection project from your company. According to your experience, considering these factors, who decides if the generators have to be equipped with Generator Fire Protection**

| Question             | Company                 | Result  |
|----------------------|-------------------------|---|
|                      |                         | Answer  |
| Any comment on that? | EMP011 (Switzerland)    | Our Consulting company, the Colenco Power Engineering, will not be ordered to supply the Generator Fire Protection System (GFPS). Generally, GFPS is a substantial part in the Specification and Delivery of the Generator. |
|                      | EMP014 (United Kingdom) | Blank   |
|                      | EMP021 (China)          | Blank   |
|                      | EMP030 (Germany)        | Blank   |
|                      | EMP035 (United Kingdom) | Our recommendations on generator fire protection would be based on our own experience and the client/end users' previous experience.  |
|                      | EMP059 (Sweden)         | Blank   |
|                      | EMP041 (Sweden)         | We do not supply GFPS. Generally the GFP's purchaser decides if a generator has to be equipped with GFH.  |
|                      | EMP042 (Norway)         | Blank   |
|                      | EMP049 (Sweden)         | Blank   |

[\[Back to Question\]](#)

**G 6.3 Check-Box**

| Question  | Company                 | Result |
|---|-------------------------|--------|
|   |                         | Answer |
| 6.3) If the choice is yours do you have a preferred extinguishing method? | EMP011 (Switzerland)    | Yes    |
|   | EMP014 (United Kingdom) | Yes    |
|   | EMP021 (China)          | Yes    |
|   | EMP030 (Germany)        | Yes    |
|   | EMP035 (United Kingdom) | No     |
|   | EMP059 (Sweden)         | No     |
|   | EMP041 (Sweden)         | No     |
|   | EMP042 (Norway)         | Yes    |
|   | EMP049 (Sweden)         | Blank  |

[\[Back to Question\]](#)

**G 6.3 Open question 1**

| 6.3) If the choice is yours do you have a preferred extinguishing method? |                         |   |          |
|---|-------------------------|---|----------|
| Question  | Company                 | Result  | Grouping |
|   |                         | Answer  |          |
| If yes please indicate which:   | EMP011 (Switzerland)    | Inert gas system  | A        |
|   | EMP014 (United Kingdom) | Water Spray   | B        |
|   | EMP021 (China)          | According to the requirement of the National Standard applied with different extinguishing materials. | D        |

|                                    |                             |  |                 |
|------------------------------------|-----------------------------|--|-----------------|
|                                    | EMP030 (Germany)            | CO2, Equipment or Inergen.   | C               |
|                                    | EMP035 (United Kingdom)     | Blank  | E               |
|                                    | EMP059 (Sweden)             | Blank  | E               |
|                                    | EMP041 (Sweden)             | Blank  | E               |
|                                    | EMP042 (Norway)             | Normally we would recommend not to install any extinguishing method, but if clients want to install we would recommend the use of water spray system | B               |
|                                    | EMP049 (Sweden)             | Blank  | E               |
| <b>Summary</b>                     |                             |  |                 |
| <b>Categories</b>                  | <b>Legend</b>               |  | <b>Quantity</b> |
| A                                  | Inert gas (like Inergen)    |  | 1               |
| B                                  | Water                       |  | 2               |
| C                                  | CO2 or Inergen              |  | 1               |
| D                                  | Type according to Standards |  | 1               |
| E                                  | Blank                       |  | 4               |
| <b>Total of answered questions</b> |                             |  | <b>9</b>        |

[\[Back to Question\]](#)

G 6.3 Open question 2

| 6.3) If the choice is yours do you have a preferred extinguishing method?                  |                         |  |
|--|-------------------------|--|
| Question   | Company                 | Result   |
|  |                         | Answer   |
| If no, please indicate how you determine the extinguishing media for each particular case: | EMP011 (Switzerland)    | Blank  |
|  | EMP014 (United Kingdom) | Blank  |
|  | EMP021 (China)          | Blank  |
|  | EMP030 (Germany)        | Blank  |
|  | EMP035 (United Kingdom) | Most of the recent projects have been CO2 generator fire protection. CO2 was generally chosen because of previous client experience. |
|  | EMP059 (Sweden)         | With modern generators / windings that don't maintain fire, we usually don't install extinguishing facilities.                       |
|  | EMP041 (Sweden)         | With modern generators / windings that don't maintain fire, we usually don't install extinguishing facilities.                       |
|  | EMP042 (Norway)         | Blank  |
|  | EMP049 (Sweden)         | Blank  |

[\[Back to Question\]](#)

G 6.3.1 Open question 1

| 6.3.1) - If you have the choice, which is the extinguishing media you usually chose for: |                         |  |          |
|--|-------------------------|--|----------|
| Question   | Company                 | Result   | Grouping |
|  |                         | Answer   |          |
| a) Above water power plants (open-air):  | EMP011 (Switzerland)    | water, CO2 or inert gas fire extinguishing system  | A        |
|  | EMP014 (United Kingdom) | Water Spray  | B        |
|  | EMP021 (China)          | Water Spray  | B        |
|  | EMP030 (Germany)        | CO2  | C        |
|  | EMP035 (United Kingdom) | For open air plant such as transformers we would normally choose deluge water spray systems. | B        |

|                                    |                         |                  |                 |
|------------------------------------|-------------------------|------------------|-----------------|
|                                    | EMP059 (Sweden)         | Water mist spray | B               |
|                                    | EMP041 (Sweden)         | Water mist spray | B               |
|                                    | EMP042 (Norway)         | None             | D               |
|                                    | EMP049 (Sweden)         | Blank            | E               |
| <b>Summary</b>                     |                         |                  |                 |
| <b>Categories</b>                  | <b>Legend</b>           |                  | <b>Quantity</b> |
| A                                  | Water, CO2 or inert gas |                  | 1               |
| B                                  | Water                   |                  | 5               |
| C                                  | CO2                     |                  | 1               |
| D                                  | None                    |                  | 1               |
| E                                  | Blank                   |                  | 1               |
| <b>Total of answered questions</b> |                         |                  | <b>9</b>        |

[\[Back to Question\]](#)

### G 6.3.1 Open question 2

| <b>6.3.1) - If you have the choice, which is the extinguishing media you usually chose for:</b> |                         |  |                 |
|---|-------------------------|--|-----------------|
| Question  | Company                 | Result   | Grouping        |
|   |                         | Answer   |                 |
| <b>b) Cavern type power plants:</b>   | EMP011 (Switzerland)    | Inert gas fire extinguishing system  | C               |
|   | EMP014 (United Kingdom) | Water Spray  | B               |
|   | EMP021 (China)          | Water Spray  | B               |
|   | EMP030 (Germany)        | Water or CO2 or Inergen.   | A               |
|   | EMP035 (United Kingdom) | For underground hydro generators we would normally choose CO2 fire protection. | D               |
|   | EMP059 (Sweden)         | Water mist spray   | B               |
|   | EMP041 (Sweden)         | Water mist spray   | B               |
|   | EMP042 (Norway)         | None   | E               |
|   | EMP049 (Sweden)         | Blank  | F               |
| <b>Summary</b>  |                         |  |                 |
| <b>Categories</b>   | <b>Legend</b>           |  | <b>Quantity</b> |
| A   | Water, CO2 or Inergen   |  | 1               |
| B   | Water                   |  | 4               |
| C   | Inert gas               |  | 1               |
| D   | CO2                     |  | 1               |
| E   | None                    |  | 1               |
| F   | Blank                   |  | 1               |
| <b>Total of answered questions</b>  |                         |  | <b>9</b>        |

[\[Back to Question\]](#)

### G 6.4 Check-Box

| Question  | Company                 | Result          |
|---|-------------------------|-----------------|
|   |                         | Answer          |
| <b>6.4) From your experience, which is the type of generator fire extinguishing method more frequently used nowadays?</b> | EMP011 (Switzerland)    | Water Spray     |
|   | EMP011 (Switzerland)    | Inergen         |
|   | EMP014 (United Kingdom) | Water Spray     |
|   | EMP021 (China)          | Water Spray     |
|   | EMP030 (Germany)        | CO <sup>2</sup> |
|   | EMP030 (Germany)        | Inergen         |
|   | EMP035 (United Kingdom) | CO <sup>2</sup> |
|   | EMP059 (Sweden)         | Water Spray     |
|   | EMP041 (Sweden)         | Water Spray     |

|  |                 |                 |
|--|-----------------|-----------------|
|  | EMP042 (Norway) | Other           |
|  | EMP049 (Sweden) | CO <sup>2</sup> |
|  | EMP049 (Sweden) | Other           |

[\[Back to Question\]](#)

#### G 6.4 Open question

6.4) From your experience, which is the type of generator fire extinguishing method more frequently used nowadays?

| Question                 | Company                 | Result                     |
|--------------------------|-------------------------|----------------------------|
|                          |                         | Answer                     |
| If other please specify: | EMP011 (Switzerland)    | Blank                      |
|                          | EMP014 (United Kingdom) | Blank                      |
|                          | EMP021 (China)          | Blank                      |
|                          | EMP030 (Germany)        | Blank                      |
|                          | EMP035 (United Kingdom) | Blank                      |
|                          | EMP059 (Sweden)         | Blank                      |
|                          | EMP041 (Sweden)         | Blank                      |
|                          | EMP042 (Norway)         | For new installation, None |
|                          | EMP049 (Sweden)         | CO2 only on old generators |

[\[Back to Question\]](#)

#### G 6.4.1 Check-Box

| Question  | Company                 | Result |
|---|-------------------------|--------|
|   |                         | Answer |
| 6.4.1) Do you recognize any change towards the former trend (status quo) in fire protection systems your country? | EMP011 (Switzerland)    | Yes    |
|   | EMP014 (United Kingdom) | No     |
|   | EMP021 (China)          | Yes    |
|   | EMP030 (Germany)        | No     |
|   | EMP035 (United Kingdom) | No     |
|   | EMP059 (Sweden)         | Blank  |
|   | EMP041 (Sweden)         | No     |
|   | EMP042 (Norway)         | No     |
|   | EMP049 (Sweden)         | No     |

[\[Back to Question\]](#)

#### G 6.4.1 Open question

6.4.1) Do you recognize any change towards the former trend (status quo) in fire protection systems your country?

| Question                      | Company                 | Result   |
|-------------------------------|-------------------------|--|
|                               |                         | Answer   |
| If yes, please state it here: | EMP011 (Switzerland)    | There are more and more inert gas fire protection system.  |
|                               | EMP014 (United Kingdom) | Blank  |
|                               | EMP021 (China)          | We considering and investigating the application scope of the fire protection system for generator in our country. |
|                               | EMP030 (Germany)        | Blank  |
|                               | EMP035 (United Kingdom) | Blank  |
|                               | EMP059 (Sweden)         | Blank  |

|  |                 |       |
|--|-----------------|-------|
|  | EMP041 (Sweden) | Blank |
|  | EMP042 (Norway) | Blank |
|  | EMP049 (Sweden) | Blank |

[\[Back to Question\]](#)

**G 6.5 Check-Box**

| Question  | Company                 | Result |
|---|-------------------------|--------|
|   |                         | Answer |
| <b>6.5) Are there standards recommending generator fire protection in your country?</b> | EMP011 (Switzerland)    | No     |
|   | EMP014 (United Kingdom) | No     |
|   | EMP021 (China)          | Yes    |
|   | EMP030 (Germany)        | No     |
|   | EMP035 (United Kingdom) | Yes    |
|   | EMP059 (Sweden)         | Blank  |
|   | EMP041 (Sweden)         | Yes    |
|   | EMP042 (Norway)         | No     |
|   | EMP049 (Sweden)         | No     |

[\[Back to Question\]](#)

**G 6.5.1 Open question**

| <b>6.5) Are there standards recommending generator fire protection in your country?</b> |                         |  |
|---|-------------------------|--|
| Question  | Company                 | Result                                     |
|   |                         | Answer                                     |
| <b>6.5.1) If yes, which standards are these?</b>  | EMP011 (Switzerland)    | Blank                                      |
|   | EMP014 (United Kingdom) | Blank                                      |
|   | EMP021 (China)          | GB50219 for water and GB50193 for CO2 gas. |
|   | EMP030 (Germany)        | Blank                                      |
|   | EMP035 (United Kingdom) | NFPA                                       |
|   | EMP059 (Sweden)         | Blank                                      |
|   | EMP041 (Sweden)         | SS-EN                                      |
|   | EMP042 (Norway)         | Blank                                      |
|   | EMP049 (Sweden)         | Blank                                      |

[\[Back to Question\]](#)

**G 6.5.2 Open question**

| <b>6.5) Are there standards recommending generator fire protection in your country?</b> |                         |   |
|---|-------------------------|---|
| Question  | Company                 | Result  |
|   |                         | Answer  |
| <b>6.5.2) If not which standards do you follow in your work?</b>                        | EMP011 (Switzerland)    | General standard for fire protection in buildings called " Brandschutzvorschriften" |
|   | EMP014 (United Kingdom) | NFPA 851  |
|   | EMP021 (China)          | Blank   |
|   | EMP030 (Germany)        | NPFA, IEC, VDE, DIN   |
|   | EMP035 (United Kingdom) | Blank   |
|   | EMP059 (Sweden)         | Blank   |
|   | EMP041 (Sweden)         | Blank   |
|   | EMP042 (Norway)         | Blank   |

|  |                 |  |
|--|-----------------|--|
|  | EMP049 (Sweden) | Provisions and recommendations issued by the National Board of Housing, Building and Planning. |
|--|-----------------|--|

[\[Back to Question\]](#)

G 6.5.2.1 Open question

| Question  | Company                                  | Result                                   | Grouping |
|---|--|--|----------|
|   |  | Answer                                   |          |
| 6.5.2.1) Are there critical items in the application of these Standards that require special attention? | EMP011 (Switzerland)                     | No                                       | A        |
|   | EMP014 (United Kingdom)                  | Bearings inside the generator enclosure. | B        |
|   | EMP021 (China)                           | No                                       | A        |
|   | EMP030 (Germany)                         | No                                       | A        |
|   | EMP035 (United Kingdom)                  | Blank                                    | D        |
|   | EMP059 (Sweden)                          | Blank                                    | D        |
|   | EMP041 (Sweden)                          | Local insurance practice and regulations | C        |
|   | EMP042 (Norway)                          | Blank                                    | D        |
|   | EMP049 (Sweden)                          | Blank                                    | D        |
| <b>Summary</b>  |  |  |          |
| Categories  | Legend                                   |  | Quantity |
| A   | No critical items                        |  | 3        |
| B   | Bearings inside generator enclosure      |  | 1        |
| C   | Local insurance practice and regulations |  | 1        |
| D   | Blank                                    |  | 4        |
| <b>Total of answered questions</b>  |  |  | <b>9</b> |

[\[Back to Question\]](#)

G 6.5.3 Check-Box

| Question   | Company                 | Result |
|--|-------------------------|--------|
|  |                         | Answer |
| 6.5.3) Considering the existence of the recently launched standards (for instance NFPA 851), is there a need of any additional specific international standard on generator fire protection? | EMP011 (Switzerland)    | Yes    |
|  | EMP014 (United Kingdom) | No     |
|  | EMP021 (China)          | Yes    |
|  | EMP030 (Germany)        | No     |
|  | EMP035 (United Kingdom) | Blank  |
|  | EMP059 (Sweden)         | Blank  |
|  | EMP041 (Sweden)         | Yes    |
|  | EMP042 (Norway)         | No     |
|  | EMP049 (Sweden)         | No     |

[\[Back to Question\]](#)

G 6.5.3 Open question

6.5.3) Considering the existence of the recently launched standards (for instance NFPA 851), is there a need of any additional specific international standard on generator fire protection?

| Question                                   | Company                 | Result |
|--|-------------------------|--------|
|  |                         | Answer |
| Any additional comment? Please state here: | EMP011 (Switzerland)    | Blank  |
|  | EMP014 (United Kingdom) | Blank  |

|  |                         |  |
|--|-------------------------|--|
|  | EMP021 (China)          | Based on the actual situation and practice, much many customers and manufacturers put forward the necessity of installation of fire extinguishing equipment, so we propose to make a report regarding the availability and scope applied for fire protection in power plant. |
|  | EMP030 (Germany)        | Blank  |
|  | EMP035 (United Kingdom) | Blank  |
|  | EMP059 (Sweden)         | Blank  |
|  | EMP041 (Sweden)         | Blank  |
|  | EMP042 (Norway)         | Blank  |
|  | EMP049 (Sweden)         | Blank  |

[\[Back to Question\]](#)

G 6.5.4 Check-Box

| Question  | Company                 | Result |
|---|-------------------------|--------|
|   |                         | Answer |
| <b>6.5.4) What is the state of the art in the detection in accordance to your experience?</b> | EMP011 (Switzerland)    | Smoke  |
|   | EMP011 (Switzerland)    | Heat   |
|   | EMP014 (United Kingdom) | Heat   |
|   | EMP021 (China)          | Smoke  |
|   | EMP021 (China)          | Heat   |
|   | EMP030 (Germany)        | Smoke  |
|   | EMP030 (Germany)        | Heat   |
|   | EMP030 (Germany)        | Other  |
|   | EMP035 (United Kingdom) | Smoke  |
|   | EMP035 (United Kingdom) | Heat   |
|   | EMP059 (Sweden)         | Smoke  |
|   | EMP059 (Sweden)         | Other  |
|   | EMP041 (Sweden)         | Smoke  |
|   | EMP041 (Sweden)         | Other  |
|   | EMP042 (Norway)         | Smoke  |
|   | EMP042 (Norway)         | Heat   |
| EMP049 (Sweden)   | Smoke                   |        |

[\[Back to Question\]](#)

G 6.5.4 Open question

| <b>6.5.4) What is the state of the art in the detection in accordance to your experience?</b> |                         |                                   |
|---|-------------------------|-----------------------------------|
| Question  | Company                 | Result                            |
|   |                         | Answer                            |
| <b>If other, please describe:</b>   | EMP011 (Switzerland)    | Blank                             |
|   | EMP014 (United Kingdom) | Blank                             |
|   | EMP021 (China)          | Blank                             |
|   | EMP030 (Germany)        | Blank                             |
|   | EMP035 (United Kingdom) | Blank                             |
|   | EMP059 (Sweden)         | Aspirating smoke detection system |
|   | EMP041 (Sweden)         | Aspirating smoke detection system |
|   | EMP042 (Norway)         | Blank                             |
| EMP049 (Sweden)   | Blank                   |                                   |

[\[Back to Question\]](#)

G 6.5.4.1 Open question

| Question  | Company                 | Result  |
|---|-------------------------|---|
|   |                         | Answer  |
| <b>6.5.4.1) Which are the types of detection devices you normally use and/or recommend?</b> | EMP011 (Switzerland)    | We require the application, however, neither recommend nor favorize certain types of detection devices. |
|   | EMP014 (United Kingdom) | Blank   |
|   | EMP021 (China)          | Normally we use smoke detector with ionization type and heat detector with temperature fixation type.   |
|   | EMP030 (Germany)        | Blank   |
|   | EMP035 (United Kingdom) | Blank   |
|   | EMP059 (Sweden)         | Blank   |
|   | EMP041 (Sweden)         | Blank   |
|   | EMP042 (Norway)         | Smoke/heat  |
|   | EMP049 (Sweden)         | Smoke detectors   |

[\[Back to Question\]](#)

G 6.5.4.2 Open question

| Question   | Company                 | Result   |
|--|-------------------------|--|
|  |                         | Answer   |
| <b>6.5.4.2) Do you recommend any specific detection and control system to minimize unwanted fire extinguishing system operation (here is meant the unwanted release of the extinguishing media)?</b> | EMP011 (Switzerland)    | We require the application, however, neither recommend nor favorize certain types of detection devices.  |
|  | EMP014 (United Kingdom) | Heat   |
|  | EMP021 (China)          | We have a closed relationship with the manufacturers, research centers and the design institute. As a result, an agreement is reached to minimize unwanted fire extinguishing system operation as stated in clause 1.11 above. |
|  | EMP030 (Germany)        | Blank  |
|  | EMP035 (United Kingdom) | Blank  |
|  | EMP059 (Sweden)         | Blank  |
|  | EMP041 (Sweden)         | Blank  |
|  | EMP042 (Norway)         | None   |
|  | EMP049 (Sweden)         | Blank  |

[\[Back to Question\]](#)

G 6.6 Check-Box

| Question   | Company                 | Result   | Category |
|--|-------------------------|--|----------|
|  |                         | Answer   |          |
| <b>6.6) Do you usually cooperate with the generator manufacturer on the Generating Fire Protection Question?</b> | EMP011 (Switzerland)    | No, our work ends with the issue of the specifications | B        |
|  | EMP014 (United Kingdom) | Yes, there is a cooperation and joint work             | A        |
|  | EMP021 (China)          | Yes, there is a cooperation and joint work             | A        |



|  |                         |  |   |
|--|-------------------------|--|---|
|  | EMP030 (Germany)        | No, our work ends with the issue of the specifications | B |
|  | EMP035 (United Kingdom) | It depends from case to case                           | C |
|  | EMP059 (Sweden)         | Blank  | - |
|  | EMP041 (Sweden)         | No, our work ends with the issue of the specifications | B |
|  | EMP042 (Norway)         | Blank  | - |
|  | EMP049 (Sweden)         | No, our work ends with the issue of the specifications | B |

[\[Back to Question\]](#)

**G 6.6 Open question**

| <b>6.6) Do you usually cooperate with the generator manufacturer on the Generating Fire Protection Question?</b> |                         |  |
|--|-------------------------|--|
| Question   | Company                 | Result   |
|  |                         | Answer   |
| <b>It depends from case to case, please specify:</b>   | EMP011 (Switzerland)    | Blank  |
|  | EMP014 (United Kingdom) | Blank  |
|  | EMP021 (China)          | Blank  |
|  | EMP030 (Germany)        | Blank  |
|  | EMP035 (United Kingdom) | In our performance specifications the fire protection system is usually included within the generator specification. |
|  | EMP059 (Sweden)         | Blank  |
|  | EMP041 (Sweden)         | Blank  |
|  | EMP042 (Norway)         | Blank  |
|  | EMP049 (Sweden)         | Blank  |

[\[Back to Question\]](#)

**G 6.7 Check-Box**

| Question   | Company                 | Result   |          |
|--|-------------------------|--|----------|
|  |                         | Answer   | Category |
| <b>6.7) Do you usually cooperate with fire protection equipment manufacturer on the Generating Fire Protection Question?</b> | EMP011 (Switzerland)    | No, our work ends with the issue of the specifications | B        |
|  | EMP014 (United Kingdom) | Yes, there is a cooperation and joint work             | A        |
|  | EMP021 (China)          | Yes, there is a cooperation and joint work             | A        |
|  | EMP030 (Germany)        | No, our work ends with the issue of the specifications | B        |
|  | EMP035 (United Kingdom) | No, our work ends with the issue of the specifications | B        |
|  | EMP059 (Sweden)         | Blank  | -        |
|  | EMP041 (Sweden)         | No, our work ends with the issue of the specifications | B        |
|  | EMP042 (Norway)         | Yes, there is a cooperation and joint work             | A        |
|  | EMP049 (Sweden)         | Yes, there is a cooperation and joint work             | A        |

[\[Back to Question\]](#)

**G 6.7 Open question**

**6.7) Do you usually cooperate with fire protection equipment manufacturer on the Generating Fire Protection Question?**

| Question                                      | Company                 | Result |
|---|-------------------------|--------|
|   |                         | Answer |
| It depends from case to case, please specify: | EMP011 (Switzerland)    | Blank  |
|   | EMP014 (United Kingdom) | Blank  |
|   | EMP021 (China)          | Blank  |
|   | EMP030 (Germany)        | Blank  |
|   | EMP035 (United Kingdom) | Blank  |
|   | EMP059 (Sweden)         | Blank  |
|   | EMP041 (Sweden)         | Blank  |
|   | EMP042 (Norway)         | Blank  |
|   | EMP049 (Sweden)         | Blank  |

[\[Back to Question\]](#)

**G 6.8 Check-Box**

| Question  | Company                 | Result |
|---|-------------------------|--------|
|   |                         | Answer |
| 6.8) Do you work also on refurbishment of Fire Protection Equipment on hydro generating plants? | EMP011 (Switzerland)    | Yes    |
|   | EMP014 (United Kingdom) | Blank  |
|   | EMP021 (China)          | Yes    |
|   | EMP030 (Germany)        | Yes    |
|   | EMP035 (United Kingdom) | Yes    |
|   | EMP059 (Sweden)         | Blank  |
|   | EMP041 (Sweden)         | Yes    |
|   | EMP042 (Norway)         | No     |
|   | EMP049 (Sweden)         | Yes    |

[\[Back to Question\]](#)

**G 6.8 Open question**

**6.8) Do you work also on refurbishment of Fire Protection Equipment on hydro generating plants?**

| Question   | Company                 | Result |
|--|-------------------------|--------|
|  |                         | Answer |
| Do you have any comment on this issue you would share with us? | EMP011 (Switzerland)    | Blank  |
|  | EMP014 (United Kingdom) | Blank  |
|  | EMP021 (China)          | Blank  |
|  | EMP030 (Germany)        | Blank  |
|  | EMP035 (United Kingdom) | Blank  |
|  | EMP059 (Sweden)         | Blank  |
|  | EMP041 (Sweden)         | Blank  |
|  | EMP042 (Norway)         | Blank  |
|  | EMP049 (Sweden)         | Blank  |

[\[Back to Question\]](#)

**G 6.9 Check-Box**

| Question | Company | Result |
|----------|---------|--------|
|          |         | Answer |

|   |                         |     |
|---|-------------------------|-----|
| <b>6.9) Do you follow you projects during erection and commissioning phrases?</b> | EMP011 (Switzerland)    | Yes |
|   | EMP014 (United Kingdom) | Yes |
|   | EMP021 (China)          | Yes |
|   | EMP030 (Germany)        | Yes |
|   | EMP035 (United Kingdom) | Yes |
|   | EMP059 (Sweden)         | Yes |
|   | EMP041 (Sweden)         | Yes |
|   | EMP042 (Norway)         | Yes |
|   | EMP049 (Sweden)         | Yes |

[\[Back to Question\]](#)

**G 6.9 Open question**

| <b>6.9) Do you follow you projects during erection and commissioning phrases?</b>  |                         |  |
|--|-------------------------|--|
| <b>Question</b>  | <b>Company</b>          | <b>Result</b>  |
|  |                         | <b>Answer</b>  |
| <b>If yes, can you tell us what are the most frequent problems you had to face in the case of the Fire Protection Equipment?</b> | EMP011 (Switzerland)    | Blank  |
|  | EMP014 (United Kingdom) | Blank  |
|  | EMP021 (China)          | The performance of test at site for fire protection equipment. |
|  | EMP030 (Germany)        | Blank  |
|  | EMP035 (United Kingdom) | Blank  |
|  | EMP059 (Sweden)         | Blank  |
|  | EMP041 (Sweden)         | Blank  |
|  | EMP042 (Norway)         | None   |
|  | EMP049 (Sweden)         | Blank  |

[\[Back to Question\]](#)

**G 6.10 Check-Box**

| <b>Question</b>   | <b>Company</b>          | <b>Result</b> |
|---|-------------------------|---------------|
|   |                         | <b>Answer</b> |
| <b>6.10) In your opinion is a Generator Fire Protection installation required nowadays?</b> | EMP011 (Switzerland)    | Yes           |
|   | EMP014 (United Kingdom) | Yes           |
|   | EMP021 (China)          | Yes           |
|   | EMP030 (Germany)        | Yes           |
|   | EMP035 (United Kingdom) | Yes           |
|   | EMP059 (Sweden)         | No            |
|   | EMP041 (Sweden)         | No            |
|   | EMP042 (Norway)         | Yes           |
|   | EMP049 (Sweden)         | Yes           |

[\[Back to Question\]](#)

**G 6.10 Open question**

| <b>6.10) In your opinion is a Generator Fire Protection installation required nowadays?</b> |                         |               |
|---|-------------------------|---------------|
| <b>Question</b>   | <b>Company</b>          | <b>Result</b> |
|   |                         | <b>Answer</b> |
| <b>Do you have any comment on this issue you would share with us?</b>                       | EMP011 (Switzerland)    | Blank         |
|   | EMP014 (United Kingdom) | Blank         |

|  |                         |   |
|--|-------------------------|---|
|  | EMP021 (China)          | "yes" is for the big and huge machines, and "no" is for small and medium size machines.                                 |
|  | EMP030 (Germany)        | Blank   |
|  | EMP035 (United Kingdom) | Blank   |
|  | EMP059 (Sweden)         | Blank   |
|  | EMP041 (Sweden)         | Blank   |
|  | EMP042 (Norway)         | Blank   |
|  | EMP049 (Sweden)         | Only fire detectors on modern epoxy type generators. Older Bitumen type generators still need fire extinguishing system |

[\[Back to Question\]](#)

#### G 6.11 Check-Box

| Question   | Company                 | Result |
|--|-------------------------|--------|
|  |                         | Answer |
| <b>6.11) According to your opinion, is there any question that is missing in this part of the questionnaire?</b> | EMP011 (Switzerland)    | No     |
|  | EMP014 (United Kingdom) | No     |
|  | EMP021 (China)          | No     |
|  | EMP030 (Germany)        | No     |
|  | EMP035 (United Kingdom) | No     |
|  | EMP059 (Sweden)         | Blank  |
|  | EMP041 (Sweden)         | Blank  |
|  | EMP042 (Norway)         | No     |
|  | EMP049 (Sweden)         | Yes    |

[\[Back to Question\]](#)

#### G 6.11 Open question

| <b>6.11) According to your opinion, is there any question that is missing in this part of the questionnaire?</b> |                         |        |
|--|-------------------------|--------|
| Question   | Company                 | Result |
|  |                         | Answer |
| <b>If yes, please state it here:</b>   | EMP011 (Switzerland)    | Blank  |
|  | EMP014 (United Kingdom) | Blank  |
|  | EMP021 (China)          | Blank  |
|  | EMP030 (Germany)        | Blank  |
|  | EMP035 (United Kingdom) | Blank  |
|  | EMP059 (Sweden)         | Blank  |
|  | EMP041 (Sweden)         | Blank  |
|  | EMP042 (Norway)         | Blank  |
|  | EMP049 (Sweden)         | Blank  |

[\[Back to Question\]](#)