ANNEX 14

Problem-solving exercise: water for Tonoumassé, a village in Togo

Student's version

Prepared by Evert Nieboer and Annalee Yassi

Adapted with permission from Water for Tonoumassé, Carleton (Ontario, Canada); Local Committee of CUSO

A. General instructions

The case scenario has two parts. The decision to proceed to Part II should be made jointly by students and instructor. Both parts are followed by questions related to the material covered in Chapter 1 and Chapter 6 of the text.

B. Case scenario, Part I

Togo is a long and narrow country in Africa that stretches 580 km north from the Gulf of Guinea. It is flanked by Ghana on the west and Benin on the east. It has an average rainfall of 100 cm/year which is considerably less than that received in other tropical areas. The United Nations classifies Togo as a “least developed country”. Tonoumassé is a village of about 100 inhabitants located 50 km or so north of the coastal capital of Lomé. The surrounding area is a mixture of forested land (teak, mahogany, bamboo) and agricultural land (small farms growing coffee, cacao and cotton). Regionally, about 18% of the people have access to safe drinking-water. Fetching water is considered "women's work". Women spend 1-4 hours daily in the wet season (March to July) and as much as 8 hours in the dry period (December to March) in walking the 15 km to the nearest river. While there, they wash the family's clothes and carry about 15 litres of water back to the village. Housework, child care, farming and handicraft production/sale needs to be taken care of after arriving home about midday. The water they collect is rarely safe. Drinking it can lead to a parasitical disease caused by the guinea worm, as well as typhoid, hepatitis, schistosomiasis, dysentery and other intestinal infections. As a result, up to 40% of the children die before the age of five. Those that survive miss a lot of school because of chronic illness. The ability of adults to work is also affected by parasitic disease and repeated infections. Not surprisingly, back ailments are prevalent among women.

Chapter I Questions

1. Meeting human survival needs is consistent with the UN Universal Declaration of Human Rights (1948). What obstacles exist in rural Togo in achieving this priority?

2. From the perspective of the WHO definition of health, what is the health status of the Tonoumassé villagers?

3. Discuss the interaction between human activity in Tonoumassé and the biological environment.

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Dr Evert Nieboer, Department of Biochemistry, McMaster University, Hamilton, Ontario, Canada
4. Poverty is considered the greatest risk factor of poor health and a major obstacle to resolving environmental health problems. Discuss this in the context of Tonoumassé.

5. Do you consider the women of Tonoumassé as a “vulnerable group” in terms of susceptibility to poor health? Explain.

Chapter 6 Questions

1. Review the causes of the diseases mentioned.

2. What categories of communicable diseases linked to water appear to be involved in the case scenario?

3. The small wet season in the period September to December is disappearing in the maritime region of Togo. Within the context of the causes of water scarcity, what might be the cause? Is this development consistent with global trends?

4. Would water treatment have helped the Tonoumassé water problem? What might have been done?

5. What options other than water treatment might be considered?

C. Selected references


D. Case scenario, Part II

During the 1980s, the Government of Togo with the help of Canadian Universities Services Overseas (CUSO) initiated a rural water supply project. The village of Tonoumassé became aware of this through a female extension officer and, because there was dissatisfaction with the lack of water, appointed a committee. One of the requirements of the project was that at least half of the committee members should be women. The men grumbled and predicted failure, but grudgingly went along with the idea. Although pump installation was free, the villagers had to agree to clean the installation site, provide materials and labour for the concrete apron, send two people to learn how to maintain the pump, and to pay for all future repairs. A formal agreement was signed in a public ceremony in the presence of high-ranking government officials.

Tonoumassé villagers chose to set up a collective farm plot and required each family to contribute a day’s work per week. Sales of produce from this venture were 10 times more than was needed to cover the pump maintenance costs. Consequently, the village had a fund that could be used for other community improvements. Effectively this constituted the first local taxes Tonoumassé ever raised.

In eight general meetings for villagers and project managers (mostly female), rural extension workers and trained villagers took time to explain the connection between clean water and sanitary conditions and good health (including use of covered water containers, curtailment of the soiling of houses and yards, and a general programme to keep the village clean). A reduction in illness became apparent soon after the pump was installed and the concomitant improvements were made.

An interesting aside concerns respect for religion and culture. After consulting the spirits of the dead, village elders agreed with the modern-day technicians about the location of the water source and the placement of the pump.

Chapter 1 Questions

1. Was the requirement of female membership of the project committee a reasonable one?

2. Discuss the required contribution to the collective farm plot in terms of individual versus community initiatives/rights.

3. Empowerment is an important motivational principle. What was its role in the pump project and how was it achieved?

4. To what extent did the principle that community decision-making needs to integrate ecological, cultural, health, technical and economic dimensions apply to Tonoumassé?

5. The ability to respond to community environmental health problems is said to depend on economic prosperity. Was that the only determinant in the pump project?

6. How did the pump project make life better in Tonoumassé?
Chapter 6 Questions

1. What criteria were used in selecting the site for the pump?
2. Why is adequate sanitation crucial to a safe local water supply?
3. Suggest some routine monitoring to test for indicator organisms in the well water.
4. Outline strategies, other than improving sanitation services, for safeguarding the water supply.
ANNEX 15

Problem-solving exercise: water availability and Trachoma

Student's version
Prepared by Nancy V. Hicks

Part I

A major cause of blindness in developing countries is trachoma resulting from repeated infections. Lack of water and increasing distance from the home to the water source has been reported to be associated with the disease, which can be hyperendemic in dusty, dry regions. However, the association is not entirely borne out by the results of all studies.

You are the epidemiologist for a region of 20 villages where the incidence of trachoma is very high. Before promoting increased water supplies as an effective method for preventing trachoma, you decide to investigate the impact of distance to water supply on the prevalence of trachoma and on water use habits among families in your region. You are concerned that factors other than water availability may influence water use for hygiene purposes.

You decide to conduct a risk factor survey for trachoma among a random sample of 20 villages. Interviews (using a pre-tested structured questionnaire) will be conducted by trained local women.

Question 1. Devising items for an epidemiological questionnaire is not always straightforward. For example, you are interested in knowing the time needed to walk one way to a water source. However, in pretesting your questionnaire, you discover that this is difficult to communicate in the interview. How would you creatively deal with this problem in terms of the characteristics of the population that you might be working with?

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* Dr Nancy Hicks, former consultant, WHO
Part II
A preliminary summary of your study data indicate that 389 households are located less than 30 minutes from the nearest water supply, 844 are within ½-2 hours, and 705 are more than 2 hours away. In the first group of 389 households, 148 households have no children with trachoma, 97 households have at least one child with trachoma, and in 144 households all children are affected. In the second group of 844 households, 228 have no children with trachoma, 202 households have at least one child with trachoma, and in 414 households all children are affected. In the third group of 705 households, 204 households have no children with trachoma, 148 households have at least one child with trachoma, and in 353 households all children are affected.

Question 2. Presenting study findings in a clear and concise way is very important. Construct a tabular presentation of your data. In addition to absolute numbers of children in each category, include a column with the corresponding percentages.

Question 3. Now, give an interpretation of your data.
Part III

Table 1 below presents the results of logistic regression (a statistical procedure that calculates the association of a particular risk factor with the outcome while controlling for the influence of other variables). (You are now a statistics expert!)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds ratio</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time to water source:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5-2 hours</td>
<td>1.45</td>
<td>1.08-1.95</td>
</tr>
<tr>
<td>&gt;2 hours</td>
<td>1.37</td>
<td>1.01-1.87</td>
</tr>
<tr>
<td><strong>Quantity of water</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>1.01</td>
<td>0.76-1.35</td>
</tr>
<tr>
<td>High</td>
<td>0.84</td>
<td>0.61-1.15</td>
</tr>
<tr>
<td><strong>No. of children</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2.49</td>
<td>1.93-3.23</td>
</tr>
<tr>
<td>≥3</td>
<td>5.16</td>
<td>3.63-7.37</td>
</tr>
<tr>
<td><strong>Herding cows</strong></td>
<td>1.85</td>
<td>1.35-2.56</td>
</tr>
<tr>
<td><strong>House with a metal roof (vs. flat or thatched)</strong></td>
<td>0.63</td>
<td>0.47-0.86</td>
</tr>
<tr>
<td><strong>Traditional religion (vs. Christian or Muslim)</strong></td>
<td>1.71</td>
<td>1.28-2.30</td>
</tr>
<tr>
<td><strong>Sleeping next to a cooking fire</strong></td>
<td>1.48</td>
<td>1.14-19.20</td>
</tr>
<tr>
<td><strong>Presence of unclean faces:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>some children</td>
<td>1.30</td>
<td>0.82-2.08</td>
</tr>
<tr>
<td>all children</td>
<td>1.70</td>
<td>1.22-2.35</td>
</tr>
</tbody>
</table>

Question 4. How do you interpret the study results in Table 1?
Part IV

Table 2. Distribution of children with clean faces, according to the time (distance) to the water source and the quantity of household water

<table>
<thead>
<tr>
<th>Time to water source:*</th>
<th>N</th>
<th>All clean</th>
<th>Some clean</th>
<th>All not clean</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30 minutes</td>
<td>386</td>
<td>15</td>
<td>16</td>
<td>70</td>
</tr>
<tr>
<td>0.5-2 hours</td>
<td>831</td>
<td>11</td>
<td>14</td>
<td>75</td>
</tr>
<tr>
<td>&gt;2 hours</td>
<td>691</td>
<td>10</td>
<td>9</td>
<td>81</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Quantity of water</th>
<th>N</th>
<th>All clean</th>
<th>Some clean</th>
<th>All not clean</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>577</td>
<td>10</td>
<td>16</td>
<td>74</td>
</tr>
<tr>
<td>Medium</td>
<td>815</td>
<td>12</td>
<td>12</td>
<td>76</td>
</tr>
<tr>
<td>Low</td>
<td>516</td>
<td>12</td>
<td>10</td>
<td>78</td>
</tr>
</tbody>
</table>

* $\chi^2 = 21.85; P = 0.01$

Question 5. Give an interpretation of the data in Table 2.

Question 6. Comment on the way these data were gathered.

Question 7. What are your overall conclusions from this study?

Question 8. How will these study findings influence your opinion concerning increased and closer water supplies as an effective public health intervention for preventing trachoma and blindness?
ANNEX 16

Typical cases of foodborne diseases
Student's version
Prepared by Gerald Moy*

Cases 1 and 2 are adapted from Food safety: it's all in your hands: Ministry of National Health and Welfare, Canada, 1993.

Instructions:
Working in your small group, read the following cases and respond to the questions.

Case No. 1: The long-remembered wedding feast in Peru
It was to be the happiest day of Magda’s life. Relatives and friends from both sides of the family would be coming over for a lavish wedding feast. Her mother had worked late into the night preparing her best dishes for the guests. She finally went to bed at 04:00 in the morning after making sure that the food was attractively arranged on the tables. The next day was hot (over 30° C) but everyone enjoyed the good food. However, later that night, many people who attended the wedding started to experience severe stomach pains, nausea, vomiting and, in some cases, diarrhoea. While Magda felt fine, her new husband became so sick he had to go to the hospital.

What might have caused the illness?
What could have been done to prevent it?

Case No. 2: Deadly dessert in Canada
One September evening, patients at a hospital in Scarborough, Ontario, were served tapioca pudding for dessert. Later the next day, patients began showing the symptoms of food poisoning (cramps, chills, vomiting, diarrhoea). In all, 103 patients became ill and two of these, both elderly and weak, died. No pudding was available for testing. However, it was known that the pudding, amounting to 225 servings, was refrigerated in one large container until dinner.

What is a possible source of contamination?
Was it food poisoning? What could have been done to prevent this?

* Dr Gerald Moy, Scientist, World Health Organization
Case No. 3: A gift of fresh fish in Fiji

A man had very good luck fishing on the reef and offered to share some of the catch with his neighbours. The fish were nice and fresh, but about one hour after eating them, one person noticed a numbness of her lips and tongue. Soon other people also showed signs of illness, such as nausea, vomiting, headache and dizziness. Some people noticed that cold drinks felt hot, and hot water felt cold. Two people were hospitalized with irregular heartbeats. After several days, the signs of poisoning subsided, but for some people symptoms of weakness and dizziness persisted for several weeks.

What was the cause of this illness?
How could have it been prevented?

Case No. 4. The good mother in Tanzania

Salome’s child was now nearly 5 months old and it was time to introduce food other than breast milk into the diet. She had heard that nutritious and inexpensive weaning food could be made from local foods and she wanted to make sure that her child would grow and thrive. Following the advice in the nutrition literature she had been given, she faithfully prepared the recipe for a follow-up food using boiled sorghum as the base. At first, her child loved the new solid food and clearly was eating more and more. However, it was difficult and time-consuming work so she started making larger batches so that she needed to prepare it only once a day. She carefully covered it with cloth gauze to protect it from flies. Subsequently, her child started to experience periodic episodes of diarrhoea and after a few months the child started to show signs of growth faltering.

What might be the reason for growth faltering in this case?
How could it be avoided?
ANNEX 17

Problem-solving exercise: pesticide poisoning - an outbreak among antimalarial workers

Student's version

Prepared by Linda Rosenstock, revised by Steven Markowitz


Part I

You are a medical officer recently appointed to take charge of a large malaria control programme. You learn that a suspected increase in the number of pesticide poisonings started soon after the beginning of the last spraying season.

Question 1. How would you proceed to investigate this situation? What more would you like to know before getting started?

* Dr. Linda Rosenstock, Director, National Institute of Occupational Safety and Health, USA
  Dr. Steven Markowitz, Division of Environmental and Occupational Medicine, Mt. Sinai School of Medicine, New York, NY, USA
You learn that the pesticide malathion (an organophosphate) has replaced DDT this spraying season because the mosquito had become resistant to DDT and because malathion is an effective pesticide that is thought to be relatively safe for human use on the basis of much experience, including field trials in Nigeria and Uganda.

You learn that there are about 7700 antimalaria workers, making up 1100 teams of seven workers each (5 spraymen, 1 mixer, 1 supervisor). In addition to the reported increase in illness (which suggested organophosphate poisoning), five deaths have occurred - two in mixers and three in spraymen. It is thought that one of the three brands of malathion was associated with the most severe illness (used by three of the five who died). It is also reported that the illness was more common on Friday and Saturday than on Sunday.

**Question 2.** What appears to be the main exposure problem in the episode described?

**Question 3.** How can you plan organizationally to investigate this outbreak?

**Question 4.** What case definition of "poisoning" would you suggest (use Table 1)?

**Table 1. Symptoms of organophosphate poisoning**

<table>
<thead>
<tr>
<th>Mild poisoning</th>
<th>Moderate poisoning</th>
<th>Severe poisoning</th>
</tr>
</thead>
<tbody>
<tr>
<td>headache</td>
<td>muscle twitching, tremor</td>
<td>pulmonary edema</td>
</tr>
<tr>
<td>nausea</td>
<td>sweating, salivation</td>
<td>bradycardia (slow heart rate)</td>
</tr>
<tr>
<td>dizziness</td>
<td>blurred vision</td>
<td>or tachycardia (fast heart rate)</td>
</tr>
<tr>
<td>anxiety, irritability</td>
<td>vomiting, diarrhoea, abdominal pain</td>
<td>confusion</td>
</tr>
<tr>
<td></td>
<td>chest tightness, wheezing</td>
<td>seizures, coma</td>
</tr>
<tr>
<td></td>
<td></td>
<td>involuntary defecation, urination</td>
</tr>
</tbody>
</table>

**Question 5.** Why are there more symptoms on Friday and Saturday than on Sunday?

Why does there appear to be a problem with a pesticide that has apparently been safely used in other antimalaria programmes?
Part III

The occurrence of cases of poisoning has been confirmed. Cases occur predominantly towards the end of the working week. You decide to study it further with a questionnaire survey.

You define a case as:
— occurring in a member of a spraying team;
— having at least four of the following five symptoms (blurred vision, dizziness, nausea, vomiting, abdominal pain).

You decide to interview a random sample (10%) of all the antimalaria workers to ask them about their past and present symptoms and their exposures at work.

Question 6. What type of epidemiologic study is this survey?

Question 7. What are the advantages and weaknesses of:
— this study design?
— this case definition?
— this sampling strategy?
Part IV

You interview 79% of those targeted in your sample. Your main findings are shown in Table 2.

Table 2. Number of acute poisonings during recent spray season

<table>
<thead>
<tr>
<th></th>
<th>Number in sample</th>
<th>Number interviewed</th>
<th>% response</th>
<th>Number with at least 1 episode of poisoning</th>
<th>% poisoned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(a)</td>
<td>(b)</td>
<td>(b/a)</td>
<td>(c)</td>
<td>(c/b)</td>
</tr>
<tr>
<td>Spraymen</td>
<td>550</td>
<td>425</td>
<td>77</td>
<td>174</td>
<td>41</td>
</tr>
<tr>
<td>Mixers</td>
<td>110</td>
<td>86</td>
<td>78</td>
<td>33</td>
<td>38</td>
</tr>
<tr>
<td>Supervisors</td>
<td>110</td>
<td>95</td>
<td>86</td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>770</strong></td>
<td><strong>606</strong></td>
<td><strong>79</strong></td>
<td><strong>226</strong></td>
<td><strong>37</strong></td>
</tr>
</tbody>
</table>

Question 8. What do you think about the overall response rate of 79%? How could the non-responders affect your assessment of the problem?

Question 9. On the basis of these questionnaire results, how might you estimate the total number of workers with at least one episode of poisoning within the whole population of 7700 antimalaria workers during the recent spraying season?

Question 10. What would you do next?
Part V

You now know that there has been a major outbreak (epidemic) of poisonings, having estimated a total of 2893 (38%) of workers with at least one episode of pesticide intoxication. Sprayers and mixers are at highest risk. Observations of spray teams showed problems such as:

— working in clothes wet from pesticides;
— direct pesticide contact with skin due to mixing with bare hands;
— leaking spray cans.

Skin patch samples confirm that there is high skin exposure, particularly for mixers and sprayers (about 10-20 times higher than for supervisors). Airborne estimates of malathion exposure to sprayers were obtained by standard methods and were determined to be low (3% of recommended US standards).

Question 11. What seems to be the most important route of exposure?

Question 12. How could you study whether poor work practices and faulty equipment explain the epidemic?

What are other possible explanations? How would you measure individual exposure more specifically?
Part VI

You conclude that factors other than poor work practices contribute to the epidemic. The workers themselves suggest that there are more problems among those using one or two malathion brands (out of a total of three brands used). But a lot of workers use more than one brand in any given day. You collect blood and measure cholinesterase levels in a small sample of workers in the three job categories who used only one brand on the day of tests.

Your findings are shown in Table 3.

<table>
<thead>
<tr>
<th>Tables 3. End-of-day cholinesterase levels and mean % change (from morning to end of day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malathion Brand</td>
</tr>
<tr>
<td>Supervisors</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Brand 1</td>
</tr>
<tr>
<td>Brand 2</td>
</tr>
<tr>
<td>Brand 3</td>
</tr>
</tbody>
</table>

*Normal range: 0.53 - 0.93

Question 13. What do you think about these results? Is any brand safe? Which brand(s) might be causing the epidemic? Why might there be differences between brands?
Part VII

Analysis of the chemicals in the three pesticide preparations showed Brands 2 and 3 had a much higher concentration of toxic breakdown products (formed when the main chemical, malathion, is degraded). This breakdown was thought to be due to different "chemical carriers" (believed to be non-toxic). You conclude that use of Brands 2 and 3 was the main cause of the epidemic, but you are also concerned about problems with poor work processes, faulty equipment and inadequate protective clothing.

Question 14. Name at least three things you would do now to deal with the epidemic.

Question 15. You learn that there may be a problem with children in the community becoming ill. How would you investigate this?
Case scenario

In late 1987, a mysterious and serious outbreak of food poisoning occurred in Canada. Symptoms of the poisoning included vomiting and diarrhoea, followed in some cases by confusion, memory loss, disorientation and even coma. Two elderly patients died and in some other severely affected cases the neurological symptoms still persist. Epidemiologists from Health and Welfare Canada soon attributed the illnesses to restaurant meals of cultured blue mussels (*Mytilus edulis* L.). Using the Association of Official Analytical Chemists’ mouse bioassay for “red-tide” paralytic shellfish poison (PSP), Health and Welfare Canada and Fisheries and Oceans scientists demonstrated that the mussels contained toxic material. Furthermore, they were able to trace the problem to mussels harvested from a specific area of eastern Prince Edward Island. All the Deputy Ministers of Health of the 10 Canadian Provinces were notified by telex of the recommendation to take Prince Edward Island mussels off the shelves in retail stores and to remove them from restaurants. Consumption was to be stopped. Statistical analysis of the mussel distribution records and reported cases showed that for each symptomatic case some 500 people ate the contaminated mussels without any toxic consequences.

Subsequently, a team of scientists using suitable chemical separation, analytical techniques and the mouse assay, established that a neuroexcitatory amino acid, domoic acid, was the probable toxic agent. It was shown that the diatom *Nitzschia pungens* (an alga) was the source of this compound. Mussels feed on plankton, of which *Nitzschia pungens* became a significant component during an algal bloom in the waters off the eastern coast of Prince Edward Island. When the toxic bloom waned early in 1989, shellfish were found to contain low levels (<20 µg/g) of domoic acid and distribution for human consumption was again allowed. No further illnesses were documented.

**Question 1.** Identify, without detailed discussion, important issues highlighted in the case scenario. (Do this in a group setting with a recorder at the blackboard or flip chart.)

**Question 2.** What is paralytic shellfish poisoning (PSP)? Can domoic acid poisoning be distinguished from it?

**Question 3.** Discuss possible mechanisms of action of domoic acid.

**Question 4.** From the information given, do you expect there to be a safe intake level of domoic acid?

*Dr Evert Nieboer, Department of Biochemistry, McMaster University, Hamilton, Ontario, Canada*
Question 5. Suggest how one might determine quantitatively the concentration of domoic acid in mussel tissue.

Question 6. Are you convinced there was enough evidence to assign the blame to domoic acid as the causative agent?

Question 7. Assess the role of the interdisciplinary investigative team.

Question 8. Suggest preventive actions to avoid future incidents.

Question 9. Discuss the broad area of food safety in public health. In your discussions, highlight the status and practices of the following aspects in your geographical region: (i) regulatory authority; (ii) setting of food safety standards; (iii) routine food inspection/surveillance; (iv) emergency response capacity.

Selected references


Case scenario

You are a health inspector who is visiting a food processing plant that produces infant food on a large scale. The product of the production line you are working on today is a drum-dried and spray-dried infant food, based on rice, maize, starch, coconut oil, sugar milk and a number of supplements. The flow diagram of the process given to you by the director is shown in Figure 1.
Figure 1
Flow diagram for drum- and spray-dried rice-based infant foods

**Ingredients**
- Rice flour, maize starch, Soya flour, coconut oil, maize oil, vitamin supplement, vanillin

**Ingredients**
- Sucrose, powdered milk, other dry ingredients, flavouring, vitamin supplement

**Legend**
- Ccp critical control point
- ● points of high concern

- Water
  - dispersal ● ccp 1
  - mixing ● ccp 2
  - belt mixer ● ccp 3
  - drum dryer ● ccp 4
  - pre-breaker ● ccp 5
  - sacks ● ccp 6
  - dry mixing ● ccp 7
  - grinding ● ccp 8
  - pneumatic transport ● ccp 9
  - trolley-tanks ● ccp 9
  - pneumatic transport ● ccp 9
  - spray-dryer with fluid bed ● ccp 10
  - trolley-tanks ● ccp 9
  - packaging ● ccp 11
Based on your visit to the plant and interviews with staff and employees, you identified a number of critical control points. Table 1 lists the critical control points and the hazards involved.

**Table 1**  
**Analysis chart of the process of spray-drying rice-based infant food and control points**

<table>
<thead>
<tr>
<th>Critical control</th>
<th>Description</th>
<th>Hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dispersal</td>
<td>Addition of hot water.</td>
<td>Bacterial proliferation occurs over time</td>
</tr>
<tr>
<td>2. Mixing</td>
<td>The solution is mixed in stir tank.</td>
<td>As above.</td>
</tr>
<tr>
<td>3. Belt mixer</td>
<td>To achieve the required mixing of all ingredients.</td>
<td>As above.</td>
</tr>
<tr>
<td>4. Drum dryer</td>
<td>Evaporation of water by a Drum Dryer (DD)</td>
<td>The products leaving DD meet the current of air caused by the extractor. Microorganisms may be transferred to the product. Bacterial proliferation occurs over time in plant and environment.</td>
</tr>
<tr>
<td></td>
<td>The dryer works at 150°C.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The product reaches ...°C</td>
<td></td>
</tr>
<tr>
<td>5. Prebreaker</td>
<td>The sheet form of the products is reduced to pieces.</td>
<td></td>
</tr>
<tr>
<td>7. Dry-mixing</td>
<td>Addition of other ingredients to the semi-finished product.</td>
<td>Pathogens in milk and fruit powders (raw materials).</td>
</tr>
<tr>
<td>8. Grinding</td>
<td>The dry mixture is ground by milling.</td>
<td>Contamination from mill.</td>
</tr>
<tr>
<td>9. Pneumatic transport</td>
<td>Pneumatic transport of product, then stored in trolley tanks until</td>
<td>During these operations the product can be contaminated by trolley-</td>
</tr>
<tr>
<td>trolley tanks</td>
<td>transferred to sprat dryer by pneumatic transport</td>
<td>tanks as these are transferred from one building to another. Contact</td>
</tr>
<tr>
<td>pneumatic transport</td>
<td></td>
<td>with air can introduce microorganisms</td>
</tr>
<tr>
<td>10. Spray dryer</td>
<td>Water is added to the dry mixture; this is then treated</td>
<td>Atomizer rotor is subject to bacterial growth.</td>
</tr>
<tr>
<td>Fluid bed</td>
<td>In a spray dryer with a fluid bed.</td>
<td></td>
</tr>
<tr>
<td>11. Packaging</td>
<td>Product placed in sachet of impermeable nitrogen flushed laminate before</td>
<td>Packaging material can be contaminated. Contamination (pathogens) from</td>
</tr>
<tr>
<td></td>
<td>heat sealing.</td>
<td>the environment. Product residues in filler can contaminate fresh</td>
</tr>
<tr>
<td></td>
<td>Sealed sachet placed in a box.</td>
<td>product as it is filled.</td>
</tr>
<tr>
<td></td>
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</tr>
</tbody>
</table>
It is your task to write a report on the safety of the foods produced by this plant. The following questions may give some guidance in doing so.

Question 1. Describe when and how the microbial hazards may give rise to toxin formation, thus resulting in poisoning of the infant that consumes the food.

Question 2. What could be the cause of mycotoxin formation in the flow of oil and starch products, and what types of mycotoxins may be formed under which conditions?

Question 3. What options are there to prevent mycotoxin formation?

Question 4. Is it possible to inactivate the mycotoxins that have already been formed in the products, either chemically or physically?

Question 5. Staphylococcus aureus enterotoxin may have been formed in the milk before it was dried (e.g. 1 ng per g dried milk powder). Is it possible that children show S. aureus poisoning after consuming 250 g of the contaminated product?

Question 6. Is it likely that children fall ill after consuming the product in case it is contaminated with 104 viable Bacillus cereus spores per g and the product was left at 20°C for 16 hours?

Question 7. Describe the toxicological hazards (other than microbiological) that may be associated with this infant formula. Take the whole sequence of production into account from raw material to the consumer (e.g. origin, level, hazards, possible avoidance/elimination).

Study hint: take the following points into account

- **Regarding the raw materials:**
  - excess vitamin A/ D;
  - antinutritive substances (soy);
  - lipid oxidation and its products;
  - contaminants (e.g. heavy metals, PCBs, dioxin, nitrate, packing materials);
  - additives.
- **Regarding the food processing:**
  - lipid oxidation (minerals, oxygen, heat treatment);
  - Maillard reactions (depending on conditions, spray-drying versus drum-drying);
  - maintenance or loss of nutritional value depending on the processing conditions;
  - contamination from the equipment;
  - oxidative and thermal degradation of proteins (drum-drying).

- **Regarding packaging/storage:**
  - contamination.

**Suggested references**


ANNEX 20
Motor vehicle air pollution health effects worksheet

Circle all the correct answers or fill in the blanks.

1. Motor vehicles become a source or air pollution as a result of:
   (a) refueling losses
   (b) evaporative emissions
   (c) exhaust emissions
   (d) crank case losses
   (e) reckless driving

2 a. What is smog?

2 b. How is smog produced?
   (a) power generating plants
   (b) reaction of hydrocarbons and nitrogen oxides with sunlight
   (c) automobile exhausts
   (d) acid rain

3. What are the main pollutants from motor vehicles?
   (a) carbon monoxide
   (b) nitrogen oxides
   (c) ozone
   (d) particulate matter
   (e) lead
   (f) benzene
   (g) carbon dioxide
   (h) sulfur dioxide
   (i) acid aerosols
   (j) halogenated hydrocarbons
4. What factors affect the composition of motor vehicle exhaust emissions?
   (a) fuel type and quality
   (b) geographical factors
   (c) maintenance of vehicle
   (d) age of vehicle
   (e) speed of vehicle
   (f) type and operating condition of engine
   (g) use of emission control device

5. Which population groups may be especially susceptible to adverse health effects from motor vehicle pollution?
   (a) children
   (b) people who live at high elevations
   (c) people who smoke
   (d) people with asthma
   (e) people with cardiovascular disease
   (f) elderly people
   (g) people with respiratory disease

6. Which groups of people have an increased chance of exposure to motor vehicle air pollution?
   (a) traffic police
   (b) pedestrians
   (c) people who live on highly trafficked streets
   (d) parking garage attendants
   (e) toll booth workers for bridges or tunnels
   (f) subway passengers
   (g) people who drive buses, taxis, trucks
   (h) urban roadside street vendors
   (i) gasoline station workers
   (j) people who work in urban centres

7. True or false: Fuels in developing countries often have a high lead and sulfur content. T F
8. True or false: All motor vehicles are equally polluting. T F
   Why or why not?

9. Which motor vehicle air pollutants can adversely affect the respiratory tract?
   (a) nitrogen oxides
   (b) ozone
   (c) lead
   (d) sulfur oxides
   (e) particulate matter
   (f) carbon monoxide

10. Which substances in motor vehicle emissions can produce toxic systemic effects?

11. Which substances in motor vehicle emissions have a potential carcinogenic effect?
    (a) lead
    (b) sulfur oxides
    (c) ozone
    (d) benzene

12. True or false: Noise pollution can cause physical, physiological and psychological effects. T F
    Why or why not?

13. How is human exposure to motor vehicle air pollution measured?
ANNEX 21

Building a healthy city - the case of Managua, Nicaragua

Student's version
Prepared by Merri Weinger

Case scenario by Francoise Barten & Angel Sanchez

At present, Nicaragua is one of the poorest countries in Latin America. The dislocation caused by the low-intensity war during the last decade led to massive migration from the countryside. The population of the capital, Managua, more than doubled in three years. Today, roughly one-third of the country’s population lives in Managua. This rapid and uncontrolled growth of the city, combined with a lack of urban planning and increased demand on urban services, has contributed to a crisis situation, with increasing social inequalities and the political polarization of society.

Between 1987 and 1994, poverty in Managua increased from 30% to 72.5% and extreme poverty from 15% to 50% - mainly among female-headed households. Unemployment stands at a staggering 62% and malnutrition in children at 68%, while domestic violence and drug abuse among school-aged youth are rapidly rising. The 270 squatter settlements constitute the most unhealthy environments of the city, and more than 300 polluting industries are located in low-income areas. Waste is dumped at 310 illegal sites throughout the city, causing serious health hazards.

Among other health problems, the city faces serious epidemics of malaria and dengue. In spite of declining health status, the public health budget was reduced by 50% in recent years.

Question 1. What are some of the key health, environmental and social problems likely to be faced by the city of Managua?

Question 2. Your task is to work with an intersectoral group in Managua to develop a municipal action plan to address some of these problems.

a. Who should be part of this working group and how do you propose to establish it?

b. You would like to ensure that the community is involved in developing the plan. What is your strategy for raising awareness about the project and fostering community participation?

c. Which problem would you make first priority and how would you go about making this decision?

d. What are the objectives of your action plan?

e. What are the key components of your municipal action plan?

f. What kind of activities might be included in the plan?

g. On the basis of the activities outlined above, which agencies might take the lead in implementing the plan?

Selected references


ANNEX 22
Problem-solving exercise: nuclear energy - a safe alternative?
Student's version
Prepared by Evert Nieboer*

Case scenario

Concern about the prevalence of childhood cancer around a nuclear installation was broadcast on a national television programme. An ad hoc committee was set up by the Ministries of Health, Labour and Environment. It initiated two epidemiologic studies: a retrospective cohort study of the workers at the plant, and a case-control study of leukemia and lymphoma among young people living in the vicinity of the plant. The installation consists of four reactors, a spent-fuel reprocessing unit, various waste treatment plants, and a fast-reactor fuel-fabrication plant.

The study of workers’ mortality included all persons first employed before 1976, followed up until 31 December 1983. Deaths from all causes and cancer were somewhat lower than expected based on the general population mortality rates of the province. However, there were positive associations between accumulated radiation dose and death rates from bladder cancer, multiple myeloma, leukemia and haematopoietic neoplasms. These were not statistically significant when exposure up to the time of death or up to two years previously was considered. Nevertheless, when exposures recorded in the 15 years before death were ignored, these associations, with the exception of that for leukemia, became significant (p < 0.05). The observed association of radiation with bladder cancer has not been found in previous studies, but the findings for myeloma have been reported before for radiation workers.

In the second study, all identified cases of leukemia and lymphoma among individuals born in the region and diagnosed at ages under 25 were compared with controls matched by sex and date of birth and selected from the same birth register as the cases (eight controls were taken for every case). The startling and significant finding (p < 0.05) was that paternal external radiation dose at work during the 6 months before conception (≥ 10 mSv) or total occupational life-time dose before conception (≥ 100 mSv) was associated with a raised incidence of leukemia and non-Hodgkin's lymphoma among children of employees of the nuclear complex. Other than antenatal abdominal X-ray examinations, for which there was a non-significant positive (p > 0.05) association, and maternal age, no other risk factors were correlated with the observed incidence of leukemia and lymphoma. This study is based on 46 cases of leukemia and 20 cases of lymphomas.

Chapter 2 Questions

1. Discuss the fundamental properties of ionizing radiation, including the types and their sources.
2. How is radiation measured and in what units? Distinguish between absorbed dose, equivalent dose and effective dose in your answer.
3. Are the health effects reported for the workers and the young people in the case scenario consistent with exposure to ionizing radiation? What are the routes of exposure?

* Dr Evert Nieboer, Department of Biochemistry, McMaster University, Hamilton, Ontario, Canada
4. Assuming that the implied link between paternal exposure and leukemia and lymphoma in children of the exposed workers is real, what underlying pathological mechanism is implied?

5. What are the allowable occupational exposure limits for external ionizing radiation in the jurisdiction in which you live?

6. In December 1984, Stanley Watras, a worker at the Limerick nuclear power plant in Pennsylvania, USA, began setting off radiation alarms when he entered the plant on a Monday morning. Interpret this incident.

Chapter 9 Questions

1. Energy is necessary for daily survival and provides heat for warmth, working and manufacturing, or power for transport and mechanical work. Energy fosters activity. Ensuring an adequate, safe and environmentally-sound energy supply is a big challenge. Compare the four major energy sources (biomass fuels, fossil fuels, hydroelectric power, nuclear power) in terms of developmental costs, safety, environmental impact, social impact and renewability.

2. Discuss the feasibility of alternative energy sources, highlighting those of special relevance to your own region.

3. With special reference to The Chernobyl Accident Case Study (see Box 9.3 of the textbook), develop arguments for and against the statement that the operation of nuclear power plants should be discontinued as it does not adequately ensure the protection implied in Article 3 of the UN Declaration of Human Rights that “everyone has the right to life, liberty and security of person.”
Selected references


Häfele W. Energy from nuclear power. Sc. A mer. 1990; 263 (Sept.):137-144.


ANNEX 23
Problem-solving exercise: occupational exposure to inorganic lead
Student's version
Prepared by Evert Nieboer

A. Case scenario

To assess lead exposure in the Jamaican lead-acid battery manufacturing industry, three separate plants were surveyed. Of the 42 personal breathing-zone air samples collected, 38 exceeded the OHSA (US Occupational Health and Safety Administration) regulated permissible exposure level (PEL) of 50 µg/m³ (range 30-5300 µg/m³) and nine samples exceeded 500 µg/m³. The air samples were collected on mixed cellulose-ester filters using a flow rate of 2 L/min for the duration of the workshift. Twenty-eight percent of the workers had blood levels exceeding 2.90 µmol/L (60 µg/dL). More specifically, in Plant B, the geometric mean of the air lead levels was 233 µg/m³, with 60% in the range 50 to 200 µg/m³ and the remaining 40% exceeding 500 µg/m³. The distribution of the measured blood-lead levels in the same plant was: 9% < 1.93 µmol/L (<40 µg/dL), 17% between 1.93 to 2.85 µmol/L (40-59 µg/dL), 57% in the range 2.90-3.81 µmol/L (60-79 µg/dL), and 17% above 3.86 µmol/L (80 µg/dL).

In a recent critical assessment of the literature, IPCS (1995) suggests the following NOAEL blood-lead levels for biochemical or health effects of lead exposure in adults: 1.20 µmol/L (25 µg/dL, men) and 0.96 µmol/L (20 µg/dL, women) for haem synthesis depression measured by zinc protoporphyrin (ZPP), also referred to as erythrocyte protoporphyrin (EP); 2.16 µmol/L (45 µg/dL) in men and 1.68 µmol/L (35 µg/dL) in women for urinary excretion of ALA (aminolaevulinic acid); ≤ 0.48 µmol/L (10 µg/dL) for learning and behavioural effects in children; 2.40 µmol/L (50 µg/dL) for anaemia; 1.44 µmol/L (30 µg/dL) for reduction in peripheral nerve conduction velocity; 1.92 µmol/L (40 µg/dL) for sensory motor function impairment; 1.68 µmol/L (35 µg/dL) for alterations in the autonomic nervous system function; and 2.88 µmol/L (60 µg/dL) for risk of nephropathy. The blood-lead/air-lead relationship in occupational settings is curvilinear, having slopes between 0.00096 and 0.0038 µmol/L (0.02 and 0.08 µg/dL) per µg/m³ air. WHO (1980) recommends that air levels should not exceed 30-60 µg/m³; in most other jurisdictions, threshold limit value-time-weighted average (TLV-TWA) values of 100 to 150 µg/m³ are recommended (Saryan and Zenz, 1994).

B. Review questions

Chapter 3 Questions

1. In terms of hazard identification, succinctly state what we know about the adverse health effects of lead.

2. Based on the biological exposure indices or NOAELs provided in the case scenario, what are the likely shapes of the dose-response curves (i.e. effect versus lead in blood)?

3. Are the threshold values in agreement with those indicated in Figure 3.10? Give reasons for any discrepancies.

* Dr Evert Nieboer, Department of Biochemistry, McMaster University, Hamilton, Ontario, Canada
4. Comment on the exposures experienced by the workers.

5. In your opinion, are the workers at risk? Justify your answer. Can you characterize this risk?

6. Do you believe the workers are subjected to a risk high enough to warrant work refusal?

7. Clearly lead is a systemic poison. Explain why the total (inhalable) lead levels are measured rather than the respirable fraction?

**Chapters 4 and 10 Questions**

1. Would you recommend that the workers in the case scenario should be issued personal protection equipment? If so, what would you recommend?

2. What additional information do you need to know about the plant and workers before an environmental control programme can be considered?

3. Discuss the control options that might be considered/implemented to decrease workers’ exposure?

4. What is a TLV-TWA? Would the promulgation of such an inorganic air-lead standard help? What about BEIs?

5. Design a risk management package that includes air monitoring, biological monitoring and medical surveillance for use after the appropriate control measures have been put into place.

6. Does the risk management package suggested adhere to the principles of occupational health surveillance stated in Table 10.6?

7. Debate workers’ rights and responsibilities using the present scenario as a basis for discussion.

**C. Selected references**


ANNEX 24

Ethical analysis for decision-making in environmental health

Student's version

Prepared by Dr Colin L. Soskolne, Lee E. Sieswerda

Part I: Definitions relevant to ethical issues in public health services

Deontology: This is a class of theories known as duty-based ethics. The scientific ethic is a duty-based ethic that specifies the duties of scientists, including their obligations to the participants of research, to society at large, to colleagues, and to the sponsors of their research. Scientists are expected to subscribe to the values of science which, in essence, include the pursuit of truth. This is most assured when scientists are impartial (i.e. objective) in their research.

Utilitarianism: This theory requires that the greatest good be done for the greatest number of people. The utilitarian approach is consistent with the values to which public health professionals have subscribed for many years.

Principle-based ethics: Moral reasoning in the health sciences can be conceived of as using the principles of beneficence, non-maleficence, autonomy and justice. There can often be tensions between the different principles. When this happens, consideration of which principles are contravened and which are given priority characterizes the nature of the ethical dilemma. An example follows the definitions of the principles below.

Beneficence: This principle requires people to maximize benefits to others. It is closely related to the utilitarian ethic. In public health, the principle of beneficence requires that more good than harm be accomplished through public health action.

Non-maleficence: This principle requires that people do not harm one another. It is related to the principle of beneficence. There is, however, a subtle but material distinction between the non-inflection of harm and the requirement to do good.

Respect for autonomy: This is the principle requiring respect for individual self-determination. Autonomy manifests itself in many ways, but an instructive example is the requirement to obtain prior informed consent from research participants whenever feasible. Honesty in informing potential research participants of potential risk and harm demonstrates respect for their right to self-determination.

* Dr Colin L. Soskolne, Professor and Director of Graduate Training, Department of Public Health Sciences, University of Alberta, Edmonton, Alberta, Canada

Lee E. Sieswerda, B.Ed., Graduate Student
Justice: This principle is also known as equity. It requires that potential risks and benefits be evenly distributed among people in the community.

Egalitarianism: Complimentary to the utilitarian ethic is the egalitarian ethic which assumes that community members are equally important. It upholds the principle of solidarity and measures the well-being of the group by the standard of the least well-off in the group. Its success is determined on the basis of equity in the distribution of harm and benefit associated with public health actions.

Libertarianism: In contrast to egalitarianism, this ethic holds that the individual is more important than the community. Under libertarianism, the just society protects the rights of property and liberty, allowing persons to improve their circumstances on their own initiative. According to libertarian theory, social intervention in the market undermines justice by placing unwarranted constraints on individual liberty. Hence, libertarians hold the view that taxation for the redistribution of wealth is coercive and, therefore, inappropriate. Consequently, health care is not a right under this conception and privatization in the health care system is a protected value. Libertarianism has less utility within public health because it makes the greatest good for the greatest number of people less attainable.

Because public health interventions can impact on vested interests, the public health professional has to remain aware of the pressures that could be brought to bear on his or her recommendations in support of health policy. Ethics guidelines can be helpful in public health decision-making and should be seen as a means to achieving a balanced dialogue on a contentious issue.

Part II: Case scenario

(Note: Information in this case study was derived from published media reports and court documents. The names of individuals and corporations used in this case study are a matter of public record.)

As countries become more environmentally aware, governments have legislated programmes and directives to limit the amount of environmentally hazardous material to which people are exposed. The main targets for this legislation are the large petroleum refining and chemical manufacturing companies. These companies are very careful to adhere to the strict regulations within their own countries but may not abide by these high standards when company operations are established in other countries where legislation may not be as strict. This type of behaviour constitutes a double standard that may pose an ethical dilemma for the employees of the company in the country with the stricter rules. While the country in which the subsidiary company is operating may not have standards as strict as those of the country where the parent company is located, the danger of exposure to the chemical of concern for any other population is just as great as that of the population in the country of the parent company. Employees who are concerned about the health of the public in the less developed/regulated country may be fired with impunity if they voice opposition to their company’s application of different standards which would place at risk the health and/or lives of people in the country with less strict regulations. In several states in the USA, these employees are now protected by so-called “whistleblower laws”. In New Jersey, this legislation is called the Conscientious Employee Protection Act, and protects employees who act in the public interest from employers who see such acts as counter to their business interests.

Dr Peter Smith was employed as the director for environmental health and toxicology for the American-owned Petroil Oil Corporation. In addition, Smith ran, in his own time, a scientific publishing
company. From time to time, Smith’s roles would overlap. Such overlap was seen by Petroil as adding to the company’s prestige and was well-known to Petroil.

In September, 1989, Smith was sent to Thailand to speak at a symposium on gasoline health risks which was also attended by executives of the Petroil-owned affiliate, Petroil Oil and Gas Thailand (POGT) and Thai government officials. In Smith’s presentation, he reported that the level of benzene in gasoline that Petroil was selling in Thailand was 2.5-3.5 times that permitted in the USA, but noted that this was well below the Thai government’s legislated level. After he had given his presentation, Smith was said to have been approached by one of the POGT executives who informed him that the level of benzene in gasoline sold by POGT was actually in excess of even the Thai standard. Smith’s figures had, in fact, been on the low side.

Benzene is a gasoline additive used as a blending agent to improve engine performance. It is also a very toxic and carcinogenic agent (a leukemogen) and has been targeted in recent years by US environmental law. Currently in the USA, any products containing more than 5% benzene must be labelled “danger” and “poison” with a skull and crossbones symbol. In 1989, maximum allowable benzene levels in US gasoline were in the 1.5-2% range. The US Environmental Protection Agency now limits levels to 1%. In the company’s Thai operation, levels were said to be in excess of 5%.

Smith informed the POGT executive that the levels were extremely high and hence very dangerous. He strongly advised the executive to reduce the benzene levels or to stop selling the gasoline. The executive is on record as having stated that upgrading the refineries (built during World War II) to provide lower benzene levels would cost Petroil hundreds of millions of dollars.

On returning to the US after the symposium, Smith was denied access to the toxicology laboratory and was informed that he had been placed on “special assignment indefinitely”. Petroil executives alleged that he had used Petroil resources and employees for his publishing business. Smith sued Petroil for wrongful dismissal under New Jersey’s whistleblower law (i.e. the Conscientious Employee Protection Act).

In court testimony, Petroil stated that it was unable to produce documents which would have cleared Smith of any wrongdoing because these documents were “eaten” and/or “defecated” upon by mice. In addition, many exculpatory (i.e. exonerating) statements about Smith were excluded from Petroil’s investigative report. Petroil’s security manager admitted that he had omitted several statements from his report that would have been exculpatory for Smith. Petroil executives also acknowledged that the company had gained prestige from Smith’s publishing activities and that many Petroil scientists had published in Smith’s journals. Despite these admissions from Petroil, Smith was fired in November 1989. The company denied that he had been fired for voicing concerns over the benzene levels in the Thai gasoline. They launched a smear campaign to discredit Smith, claiming that he had appropriated Petroil funds and employees’ time for his publishing company.

Question 1.a) Is it the responsibility of companies from more environmentally regulated countries to protect the citizens of other countries by enforcing the strict environmental standards of the more regulated country on their operations in the less regulated country? Use ideas from egalitarianism and libertarianism to help formulate your answers.

b) If so, should these standards be enforced even if the facilities in the less regulated country are unable to meet these higher standards? Should the company insist that inadequate facilities be upgraded, possibly at the company’s expense?

c) If not, what number of expected deaths could be considered an unacceptable risk to the population of the less regulated country? Who decides what that level is?
Question 2. Would Petroil’s decision not to upgrade its Thai plant result in more good than harm? Identify the stakeholders involved in this decision and what they have to gain or lose.

Question 3. Discuss how the introduction of whistleblower laws may help to prevent negligent and unethical behaviour on the part of corporate executives/employers. Do you believe that such legislation is appropriate in view of the lengths to which Petroil demonstrated that it would go to protect its interests? What distinctions are there between law and professional codes of conduct and would codes be sufficient to prevent unethical behaviour?

Question 4. How tenacious should Dr Smith have been in making his point that people should not be subjected to poisonous levels of a substance regardless of whether they are American or Thai citizens? Were his actions justifiable? Use the principles of beneficence, non-maleficence, autonomy and justice to help formulate your answers. How typical is the fortitude demonstrated by Dr Smith?

Question 5. How common do you think instances analogous to the firing of Dr Smith are in industry, government and academia? On what basis? How might one obtain a more precise estimate of the prevalence of such disciplinary action? What might some of the difficulties be in conducting a study to obtain such estimates?

Question 6. Should employees be permitted, or even encouraged, to hold more than a single job? At what stage would the holding of more than one job constitute a conflict of interests for the employee?
**Part III: Resolving the issues**

The jury awarded Smith US$3.4 million in compensatory damages and US$3.5 million for punitive damages in March 1994. The trial judge allowed only half of the jury's award, saying that the compensatory damages were inapplicable because the whistleblower law was not valid outside the USA.

Both sides appealed the ruling - Petroil against the heavy punitive damages, and Smith for reinstatement of the full award.

In June 1996, a three-judge appellate court ruled in Smith's favour, stating that he had identified a "clear mandate for public policy" under the whistleblower law. In its decision, the panel wrote that Smith's concerns with "professional negligence" and "professional ethics" were justified as Petroil had defied its own policy to apply "health standards of developed countries in the absence of local regulations". Smith's lawyer said that the decision will serve as a warning to American oil companies not to ignore the health of customers abroad. He further predicted that US companies would no longer be able to apply the double standard of abiding by strict regulations set by federal and state environmental laws within the USA while allowing hazardous levels to exist elsewhere. A further award of approximately US$3 million was granted by the court in interest payments and additional legal fees. The decision was being appealed by Petroil to the State Supreme Court at the time this case study went to press.

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**Question 1.** Is there a point at which ethics and law interact in the above case study? What arguments might Petroil invoke in its further appeal against the decision to the State Supreme Court? How do you think the Court will decide? Discuss.

**Question 2.** Leaving the legal aspects aside and concentrating on ethics, do you think that the court made the correct decision? How does your ideological perspective (i.e. libertarian, egalitarian, etc.) affect your judgement of the court decision?

**Question 3.** Do you think that this case will substantially affect the operation of multinational corporations? Why?

**Question 4.** List examples of standards of practice to which scientists must always adhere regardless of their affiliation with any government, corporation or academic institution.
## ANNEX 25

**Sample evaluation questionnaire**

*Workshop on teaching approaches for environmental health, Cape Town, South Africa*

Please complete the following evaluation questionnaire. Your comments will assist us in planning future workshops.

<table>
<thead>
<tr>
<th>I. Teaching processes/ contents</th>
<th>Definitely yes</th>
<th>No, not at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. In general, were you satisfied with the presentation and explanations of the instructors? If not, please explain:</td>
<td>5 4 3 2 1</td>
<td></td>
</tr>
<tr>
<td>B. More specifically, were you satisfied with the presentation and explanations of the following instructors' topics?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching approaches</td>
<td>5 4 3 2 1</td>
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</tr>
<tr>
<td>Merri Weinger</td>
<td></td>
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<tr>
<td>Issues in Environmental Health</td>
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<tr>
<td>Annalee Yassi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identifying hazards</td>
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<td></td>
</tr>
<tr>
<td>Annalee Yassi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk assessment</td>
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<tr>
<td>Risk management</td>
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<td></td>
</tr>
<tr>
<td>Annalee Yassi</td>
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<td></td>
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<tr>
<td>Topic</td>
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<td>4</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Use of audiovisuals and discussion starters</td>
<td>Merri Weinger</td>
<td></td>
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<tr>
<td>Air quality</td>
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<td>Water and health</td>
<td>Ilse Wilson</td>
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<tr>
<td>Food safety and nutrition</td>
<td>Brian Delcarme</td>
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<tr>
<td>Urbanization</td>
<td>John Seager</td>
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<tr>
<td>Industrial pollution</td>
<td>Simphiwe Mbuli</td>
<td></td>
</tr>
<tr>
<td>Energy and health</td>
<td>Annalee Yassi</td>
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<tr>
<td>Global health problems</td>
<td>Annalee Yassi</td>
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<tr>
<td>Preparing case studies</td>
<td>Merri Weinger</td>
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<td>Evaluation</td>
<td>Merri Weinger</td>
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</tbody>
</table>
C. Were you satisfied with the handouts? 5 4 3 2 1
If not, please explain:

D. Considering your previous background, was the academic level of the course:

1. Too low ___
2. About right ___
3. Too advanced ___

E. Which of the topics were most interesting to you? Please list.

F. Which of the topics were least interesting to you? Please list.

II. Teaching materials: Basic Environmental Health text

A. Is the content suitable for your teaching? Yes, very suitable No, not suitable at all 5 4 3 2 1
If the content was not suitable, please comment on how you would like it to be changed.

B. Which topics from the text would you be most likely to teach after the workshop? For which audience(s)?

| TOPIC | AUDIENCE |
C. For the audience you have in mind (please name:_______________________________________), the level was:

- Too advanced
- Just right
- Too basic

c. Which topics should be added to the text or given more space?

d. Which topics should be deleted from the text or given less space?

e. Were the examples appropriate?

If not, please comment on how they should be changed.

III. Educational gains

A. At the beginning of the workshop, you indicated your expectations.

1. Which of them have been satisfied?

2. Which of them have not been satisfied and should be considered for future training programmes?

B. Did you learn any new skills or concepts in the workshop? Definitely yes

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<th>Definitely yes</th>
<th>Definitely no</th>
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5 4 3 2 1
If so, which? Please list:

C. Can these skills be applied in your work?

If so, which? Please list:

IV. Organization and logistics

A. Were you satisfied with the course organization and leadership?

B. Were you satisfied with travel and lodging?

If not, please explain:

V. Recommendations for the future

A. As a result of this workshop, what new activities do you plan to undertake?

B. What are your suggestions for future workshops?

C. Other comments or suggestions?