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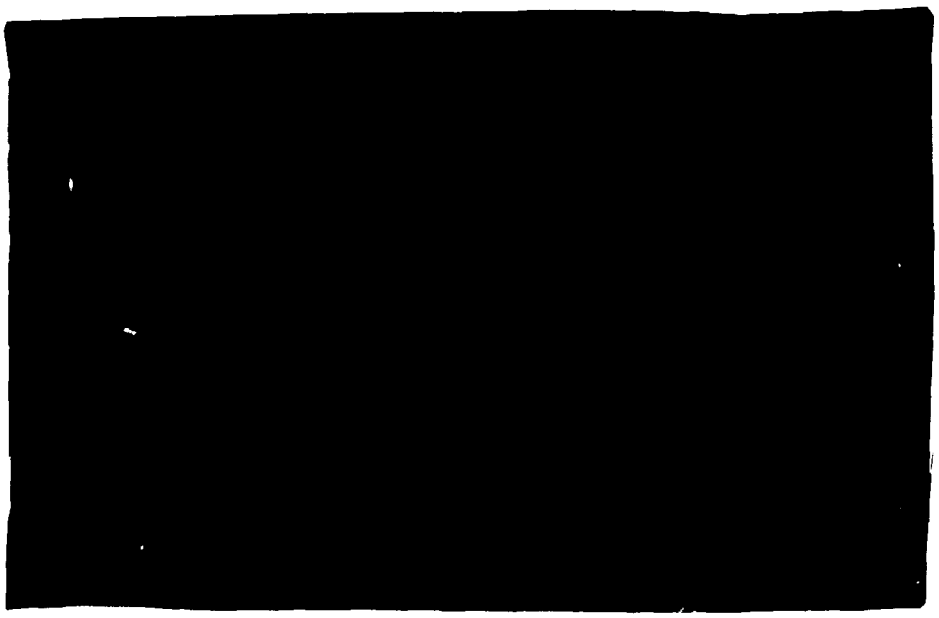

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# TRAINING SESSIONS FOR RADIATION PROTECTION. A SINGULAR OCCASION TO ANALYZE THE RISK PERCEPTION BY NUCLEAR WORKERS.

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# TRAINING SESSIONS FOR RADIATION PROTECTION - A SINGULAR OCCASION TO ANALYZE THE RISK PERCEPTION BY NUCLEAR WORKERS

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ABSTRACT

The training sessions for radiation protection - given on the one hand to employees of the decontamination and storage action section, of the nuclear center of Saclay, and on the other hand to technicians of low and medium activity laboratories - represent a good ground to test hypotheses mentioned at the origin of the analysis of the perception of risk by the nuclear workers undertaken by the Laboratoire d'Etude du Facteur Humain (L.E.F.H., Human Factor Analysis Laboratory) of the Commissariat à l'Energie Atomique (C.E.A., Atomic Energy Commission of France).

## I. ANALYSIS OF RISK PERCEPTION BY NUCLEAR WORKERS

At the origin of the research undertaken by L.E.F.H. about risk perception by nuclear workers, a bibliography on the subject covered was naturally prepared and the working assumptions, whether to be invalidated or to be confirmed, were formulated in a report entitled : "Risk perception by nuclear workers - Working assumptions" - M. ESCUDIE and P.Y. FICHET- CLAIRFONTAINE, LEFH Report n° 9. These assumptions arose from an awareness of the problem of risk perception acquired in other industrial fields, from an examination of documents relative to the question plus an analysis of the reports prepared by the radiation protection department (SPR) of the Nuclear Study Center at Saclay covering incidents which occurred at that center.

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These working assumptions were confronted with an examination of various situations :

A. Various safety analysis or research tasks performed by the L.E.P.H., although not giving first priority to the problem of risk perception by nuclear workers, are interesting sources of data. In particular, this may be the case of each examination of a given nuclear facility in normal operation or the analysis of safety of incidents or accidents occurring in nuclear facilities, particularly those for power reactors within the framework of the examination of the "experience feedback", but also for laboratories and plants.

B. Studies performed specifically on the theme of risk perception by workers, for example for the Saclay "hot laboratories", are naturally preferentiel information sources. The first work of this type performed until today aimed at a general study of risk perception by nuclear workers. It particularly indicated the advantage of performing individual investigations of the risks whose perception by nuclear workers presents specific characteristics such as the risks linked to criticality, tritium, plutonium, sodium, uranium hexafluoride, or the presence of explosive in nuclear environment, for example.

C. However, it was within the framework of the activity of answering requests for expertise sent by various units of the C.E.A. that the lessons concerning risk perception by nuclear workers were the most precious.

These requests can roughly be separated into two categories :

1. On the one hand, those coming from the facility heads or their managements and concerning a diagnosis of the units for which they are responsible, an improvement in the productivity of these units and often accompanied by the implementation of solutions to problems identified during the diagnosis ; this implementation of solutions generally was acquired by the introduction or the reinforcement of structures providing a follow-up of the problems and not only by solving them as they come up.

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2. And on the other hand, those arising from the central activities of the C.E.A., such as the Social Relations Division or the Central Comittee of Hygien and Safety and aiming at investigations performed in all the C.E.A. centers on a theme generally linked to the perception of risk by workers : work accidents, identification of persons actually assigned to work under radiation and their activities, for example.

The roles given to laboratory employees by this consulting activity within the C.E.A. give them a special view of the defense mechanisms in the work developed by the nuclear workers. This is particularly true of the work of the laboratory employees in the framework of their collaboration with the radiation protection service of Saclay which aims to examine the integration of radiation protection in the daily life of personnel exposed to radiation and includes an analysis of :

- incidents
- the daily operation of a radiation protection team in a nuclear facility,
- decontamination work, transfer or treatment of radioactive effluents and waste,
- training sessions for radiation protection.

## II. EDUCATIONAL ELEMENTS CONCERNING THE PERCEPTION OF RISK BY NUCLEAR WORKERS COMING OUT OF TRAINING SESSIONS FOR RADIATION PROTECTION.

### A. Method elements.

L.E.F.H. members were led to assist at the training sessions for radiation protection on the one hand organized or assumed by the S.P.R. of Saclay within the framework of the collaboration mentioned above, and on the other hand, at Marcoule (training of the employees of outside organizations).

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At Saclay, this training for radiation protection was designed for personnel who had been newly hired by the center, for employees of the decontamination and storage action section of the center (SIDS), for technicians of low and medium activity laboratories, for supervisory personnel, for fire department officiers, for the personnel of organizations outside "Electricité de France" (E.D.F., the French national electricity utility) who must work in nuclear power plants, etc...

It should be stressed that the L.E.F.H. personnel did not assist at the training sessions for radiation protection with a priority objective of theoretical research about risk perception, but whith an operational objective as pointed out by A. MOREAU, coordinator of the collaboration between the L.E.F.H. employees and his service, the S.P.R., at the first work psychopathology conference held in Paris in 1984 : "This change in the behavior and in the emotions of the operator placed in a radiological risk situation is indissociable from the changes in the behavior and ideology of the radiation protection specialist. It is for this reason that the observation work by an outside organization, like the L.E.F.H., observing the present reality of the perception of radiological risk and the relationships between operators and specialists is precious. Its presence in the training sessions comes under this framework". The content of this paper should also be placed within the context of that collaboration with the S.P.R., which leads to a proper relationship between the action in the field - the state of advancement of the reflections and discussions going on within this framework - and the publications.

Within the framework of this analysis of the perception of risk by nuclear workers, the fact of assisting at the training sessions for radiation protection enables the laboratory personnel to identify the discussion elements of the participants (trainees and teachers) which reveal or confirm the assumptions mentioned at the origin of the analysis.

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B. Assumptions relative to the perception of risk by nuclear workers.

The assumptions which have been proposed for testing during the analysis of risk perception by nuclear workers concern the genesis of incidents and accidents, the insertion of radiation protection in the daily life of the concerned workers, even the procedures for their training in radiation protection, as well as the maintaining of their aptitudes (knowledge, respect for operating instructions)for working in active areas. Here is the list :

1. Nuclear workers are subjected to a genuine risk,

2. The radioactive risk is specific according to :
   a. the invisible character of the risks linked to radiation,
   b. the way time takes place,
      . at the moment of the accident (immediate death is extremely rare) ;
      . in identifying the accident (the consequences of accident are not known until the work sequence has passed) ;
      . at long term ;
   c. the fact that at a given moment, the workers perception is determined by the state of its scientific, social, economic and technological context;
   d. the secrecy which surrounds certain nuclear activities,

3. There is an effective handling of the radioactive risk,

4. Nuclear workers feel anxiety at work,

5. To combat anxiety, nuclear workers react individually and as a group, adopting a specific defensive ideology :
   a. attitude of apparent scorn in relation to the risk,
   b. the risk is always greater for others,

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c. each has his place in the structure,
d. highlighting risks other than that which inspires the most anxiety.

6. This defensive ideology operates like a standard for individuals,
   a. there is an initiation phase,
   b. the defensive ideology is made mandatory.

7. The worker accustoms himself to the risk.

8. Different radiation protection practices co-exist.

C. Elements of risk perception by S.I.D.S. employees.

The S.I.D.S. agents have to treat, store and carry radioactive waste and effluents ; their activity is absolutely necessary in the nuclear center running. They are those who absorb the highest doses at Saclay. The trainers are the agents of health physics section responsible for health physics in the S.I.D.S. facilities.

The following elements concerning risk perception by S.I.D.S. employees which were recorded are typical of what C. DEJOURS calls the defensive ideology of the trade.

1. The S.I.D.S. employees "are afraid" (see assumption 4 : "Nuclear workers feel anxiety at work") :

a) At the conclusion of the training period, the Department Manager speaks to an employee who has been newly hired : "I would like to know what a new arrival thinks". Another answers in his place : "He is afraid". The "new person" then says : "I am not afraid like that" and another specifies : "Everyone is afraid. We all have the same reaction when we come into the C.E.A." ; another states : "If they are not afraid, they are oblivious". The Department Manager is much concerned

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then to find out whether the fear is stronger before or after the course : the new employee explains that he was not completely ignorant of the problems linked to the risk in the nuclear industry, because he comes from a district where there was considerable agitation concerning that question.

This "fear" was explicitly mentioned several times during the week : "Everyone is afraid of radioacive materials" ; a manager who wishes to send an employee alone into a compartment (where the safety instructions stipulate that there must always be at least two employees together) is considered to be "crazy".

b) The "fear" is also demonstrated by the treatment reserved for it by the S.P.R. management and a plant doctor. Naturally, we are absolutely not bringing into question here the objecivity of the information supplied, but we are noting a correlation between the choice of this information and the "fear" of the S.I.D.S. employees :

- concerning the S.P.R. head of the training course, an S.I.D.S. employee feels that : "He wishes to reassure us ; he feels that if he does not, everyone will leave the department there will be no one left".

  The themes brought up by the S.P.R. concern in particular :

- natural radioactivity : "Radiodermatitis does not occur spontaneously, but we are bathing in a universe of radiation (100 mrem/year and a few rems for certain) and we are never sure just what their effect must be",
- the presence of radionuclides in ordinary life (mineral waters and particularly medical examinations) plus a list of "off the shelf" articles which contain radionuclides : paints, speed indicators, door bell buttons, "exit" signs at public buildings, porcelain, C.R.T., bank checks,
- the effects of alcohol and in particularly of tobacco : "One pack of cigarettes per day produces in one year more than ten times the maximun dose authorized for workers directly assigned to work under radiation" such as the S.I.D.S. employees,

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- in the same way, management gives information which can help the S.I.D.S. employees to make their "fear" relative : the section supervisor jokes : "In a few years, it will not be possible to carry mineral water in a tank truck, this will be too active". He also sometimes insists upon the strong natural radioactivity to which "the whole swedish population is exposed" or the exemplary character of the nuclear industry in terms of safety : "It is no so good elsewhere, the harmful phenomenon sheet is a model document". The Department Manager also reminds them that "nuclear plants pollute less than others".
- the factory doctor notes that nuclear workers, like those in all other industries, are considered as subject to the risk to one death per year per 10,000 workers per accident or serious professional illness. He also indicates that the harmful phenomenon sheets of the C.E.A. have been used as a model for other organizations,

c) The subjects brought up during the week of training for radiation protection for S.I.D.S. employees constitute the indices of their fear :

- The questions submitted to the plant doctor may be condisered as significant, particurlarly :
  . How are the values concerning the biological effects established ?
  . History of damages.
  . Professional illnesses : how are they recognized ? What are they ?
  . The limits of harmful chemical phenomena in comparison with standards in the nuclear industry.
  . The effects of the accumulation of small doses with time.
  . How is the quality factor established ? What are the mechanisms at the exposed organ according to the radiation ?
  . The treatment in case of exposure accident.
  . How is internal contamination eliminated ? What are the methods of internal decontamination ?
  . The methods of external skin decontamination.
- A film concerning the accident which occurred in the SL1 reactor at Idaho Falls in the United States in 1961 during which 3 persons were

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killed was shown. Following this film, a certain number of incidents or accidents known by S.I.D.S. employees (sometimes because certain of them had been involved) were reviewed. The fear in relation to the occurrence of incidents in certain installations was brought up. Various accident scenarios were then considered : " a cask falls and knocks out the man with 700 to 800 rads at the cask", "if the hoist fails and the person is squeezed under the cask, the forces multiply by ten in this case" or in another case : "I cut off the air and I get out". They are then led to calculate how to get a co-worker out of an installation in accidental situation :

"if it necessary to get a guy out, who cares about the contamination ?",

"if there are guys inside, those are human lives",

"if he can't help himself and if he is held immobile, we don't know where the other guy is. There is nothing more to do but cry",

"if you know the guy inside, it is worse ; your boss, even a stinker, you are going to go get him",

"who decides if it is possible to go there ? You can make a long list of all the people to notify, but the guy has time to croak, even if you pick up the orange telephone of the Local Safety Force. You notify people afterward, when the guy is saved".

Then the problem of panic was brought up : a number of employees had obviously been really confronted with situations of this type and the following was reported :

during the "fire at a silo at La Hague", a S.I.D.S. employee took action as a "member of an outside organization" : "The S.P.R. detects a major contamination, but does not see where it comes from. Panic resulted : all the people were brought outside, men were angry with each other. They realized that it was more rotten on the outside than in the inside : then everyone went back in",

"It is possible to panic, then no longer be capable of estimating the radioactive risks and lose one's nerve. It is necessary to train oneself. I am prepared. That can be acquired. That does not exclude a big panic, but safety exercises must be carried out : calm, tranquil",

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"Myself, I followed the instructions of the Paris Firemen",

"At Cadarache, in the undressing vestibules...someone takes the initiative : "Everyone put on your masks". Everything becomes calm, even if there is some "picoes" in the nose",
"The guy who lowers the milk, he is essential" is the metaphor used by an employee for the person who stops the increase in tension.

d) This "fear" comes back to the fear of death ; this is because :
- when the carbon 14 dating procedure is explained someone said : "They kill the worms also", confusing this procedure with accidental exposure to radiation,
- the film concerning the Idaho Falls accident inspired numerous immediate reactions : at the moment when one of the victimes was brought out of the reactor : "That guy there, he's giving off" ; during the measurement of the dose emitted outside the coffin : "He is fit as a fiddle that guy" and "How deep did they bury him ?",
- "It is our health, radiation protection", said an S.I.D.S. employee.

e) The "fear" also concerns sexual functionning, and this theme was brought up often :
"And how much did you take in the gonads ? and in the head (to the tune of "Alouette...") ?
Were you able to perform your marital duty ?
- "Yes" - "So, it is not serious !".
Once the question was brought up of "false testicles",
"If you want to reorientate yourself, they have an irradiator to sterilize those guys in India : they bring them in one end, give them a squirt, then bring them out the other end".

f) Fear again concerns the genetic effects of radiation : one fellow talks about "making little green men", and another says : "My son..., he has blue ears".

g) The fear of the S.I.D.S. employees is linked to their difficulty of mastering the manipulation of protection equipment :

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- one employeed is worried about the difference in the indication of two films placed one beside the other (wrist and pocket) while this difference is coherent given the accuracy of the measurments of the films,
- "How are these films developed to give the result of the doses received ? We receive them three months after !",
- "Neutrons, nobody talks about them, you can get trapped as easy as can be !",
- "This is a protection tool, you should know how to use it... if not, it is an extra subject of dread",
- "The harmful phenomenon sheet which you sign : we don't know what we are risking with these symbols !".

h) The S.I.D.S. employees stress the effects of their lack of knowledge of the data necessary for understanding their work situation :
   - "That's twenty years that I am at Saclay, it is the first time that I took a course like that !".
   - A number of times, they posed questions and tried to mutually explain what ionizing radiation is by comparing it to the sun's rays "because the photons are grains of light", trying to find analogies with the shifting of material in waves or with fire which burns and stops when there is no more material,
   - They are not sure of their operating methods : "We begin with a routine. Is it good ? Is it not good ?".

2. Within this context, the S.I.D.S. employees define themselves as radiation prone (See assumption 53 : Each one has his place in the building").

a) The S.I.D.S. employees hold a discussion where their work is considered equivalent to "absorbing doses". To a co-worker who was subjected to an accidental exposure, an employee says : "Well, you have got to justify our bonuses". They say a number of times : "We are not making chocolate". When one mentions to them the radioactivity in mineral

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water and C.R.T., one of them says : "You can absorb your doses at home, that's practical ! ".

They try to rationalize the distribution of doses : "It is always the same people who are at the same work stations where the doses are absorbed. What is needed is a better distribution of doses among employees : right now there is injustice". They recommend dividing the total dose necessary for performing the tasks by a greater number of persons and show there should be recruitment to avoid having recourse to "the long time employees" because "one doesn't begin the protective suit when one is old".

Furthermore, they consider that they should be used to limit the risks to which are exposed the employees of outside Companies (many of them had this status before they were hired by the C.E.A.).

This preponderance in their work situation of this characteristic, the corresponding risk, is essential to their eyes, since that they feel that "one cannot work in industry without the disadvantages" (referring to the treatment of the waste problem).

b) And furthermore, they situate themselves historically and socially in relation to this treatment of radioactive risk :
   - noting the absence of gloves and masks on the site, at Idaho Falls, they conclude that "we don't work like in 1961 ,
   - they state that "it is those who have irradiation problems who understand" them in the various installations,
   - in E.D.F., there is one "baby" for 500 guys. I would avoid going to work in the plant. I worked at Chooz. They make the plant rotten for you in one week. They blame it on outside companies. From 6 to all the way up, they make everything rotten for you... They cannot make a high performance safety. There are too many people to watch, people who are incompetent from the nuclear point of view", (see assumption 5 : "the risk is always greath for other").

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   - "There are the nuclear plants ! but the nuts in the hospitals !" In other words, the working conditions and the radiation protection in

the nuclear power plants are not perfect, but those in the hospitals are worse since the doctors can be considered as nuts !

- "We work American style !" they say looking at the workers in Idaho Falls unrolling the adhesive tape,
- "in La Hague, those guys work".

c) They are considered radiation prone by the rest of the Company :

- the personnel of the installations considered at the risk "for I.D.S. is logical ; for them, that shocks them" ; if we believe the I.D.S. employees : "it has already occurred" that employees who are asked to participate in solving the problem of waste" giving them bonuses, refuse and appeal to the hygiene and safety committee" about this situation,
- the plant Doctor indicates to them that they are subject to a risk evaluated socially "as acceptable for the society even if there is a social injustice in relation to risks" : they are more exposed than many others, as minors, construction workers, etc...
- an S.P.R. employee says to them "I am going to make you work a little, irradiate you a little" while another fellow is concerned with managing the risk to which they are subjected by proposing that everybody identify the "useless doses" by "looking for the possibilities of a better distribution of doses whithin S.I.D.S.",
- as to the management, it is remarkable to note that the present section supervisor stresses : "When there is an exceptional operation, I go there also", while the supervisor who is going to succeed him in the near future suggests installing a new accounting, not only in money but in man rem too.

3. The defensive ideology operates like a standard for the S.I.D.S. employees (see Assumption 6). In effect, the department Manager insists upon the fact that "there is no question of keeping someone who is afraid in I.D.S. : it is like war planes, deep sea diving or mountain climbing, if one is afraid it is not possible". He brings up the case of a former employee who, in spite of the measurements, was persuaded that he was being exposed, and attributed any simple to a leak from the lead cask,

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was worried about a "thing on his calf which didn't get better" and it was necessary to find him another assignment. He also mentioned the stress of another employee "whenever he had to put on a protective suit" and he concluded : "to work in this trade, one has to learn to master the risks to work".

D. Elements of risk perception by workers in low and medium activity laboratories. The radiation protection training course in low and medium activity laboratories is given to trainees coming from different trades. Eight of the fifteen trainees are employed by the Atomic Energy Commission. Seven of them are Laboratory technicians in the biology laboratories of the Saclay Nuclear Study Center, the eighth is a nurse in the center's Plant Medical Department. The seven other trainees do not work for the C.E.A. but are either technicians in laboratories in the pharmaceutical industry, or nurses in nuclear medical departments.

Most of these trainees manipulate sources or solutions whose activities are relatively weak and in any case, nowhere near as strong as the activities to which are confronted the employees of the Decontamination and Storage Action Section (S.I.D.S.). In this way, the radionuclides used are, for example, iodine 125 and tritium with activities not exceeding 1.25 microcurie, phosphorus 32 with activities not exceeding 500 microcuries... Only one trainee works on plutonium in a "hot compartment".

The course is run by Radiation Protection Service employees of the Saclay Center.

1. Anxiety (see Assumption 4). From the first morning of the course, it appears very clearly that anxiety linked to radiation protection and to the effects of ionising radiation constitutes the background of the training which is going to be given. In this way, it appears first of all that through the presentation of the program for the week, the objective of the training personnel is to make the trainees comfortable by taking the mystery out of the idea of ionising radiation. Presenting one of the

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practical work projects during which will be analyzed the phenomena of the radiation caused by a source of a cobalt 60, one of trainers explains :

"but we will manipulate radioactive sources, real ones,... we will install alarms around the practical exercise room, we don't risk anything given the activity level of the source which we will use, but it is a principle". Then : after that, if you are still alive, Thursday you will have a course about..". Then : "at Saclay with the radon which is emitted spontaneously by the ground, we bathe in radioactivity....".

It should be noted that reference to natural radioactivity will be taken up again by the trainers at the end of the course, as a preface to their presentation of the biological effects of radiation. In spite of this presentation, the first question posed by one of the C.E.A. trainees shows that the anxiety caused by radiation definitely exists for some nuclear workers. Here is the conversation between this trainee and the S.P.R. employee :

. Traine's question : "When we receive a film which was positive, what does that mean ? "

. S.P.R's answer : "What does it tell you that film ?"

. Traine's answer : "From 0 to 35 mrems".

. S.P.R's answer : "It is not positive, that is not like a cuti-reaction where one answers right away. If you are anxious : that is nothing at all".

In spite of the rassuring answer of the S.P.R. employee, and his explanations about the fact that a film showing from 0 to 35 mrem generally means that no dose has been taken in by the individual, the trainee seems to have some difficulties in understanding why, if he has not absorbed a dose, his monthly dose report is not simply zero.

The anxiety caused by the doubt or lack of information is going to come through during the whole course by the questions and comments of some trainees.

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During the discussion at the beginning of the course, a nurse explains : "I inject bromine 76 into patients, I know the period of the product but that's all...we are nurses, we are not trained in radiation protection... we are worried we absorb doses, well, in a long run...", and then a bit later during a practical exercise on the precautions to be taken in order to avoid risk of contamination : "at the beginning, the boss of our department explained to the nurses that a syringe holding bromine was not radioactive..., we found out that this was false because the syringe was lead lined.., so we asked ourselves questions"... before, at the hospital (where she worked) everyone was mum, now it has changed a little, because now we grumble". Today, in spite of the lead protection of the syringe which she uses, the nurse is worried. This is because she feels that the bromine 76 is volatile and, because of this , she inhales this radioactive substance during the injections. She is sure of this, in spite of the fact that her bosses tell her te opposite. She thinks : "Like before, they tell me that the product used is not risky". She is worried because she absorbs doses, certainly weak ones, but doses whose long term effects she does not know. Two other trainees, employees in a phamaceutical industry laboratory express their doubts about the efficiency of the protection given to them : "In the beginning, in our place, we all had a photosensitive film badge and then afterward, we were told that whith the amount of activity which we manipulated, the films were not useful. Well, this was replaced by urine analyses and it is up to the people to request the urine analyses. The films were paid for monthly by the Company while the urine analysis is less expensive". "There is a photosensitive film hung up in the laboratory, but the film is not kept in the same place. The film goes from month to month to various laboratories in the section".

The trainees are anxious for the long time effects of radiation. This anxiety is reinforced by certain management decisions (economic or organizational). Expressed around certain questions and attitudes during the first three days of the course, the anxiety linked to radiation showed up more clearly on the fourth day during the explanation of the

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biological effects of radiation. This explanation was given in two phases. In the first phase, the explanation covered natural radioactivity, in the second phase, it was the effect of radiation on the organism as a function of the doses absorbed. The S.P.R. employees insist upon the fact that the organism is subject to lesions when the doses absorbed are substantial but at the same time the effects of weak doses are not known. Simultaneously, the trainers reassure the trainees by explaining that with the weak activities which they manipulate daily they are in no danger of being subjected to the physical harm which has just been presented.

For the first time since the begining of the course, the questions and remarks of the trainees spring up all over. Here are some of them along with some of the answers from the S.P.R. people :

Non CEA trainee : "Are the effects the same if the person is fat, thin, tall or short ? ",

Nurse : "Why are pregnant women separated out if there are no risks ? ",

S.P.R's answer : "But this is because we do not really know the effects of weak doses",

Non CEA trainee : "Women who want to have a child should not come to work at the CEA",

CEA nurse : But this is the same thing for a man who risks not being able to have a child ; they should warn people at hiring",

S.P.R's answer : "For a man it is not the same thing, that only affects him if he becomes sterile, while with a pregnant woman, there is the woman and the child... and when one goes into a nuclear center one knows...",

CEA nurse : "You are talking about yourself, but the cleaning woman, he doesn't know about it".

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The fears concerning reproduction an sterility were then the center of the discussion after the presentation of the S.P.R. people.

This discussion continued on the last day of the course. Clearly, the reassuring explanation of the trainers did not completely succeed in getting rid of the fears of some trainees. These fears are still present and, it would seem, are added to by the very content of the trainers' explanation. And on this subject, here is a remark from one of the trainees : "you have spoken to us about doses due to natural radioactivity and to tobacco, what are you trying to show us ? ... because for someone who is already worried !".

The "What are you trying to show us ?" seems very significant in the reasoning of this trainee : "Certainly, each individual absorbs doses caused by natural radioactivity, but aren't you talking about that to minimise the effects of the doses which are absorbed at the work site ?".

2. Attitudes of apparent scorn of risk (see assumption 5.1).
Confronting these direct expressions of anxiety, we note on the other hand attitudes which aim to deny the risks linked to radiation, speaking in a joking tone, boasting about working on active.

During the discussion around the table at the beginning of the course, each participant was invited by the S.P.R. people to present the radionuclides upon which he works and the radioactive period of these products. The period of the radionuclides manipulated by the great majority of the trainees is relatively short, for example 16 hours for bromine 76. When the term came for the trainee working in the "hot compartment", he explained : "I work on plutonium, its period is 25,000 years". His tone, when he said this, left no doubt as to the meaning : to work on a product with a period of 25,000 years, is quite different from manipulating a product whose period is only 16 hours, this is serious, and, it is plutonium (the Pu in nuclear language)....

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During one of the practical exercises whose objective was to make the trainees conscious of all the safety measures made necessary by the manipulations of radioactive solutions, one of the trainees openly violated the instructions of the S.P.R. employee (back pressed at the hood in which the active solution is contained, use of methods which he habitually employs, refusal to apply the methods recommended by the S.P.R.). After having performed his manipulation, the trainee smilingly announced to the S.P.R. employee : "Good, I performed my manipulation, I am checking myself (using the detection instruments provided for that purpose)... okay doctor, there is no problem".

During a presentation by one of the trainers, the trainer explained : "We are not biologists, our function at the S.P.R. when someone is exposed is to say : that individual has been subjected to a beam of X Rads of gamma radiation... after that, the medical department makes their calculation"... which elicited the following reflection from one of the trainees : "Me, that doesn't bother me (to absorb doses) : that or alcohol, same thing !".

The doctor, the alcohol... In spite of appearances, the body and its behavior under the effect of ionising radiation definitely seems to pose a number of problems to these two trainees.

## III. CONCLUSION

As we have mentioned, this paper presents the elements of risk perception by nuclear workers, elements which have been identified during training sessions for radiation protection and which today appear susceptible to being presented due to the progress made in the reflections and discussions occurring within the framework of the ongoing collaboration between the L.E.F.H. employees and the S.P.R. of Saclay ; some characteristics of a specific collective defensive ideology have already been identified. They give data to discuss some of the main questions of radiation protection :

.../...

- is anxiety necessary to product ?
- how runs fear in a plant, specially in a nuclear center ?
- to treat workers'anxiety, is an health physicist behind every worker like an angel or a policeman usefull or too expansive in rems ?
- and so on.

These elements of a specific collective defensive ideology have been suggested in the present paper and this analysis will be refined during the later works and in particular during the training courses in radiation protection and during the analyses of work situations.

They also will be used within the framework of our ongoing collaboration with the health physics services :
- to define the programs of the training sessions for radiation protection,
- to define the outline and the training of the trainers,
- to discuss the orientation of radiation protection practice,
- to reorganize the work of the employees after an analyse of their work situation in the facilities.

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