

How to Help People Work Safely - Promoting Safety Culture and Safe Work Practices

Senior Research Scientist Kaarin Ruuhilehto, Research Scientist Jouko Heikkilä
and Development Manager Terho Suna¹

VTT Industrial Systems, P.O. Box 1306, FIN-33101 Tampere, Finland
kaarin.ruuhilehto@vtt.fi, jouko.heikkila@vtt.fi, <http://www.vtt.fi/tuo/44/>

¹Fortum Oil and Gas, P.O. Box 310, FIN-06101 Porvoo, Finland
terho.suna@fortum.com, <http://www.fortum.com/>

Abstract

Recently, a clear demand for tools to improve safety by affecting human behaviour has been identified in industries all over the world. It has become evident that technical and management improvements are no longer sufficient to promote safety. At-risk behaviour and unsafe attitudes still prevail in spite of all the training, instructions, supervision and guidance. Knowledge and tools to manage safety of technical devices and the working environment are available and in daily use. Individual behaviour and personal attitudes are more difficult to tackle and handle in work places, and effective tools seem to be missing.

In Finland, Fortum Oil and Gas started a programme in co-operation with VTT's researchers and a national development project to promote safe behaviour and a stronger positive attitude to safety. A tool to analyse behaviour was introduced. The goal was to reduce the number of occupational and environmental accidents from the current very good national level to those among the best in the world. The programme was started with two pilot cases. On the basis of behaviour analyses, systematic and focused support for safe behaviour has been organised. Based on the experiences in the pilot cases, the tools were improved. The improved tools have been gradually taken into wider use in the company. Facilitators have been appointed within the company to support the use of the tools.

This paper describes the implementation and use of behaviour modification programme in Fortum Oil and Gas. The results and lessons learned are presented. The aspects of participation, gaining an insight and commitment on every level of the organisation as an important part of promoting safe behaviour are discussed.

1. Introduction

This paper describes a case study that demonstrates how a safety culture development programme in a Finnish industrial company was planned and implemented. The case study was conducted as a part of the activities of the *Safe Work Practices* project. This national research project focuses on developing and exploiting behaviour modification programmes integrated with safety leadership promotion in order to improve the safety culture in Finnish companies.

The project started in spring 2001 and it will end in August 2004. VTT is the project leader. Other partners in the project are Tampere Regional Institute of Occupational Health, Fortum, Rautaruukki Steel and Hercules Finland Oy.

The aim of the project is to import, further develop, distribute and support to exploit behavioural safety programmes and safety culture improvement tools in Finnish for Finns, that is to say considering the special characteristics of the national culture. Behaviour is in the focus because behaviour, at all levels of the organisation, turns culture and systems into reality. Behaviour can be measured and managed. The mechanisms maintaining such behaviours that produce problems, like accidents, incidents or near misses, have to be analysed and behaviours have to be changed. Making and maintaining the change is the key issue. That is where new tools and methods are needed. In

building up the Finnish model, several recognized reference sources were used e.g. Krause 1997, McSween 1995, Fleming and Lardner, 2002, and many other HSE reports on the subject prepared by the Keil Centre.

In the research project a toolkit, *the Safe Work Practices programme* was prepared. It consists of three modules suitable to find out what has to be done to change behaviours or the safety culture and how to support the change. The *Work Practices Analysis (WPA)* is suitable to plan and decide what needs to be done. The *Safety Discussions* module helps to improve management visibility and using the *Observation and Feedback Programme* companies can establish systematic support to safe work practices.

Six pilot case studies in three companies were carried out during the development of the tools. One of them is the Fortum tanker truck terminal case discussed here.

2. About Fortum

Fortum is a leading energy company in the Nordic countries. Fortum's activities cover the generation, distribution and sale of electricity and heat; the production, refining and marketing of oil; the operation and maintenance of power plants as well as energy-related services.

Fortum's oil related operations include oil and gas exploration and production, the supply of crude oil and feedstock for the refineries, oil refining, storage, inland and maritime transportation, harbour services, product sales and marketing and international oil and LPG trading. In 2002, Fortum supplied 8,0 million tonnes of petroleum products to Finland and exported 5,2 million tonnes.

The logistics unit is responsible for tanker truck deliveries and terminal operations in Finland. Independent traffic contractors have contracts with Logistics and manage oil deliveries. In 2002, there were 54 independent traffic contractors, 150 tanker trucks with 450 truck drivers altogether driving for Neste (Fortum). Annually, they transport over 4 million tonnes of oil products.

There are four terminals, at the refineries in Porvoo and Naantali as well as in Kemi and Kokkola. Porvoo sees the largest amount of traffic passing through.

3. About the Porvoo tanker truck terminal

The terminal is situated next to the Porvoo refinery. The terminal area consists of 100 hectares. There are three separated loading platforms, one for gasoline and oils, and one for bitumen (next to each other on the same area) and one for LPG (separate, in some hundred meters' distance from the others). The total number of loading booms on these three platforms is 28. At the moment, fifteen different products are loaded.

There is a crew of three operators present day and night, one in the control room and two in the field, (one in the LPG loading area and one in the gasoline and oils area). The average number of trucks visiting the terminal round a clock (in 24 hours) is 250. The terminal works by a self-service concept. The terminal personnel - especially the operators and their supervisors - are responsible for controlling the loading work of the truck drivers. Visiting rounds are made on the platforms and cameras are also used for monitoring in the control room.

The truck drivers start the loading process with the load planning using the computer based system in the office. Then they drive to the platform, choose the specified loading boom and fill the tanks. After loading they drive onto the truck scales to weight the cargo, print the necessary loading reports and check out using the computer in the control room. The drivers can do the whole loading all by themselves. The communication with the terminal personnel is not necessary unless problems in loading occur. Damages can be reported by using forms. From the terminal's point of view, no face-to-face communication is necessary either. Messages concerning acute changes, e.g. breaks or delays in deliveries and damaged equipment, are sent to the truck computers or put on the notice board in the terminal office. The only purpose for an operator to communicate with a truck driver would be to give

feedback on the loading performance. But as explained below, face-to-face communication was not something that an operator was looking forward to.

4. Why the behavioural safety programme and why just now

The improvement of safety is one of the key focus areas of Fortum's EHS activities. The long-term strategic target in safety is to become one of the best companies in the field. Currently, the target is still fairly far. In 2002, a thorough investigation of Fortum's safety management was conducted. On the basis of the investigation, several projects have been launched in order to develop the safety culture. At the corporate level, the key concepts of the development work were defined as follows:

- Safety is part of management
 - Lost workday injuries are reported within 24 hours to the line organisation all the way to the President and CEO.
 - Monthly summaries are compiled of the reports, to be handled by the management teams
 - Safety is part of the regular performance review of business units
- Safety is part of operational development
 - Risk assessment
 - Reporting of near-misses
 - Making incident investigation more efficient
 - Developing contractor practices
- Safety is part of everyone's ability to be aware of hazards and to act safely while taking the hazards into account
 - Promotion of permanent safety thinking at work and at leisure.

At the same time, VTT was searching for industrial partners to cooperate in a research project. The aim was to develop behavioural safety programmes and tools suitable for Finnish speaking Finns and the industrial culture in Finland. An action research approach was used and therefore some pilot studies were needed. Fortum responded and the Porvoo tanker truck terminal was selected to be one of the two pilot cases at Fortum.

The business unit that the terminal belonged to was one of those investigated in the Fortum's safety management investigation. The investigation proved that the safety climate in the unit was very positive - when expressed verbally. Yet, there were some problems in the behaviours of both the terminal personnel and the tanker truck drivers. Safety instructions were not perfectly followed by either of them. Several interventions, from safety education and bonus systems to stricter controls and sanctions, had been implemented. Each of them had had its positive contribution but the effects had not lasted long.

By participating in the research project the terminal wanted to increase the use of safe work practices and eliminate the unsafe acts, to improve managerial skills, the working environment and especially the relations between the terminal personnel and the transport companies including the truck drivers.

5. Implementation of the *Safe Work Practices* programme at Porvoo tanker truck terminal

In a nutshell, the implementation consisted of the following main activities:

- Behaviours were analysed. Analysed behaviours were such where risk taking and unsafe acts had been identified. *The Safe Work Practices Analysis* based on the ABC model of behaviour modification was used. In the model behaviour (B) is triggered by antecedents (A) and followed by consequences (C). The analysis identifies ways to change the behaviour: what has to be done to ensure that the appropriate antecedents exist and that the consequences support the safe behaviour and reduce the undesired behaviour.
- Remedies were implemented or initiated. They had been identified in the analyses. Objective was to ensure the optimal conditions for desired behaviours.

- The observation and feedback process was planned and implemented to reinforce and encourage the desired, safe behaviour to become a habit. A programme providing consistent reinforcement has lasted over an extended time period.
- Actions were planned and performed to exploit further the development model used in the pilot case: how to expand it to other business units and other users, as well as, how to ensure that it is sustainable even after the support from the research project is finished.

The work started in November 2001. In the terminal the most active phase was the year 2002 when the new programmes were designed and implemented. In 2003 the focus was in the follow up and in transferring the behavioural safety ideas and tools to other work places in the business unit.

In the beginning, special attention was paid to convince both the management and the workforce of the terminal that they themselves are at the helm. They are able to direct and decide what will be done and how it would be done. The researchers' role was to turn theories into such practical solutions that the management and workforce could adopt. The co-operation in the pilot study was started with training sessions where the managers, the operators, the EHSQ professionals and the representatives (drivers and owners) from the participating transport companies outlined the development policy they could commit themselves to.

A work group, a team, was established where all parties were represented. It was running the programme. All the documents, e.g. minutes of meetings, drafts of all kinds, analysis sheets, observation results, and graphs were made available to anyone interested in the terminal or in the four participating transport companies. Information newsletters were sent in regular intervals to the other transport partners. The work group was open to proposals and feedback and encouraged especially the employee members to discuss the items with their colleagues.

The details of the process are briefly summed up phase by phase as follows:

Start-up, November – December 2001

Kick off meeting

VTT's research scientists with the unit managers were in charge. The whole personnel of the truck terminal and drivers from 4 selected transport companies participated. Background, aims, phases and timescale were presented in general. The work was organised (analysis teams).

Training sessions

Trainer came from VTT; selected members of analysis team (approximately 20 persons) participated. Non-technical aspects of safety were introduced: why to focus on behaviours, how to change behaviours; what is the underpinning behavioural theory used in this project. The tool to be used was introduced: the *Work Practices Analysis* (an applied ABC-analysis)

Analysis of selected behaviours; improvements in environment, January – April 2002

Analysis sessions

The research scientist from VTT or the Fortum EHSQ professional presided sessions and also took notes; the selected team (operators, drivers etc. – 6–11 persons per meeting) carried out the analysis. Critical behaviours were selected by using the harmful effects of unsafe behaviours as criteria. Several data sources were examined: analyses of past incidents, risk assessments, task analyses, expert judgements and worker interviews. Six behaviours in the loading process were analysed in 11 meetings (five of them behaviours of drivers, one of terminal operators).

Work environment improvements

The analysis team made action plan for work environment improvements. The actions were based on the findings in the analysis. The EHSQ professional prepared a summary report, and sent it to

the line managers for decision-making, implementation and follow up. During the following 12 months 16 of the 34 suggested actions were implemented.

Planning and preparing observation and feedback procedure, June – October 2002

Developing the process

The analysis team continued its work and selected behaviours to be observed, defined criteria for safe and unsafe acts, drafted and revised checklists, designed feedback and involvement procedures, and planned data processing. VTT provided basic theory underlying the procedure, conducted the design process and prepared the data processing tool. Drafts were circulated among all the other operators and some truck drivers for comments. Two different observation lists were prepared: LGP loading and fuels loading. Video tapes were prepared for training.

Designing management's role

The analysis team made a proposal which was finalised in a line managers' meeting. VTT and Fortum's EHSQ professional guided the work. Management's role includes participating in implementation efforts and follow-up, participating in training, using observation results, reviewing and providing feedback on observation completion, evaluating the observation and feedback process.

Planning training sessions and training of observers

The analysis team carried out the planning. Four training sessions – one for each shift – was arranged. A 3-4 h session included: a) introducing the facts on the process by VTT, b) filling the observation list on the basis of a video of actual work, c) practical training in real situation: line manager / EHSQ professional setting an example and trainee personally practicing, and d) entering the data into the data processing tool (based on a spreadsheet). All terminal operators, the line managers and the analysis team were trained.

Kick off information

Information sheets into the close-circuit television for the terminal personnel, information letters to the transport companies and handouts for the truck drivers were prepared by VTT, line managers, the EHSQ professional and a reporter responsible for the unit's newsletter. Distribution of these materials was organised.

Running the observation and feedback process, started October 2002

Gathering observations and providing feedback

Every terminal operator made observations on the loadings – 5 loadings per shift at minimum, timing free. Two operators per shift in oils and one per shift in LPG made observations. Supervisors and line managers made observations every now and then. Face to face feedback was supposed to be given to each observed person regardless of their performance.

Follow-up and evaluation of observation performance

Number of reported observations and feedback giving was reviewed. Observed rate of safe behaviour (number of observed safe behaviours per all observations) and the trend were reviewed. Plans for further improvements were discussed. The follow-up and evaluation was done in line managers' operative meetings and analysis team's monthly meetings. Transport companies were given a status report monthly.

Revision of feedback to transport companies

Reporting interval was shortened from one month to a week. In case an unsafe act was observed, a report was sent directly to the truck in question in addition to the companies. Revision was planned by the analysis team. The terminal line personnel took care of the increased feedback.

Introducing the development model to all contract transport companies

The *Safe Work Practices* analysis model was introduced to those contract transport companies which did not originally participate to the project. The work was planned and done by EHSQ professional.

New objects for observation in pilot terminal

Three new behaviours were included in observations and three of the ten old ones were dropped out. The new ones occurred on the different area, i.e. waiting area outside of the platforms. They were not directly related to the loading of tanker truck but other behaviour of drivers (e.g. unnecessary idle running). The change was planned and initiated by the development team.

Expansion, started April 2003

Starting observation and feedback processes in three other tanker truck terminals

Original Porvoo terminal system was used (same observed behaviours, procedures, tools etc.) EHSQ professional launched the system with the local line personnel in terminals. Line personnel has responsibility to run the observations process. Implementation of the new processes was completed during 2003.

Closing the case study and active external support

The active connection to the national research program was closed in a meeting of the development team. Experiences and results were reviewed, the development process was evaluated: success factors, barriers encountered and lessons learned, and future plans were discussed. VTT conducted the review in the meeting and gathered feedback for the national research project.

Transferring the development model to other production units

The development model was applied in one production line and in the harbour (analyses, observations and training). The business unit manager was the initiator. Internal consultant (EHSQ professional) and external consultant (VTT) were used. Development teams consisted of the line personnel from various tasks and levels of the organisation

Support to and from other programmes

Several other safety activities have been implemented after this safety culture development programme at tanker truck terminal has been started:

- Extensive training programme on safety management for all top and line managers. The programme focused on leadership and behavioural safety. It concerned all managers in the whole oil and gas business unit and was initiated by the CEO.
- Training sessions on leisure time accidents for the oil and gas unit's personnel. These sessions focused on behavioural safety and attitudes. They were arranged in co-operation with an insurance company and carried out by a number of trained internal facilitators.
- Emphasising safety management as essential part of business management in training programmes for young managers. This is carried out at corporate level in management training.

The ideas and applications of *Safe Work Practices* programme were included in those activities.

6. Results

Antecedents and consequences: identified needs for change

The object of the *Work Practices* analysis was the tanker truck loading process. In the analyses the antecedents and consequences of the following critical behaviours were identified:

1. Reporting faults and hazards
2. Planning the load weight
3. Checking the contents of the tank compartments before loading

4. Using the ground connector
5. Using the overfill protector
6. Using the vapour recovery system
7. Monitoring the flow
8. Using the required safety equipment
 - o Helmet
 - o Safety goggles
 - o Antistatic gloves
 - o Antistatic shoes
 - o Antistatic working clothes with long sleeves and long legs
 - o Refraining from carrying and using mobile phone while working on the platform.

In six separate analyses conducted, the analysis team proposed 34 corrective actions. Twenty of them were connected to the antecedents. Improvement proposals included more specific rules and instructions, additional training, advanced automatic systems, reforms in work environment and in work conditions, for example.

Most of the other 14 improvement proposals were focused on the consequences and concerned feedback. More feedback was wanted to truck drivers, terminal operators, transport companies and maintenance workers. There were two proposals in which stricter control for "evildoers" to increase the risk to be caught and punished was looked for. However, more reinforcement and encouragement was proposed, too.

Half of the original proposals were dealt with and, when checked again a few months later, either fixed or under construction. One of them was the observation and feedback programme for truck drivers' loading tasks which was implemented in October 2002.

Impact on behaviour

The analyses indicated that feedback on the whole needed to be improved. There was no culture for giving face-to-face feedback in the terminal. It was taken obvious that once an order was given every one would behave accordingly and feedback's impact as motivation to change was weakly realised. Hence, the execution of the observations was one indicator measuring the success of the observation and feedback programme.

The actual indicator to measure the impact on the drivers' loading behaviours was the observed rates of safe actions. The safety observation checklist consisted of ten single behaviours. No baseline was established, though it was understood as a useful feedback on the programme's success in changing behaviour. This tool was sacrificed to ensure the acceptance of the new procedure among the drivers and the operators. Open communication in the start included giving the drivers definitions of safe practices. Hence, they were able to compare their practices with the expected, and - if desired - change them.

The observation rounds were executed perfectly from the beginning. Every operator was due to observe ten critical behaviours in a driver's performance and this was repeated five times a shift. The precise timing was optional which made it easier for an operator to have time for the task. The number of observations was controlled weekly.

The ten behaviours observed were 1) use of helmet, 2) use of safety goggles, 3) use of antistatic gloves, 4) use of antistatic shoes, 5) use of antistatic working clothes with long sleeves and long legs, 6) use of ground connector, 7) use of overfill protector, 8) use of vapour recovery system, 9) flow monitoring (being near enough to cut off in case of emergency), 10) refraining from using mobile phone on platform.

The graph presented in the figure 1 below presents the results of one of the observed behaviours, use of safety goggles. The results of the other nine observed behaviours were even better. The "baselines" were higher (85 - 95 %) and quite soon the maximum scores were reached and maintained, with the exception of rare hiccups in the use of other safety equipment.

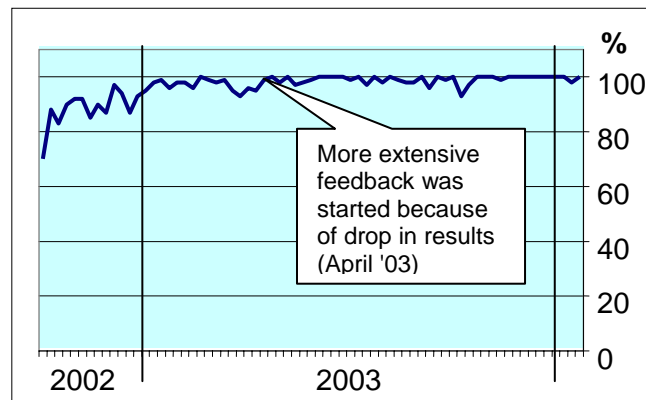


Figure 1: Observed rate of use of safety goggles

Impact on work climate and job satisfaction

The programme helped to identify problems in work environment. Many proposals were produced and corrections done. The rate of safe work practices increased. Through all those changes, the programme helped to improve working climate and increase participation to the development work in the terminal. The following failure reporting anecdote gives an example of the programme's impact on working climate and co-operation.

Reporting of failures and hazards was found to be poor. The analysis revealed that one reason for that was insufficient feedback. "Why bother? You never hear anything of your report ever since. And nothing seems to be done to the problems." On the other hand, the maintenance workers often lacked precise information on failures. The friendly atmosphere was endangered, too. The analysis team proposed changes to both the antecedents and the consequences. The report form was revised user-friendlier by using sketches where the equipment to be repaired could be easily marked. Moreover, the reports were gathered in a folder where everybody can follow the progress of the repairing. In a short time the new procedure was found to be very helpful. The maintenance manager expressed his satisfaction. They did not only get more reports but the reports were more precise and even the repair time had become shorter. And still more, the manager could justify his proposal to the purchasing department by referring to the number of failures. Gradually accusing of each other and name-calling turned into constructive proposals to solve problems and better co-operation between the repairmen and the drivers.

In September 2003 a closing meeting at the terminal was held where the researcher gathered the team members' experiences and feelings concerning what has been done and happened in the pilot case. The meeting was the last official event in the pilot case in the national development project. Besides evaluating the past, outlines and guidelines for the independent continuation in the future were discussed.

According to the experiences of the team the main result was that the rate of safe working practices among the truck drivers had clearly increased. "It looks different, almost as it was another place!" Additionally, the following positive findings were listed:

- The terminal now gets clear facts on the behaviours and need not react to assumptions and scattered information
- Improvements in the work environment have been implemented. The drivers' point of view brought improvements to problems not noticed by the terminal personnel.

- There is a better relationship between drivers and terminal personnel due to clear rules and just observation practices. Everybody is treated equally.
- Participation in the project was felt positive by the terminal personnel. It felt nice to be a frontline developer. Earlier the terminal had reputation of being somewhat cautious in adopting new ideas.
- Piloting gave insight into continuation of the development work with all transport company partners
- Participating in the development work has taught both the terminal personnel and the partner transport companies (owners and drivers) to discuss common interests, to bring up problems and make proposals for further development. Regular meetings will be held to keep this well- tried custom alive.

Looking back, the team members suggested some changes that would have helped the implementation. The whole personnel should be committed by profound communications. Everybody from the top managers to every field operator should be informed on the reasons, targets and actions that will follow. The whole process was seen to proceed too slowly and demand too many meetings. On the other hand, it was understood that it takes time to make changes and that human behaviour is not the easiest to affect.

7. Conclusions

This case study supports the strong research evidence on the effectiveness of behaviour modification programmes (see Sulzer-Azaroff, B. 1987). Regular observations and feedback increased the rate of safe behaviours. Further, the preceding analyses resulted in several technical and work environment improvements. Any remedy developed in the pilot that could be transferred to other units or users as a one-to-one application was transferred. The observation checklist and the data processing tool, as well as the new fault reporting form were quite easily adopted. However, it remains still to be seen if the use of the behavioural approach is sustainable.

In Finland, the time is getting ripe for affecting human behaviour. During the last decade, the frequency of occupational accidents and LTIs has significantly diminished. However, the progress has slowed, and may even have reversed. It has become evident that technical and management improvements are no longer sufficient to promote safety. Something new is looked for. The experiences from this pilot show that it's not easy to learn to deal with human behaviour.

The most difficult part in conducting the *Safe Work Practices Analysis* was defining the behaviour. The team members were accustomed to participate in risk analyses. It could have been expected that it would have been easy to continue with quite similar behaviour analysis. But, on the contrary, it seemed to be very difficult. The analysts had learnt to focus on work environment factors, managerial factors etc. as such, and not factors related to their own behaviour. They were willing to express safe or unsafe behaviour in the terms of antecedents or consequences when definition of behaviour - what a person actually does or what s/he fails to do - was wanted. E.g. instead of using the expression "I do not write my actions during the shift in the log book" a result was given like "next shift lacks information".

Another interesting finding was that though more feedback was frequently wanted in the analyses it turned out to be very difficult to give feedback when people were gathering the observations. Especially when the high rate of safe behaviours started to keep stable some observers felt it embarrassing or even annoying to keep on giving feedback. The same effect has been noticed with managers who were trained to carry out safety walks and discussions with their staff to motivate people to judge their own working habits.

The above described findings indicate that people are not yet accustomed to handle behaviour - least of all their own behaviour. Much more support is needed both in implementing new tools and programmes and developing the tools themselves. This pilot case gave the research project valuable

experiences and showed two clear development trends. The materials have to be as exhaustive as possible. Helpful practical checklists of how to proceed in carrying out analyses or planning and implementing observation and feedback systems with many exemplification, both success and failure stories, are needed. On the same time competent training has to be available to persons who intend to use behavioural approach.

The case discussed here can be considered as a long training session for the involved. Moreover, an EHSQ officer was deliberately trained to serve as an internal facilitator. He learnt the procedure thoroughly by participating in all meetings and training sessions during the implementation. He played a key role in the expansion phase, and is still doing so as the expansion is going on.

Integrating behavioural strategies into management systems through individual cases is not a fruitful approach. There is a risk that new ideas and processes remain local and separate. Implementing behavioural programmes effectively requires strong and extensive support: every one has to be committed and activities must happen all over the company. Behaviour modification is not successful unless the work environment and organisational factors are also considered. This will require behaviour changes at all levels of the organisation, not just in the workplace. Nationally, the important question is to inspire the managers. The role of behavioural aspects of safety has to be strengthened in managers' training. Another important development task is to increase the competency of safety consultants in behaviour sciences.

8. Acknowledgements

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