THE "HOW TO's" OF

ENVIRONMENTAL EVALUATION

IF you are proposing a new product, new formulation, or new application, or

IF you are developing new processes or process modifications which will increase the total volume or the concentration of any component (except water, nitrogen, oxygen, or carbon dioxide)

--by 25%, or

--above legal limits, or

--from zero

THEN you will enter onto the steps of this procedure...

FOR NEW PRODUCTS, NEW FORMULATIONS OR NEW APPLICATIONS OF EXISTING PRODUCTS

Depending on where the idea is conceived (R&D, Commercial Development, Marketing), it is up to the appropriate Research Group Leader, Commercial Development Project Manager, or Product/Market Manager...

1. TO FACT FIND, AND PREPARE A PRELIMINARY ENVIRONMENTAL COMPATIBILITY ASSESSMENT, TO BE SENT TO THE MEDICAL DEPARTMENT.

THIS ASSESSMENT WILL INCLUDE A STATEMENT OF PRINCIPAL SOURCES OF INFORMATION, A REQUEST FOR A PRELIMINARY ENVIRONMENTAL EVALUATION, AND COMMENTS OR ANSWERS ABOUT THE FOLLOWING:

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Environmental Compatability Assessment - Data Sheet EC-201 (cont.)

Description of the Product -

Probable End Uses -

A. Is the acute toxicity (via oral ingestion, skin absorption, inhalation) known or can it be estimated by analogy based on data for chemically related compounds? Indicate below:

	Known		Estimated
1) oral LD_{50}-rats	_____	or	_____ mg/kg
2) skin absorption MLD-rabbits	_____	or	_____ mg/kg
3) inhalation effect	_____	or	_____
4) skin irritation potential	_____	or	_____
5) eye irritation potential	_____	or	_____

B. Are harmful effects from repeated or chronic exposures known or can they be predicted by analogy?

C. Will 1) wastes from manufacturing
2) anticipated use, and/or
3) ultimate disposal of end product create environmental problems because product fails to readily degrade or decompose?

D. Is there an indication based on data or analogy, that the product can be stored or concentrated in biological systems?

E. Is it likely that harmful secondary reaction products will arise from a harmless-appearing parent as a result of chemical, biochemical, or biological activity in the environment?

NOTE: The Medical Department should be consulted for answers to Questions A and B. Questions C - E require speculation by people knowledgeable about the process and end use.

2. ONLY AFTER THE MEDICAL DEPARTMENT responds to your EC-201, and concurs, can you release samples to potential users.

3. BASED ON THE RESULTS OF THE EC-201, you should arrange for additional studies (toxicity, biodegradation, etc.) to obtain more information on how your product will affect the environment.

4. BEFORE COMMERCIALIZATION, you'll have to initiate a final environmental evaluation (Data Sheet EC-202, below). Include the principal sources of your information, the uses of the new product, and a request for an environmental evaluation with intent to commercialize.

   Send your completed Data Sheet to the Medical Director and Manager, Environmental Protection (Bill Papageorge).

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Environmental Compatibility Assessment Scheme

Instructions:

Answer each question in turn, "yes" or "no". Each answer is provided with a directive concerning the question to be answered next: the logic of the scheme assumes that questions skipped would be answered "no" and can thus be ignored. The last question, No. 12, should be considered if it is decided to make and sell materials which are very useful but potentially dangerous to man or his environment. When applying this form, consideration must be given to the product Monsanto supplies, product impurities, as well as thefinal or end prpduct that enters the environment.

ITEMS 1 THROUGH 3 ARE TO ESTABLISH THE HAZARDS TO HUMANS OF PRODUCTS, PRODUCT IMPURITIES, BY-PRODUCTS OR MANUFACTURING AND DEGRADATION PRODUCTS.

	If	Go to:
1. Is the material so physiologically inert that there need be no concern about health hazards to humans?	Yes	4
	No	2 & 3
2. a) Is the material toxic to persons as a result of a single contact with high concentrations?		
b) Is the material toxic to persons at lesser concentrations following repeated or prolonged exposure?		
c) Is the material likely to be carcinogenic, teratogenic or mutagenic?		
3. Recognizing the hazards to people, can procedures be devised for safe handling at reasonable cost?	Yes	4
	No	-Do Not Sell

ITEMS 4 THROUGH 6 ARE TO ESTABLISH IF CONSIDERATION HAS BEEN GIVEN TO DISPOSAL, DEGRADATION PRODUCTS OF DISPOSAL AND ENVIRONMENTAL DEGRADABILITY.

	If	Go to:
4. Can "closed-loop" disposal provisions be developed for the product so it will never reach the environment?	Yes	5
	No	6

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	If	Go to:
5. Is it likely the degradation products from the "closed-loop" disposal system could be harmful to humans?	Yes	-Recycle Degradation Products to 2. Continue at 6.
	No	7
6. Is it likely that the product will degrade in the environment or in any of the currently used disposal systems?	Yes	-Recycle Degradation Products to 1. Continue at 7.
	No	7

ITEMS 7 THROUGH 10 ARE TO ESTABLISH HAZARDS OF PRODUCTS AND DEGRADATION PRODUCTS TO PLANTS, ANIMALS OR ECOSYSTEMS.

7. Is it probable that the product or degradation products are harmful to plants and animals at concentrations to which they are likely to be exposed?	Yes	8
	No	9
8. Recognizing the hazards to plants and animals, can procedures be devised at reasonable costs to render the material innocuous?	Yes	9
	No	-Do Not Sell
9. Is it likely that harmful secondary reaction products could be formed from the harmless parent material as a result of a chemical, biochemical, or biological activity in the environment?	Yes	-Recycle the By-product at 1 & 7. Continue at 10.
	No	10
10. Is there reason to suppose that the material could have deleterious effect on the ecosystem, e.g., through concentration in the food chain, antagonism, synergism, abiotic reactions, chelation or plain physical concentration even though the material was not directly toxic to the biota?	Yes	-Recycle to 8. Continue at 11.
	No	11
11. Have procedures been devized to handle catastrophes in the production, storage, or transportation of the product?	Yes	-Sell
12. Is it necessary to restrict sales to specific end uses?		

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5. BASED ON YOUR REPORT, the Medical Director will respond on the environmental acceptability, restrictions, or additional information required about the new product.

6. WITH THE MEDICAL DIRECTOR'S blessings, the Business Group Director can approve commercialization.

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FOR NEW PROCESSES

1. DEPENDING ON WHO IS RESPONSIBLE (Research Group Leader, General Superintendent, TSD, or Guest Superintendent), you will have to prepare a preliminary environment evaluation review.

   This should be made along with the loss prevention review, and be coordinated with the Director of Safety and Property Protection.

   Use the environmental control check list below as your check list.

ENVIRONMENTAL CONTROL CHECK LIST

This guide for conducting an Environmental Control Review is primarily a check list of items which should be considered.

The goal of the Environmental Control Review is to insure that all plant effluents are adequately and economically handled to minimize pollution potential and the possibility of unfavorable publicity and payment of penalties. Special effort should be directed toward recycling by-products, controlling raw material and product losses, and reducing waste volumes as an economical approach to pollution control, especially as compared to potential collection and treatment costs.

I. ENVIRONMENTAL CONTROL AUDIT

An audit of all plant effluents must be made to provide a basis for evaluating pollution potential and determining the requirements for environmental control facilities. Each discharge to the environment should be reviewed and the following data assembled, both the normal or average, and the range for each component.

A. Atmospheric Discharges

Chemical composition

Quantity - lbs/hr

Specific volume - cubic feet/lb

Temperature of the discharge

Particulate matter included in the vent or stack

- Chemical composition
- Quantities
- Particle size (if available)

Height of discharge (elevation above surroundings)

Toxicity (if available)

B. Liquid Discharges

Chemical composition

Flow or quantity

pH

Acidity or alkalinity

Specific gravity

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Total solids
- Total dissolved solids
- Total suspended solids
- Total settleable solids

BOD (biochemical oxygen demand)

COD (chemical oxygen demand, i.e., ultimate BOD)

Quantities of nutrients
- Nitrogen (nitrates, nitrites, ammonia)
- Phosphorus (phosphates)

Temperature

Color

Toxicity (if available)

C. Solid Discharges

Chemical composition

Quantity - lbs/hr

Toxicity (if available)

Collection method

II. QUESTIONS

The following questions should be considered when making an Environmental Control Audit.

A. General

1. Flow Measurement

Can the flow or quantities be measured? If so, are such facilities necessary? Are they required by law?

Sampling

Are sampling provisions necessary? Are they required by law? If so, have they been provided and are they adequate, especially those for gaseous discharges where particulates are present? Can sampling locations be reached safely or are access platforms necessary?

2. Monitoring

Are special instrumentation necessary or justified to detect potential upsets which would result in unwanted (due to the value of lost materials or to potential for pollution) discharges to the environment, especially on sewer connnections which may otherwise go undetected?

3. Special Considerations

Special consideration should be given any potential discharge of the following materials to the environment.

a. Acid Gases and Mists

I.e., HCl, NO_x, SO_x, H_2S, HF.

b. Heavy Metals and Metal Oxides

I.e., Arsenic, barium, beryllium, cadmium, chromium (hexavalent), copper, iron, lead, mercury, nickel, phosphorus, selenium, silver, zinc.

c. Miscellaneous Gases

Ammonia, bromine, carbonbisulfide, carbon monoxide, chlorine, fluorides, hydrogen cyanide.

d. Organic Compounds

Acetone (and other solvents)
Acrylonitrile
Benzene
Carbamate compounds
Chlorinated biphenols
DDT
Fuel oil
Gasoline
Highly chlorinated organic insecticides
Naptha

Naphthalene

Organophosphorus compounds

Phenolic compounds

Tetraethyl lead

Tetramethyl lead

(1) Hydrocarbons emissions (atmospheric)

Refer to the National Air Pollution Control Administration, Publication No. AP-64, March, 1970 entitled "Air Quality Criteria for Hydrocarbons."

e. Radioactive materials

NOTE: The above chemicals have appeared in various existing and/or proposed regulations; thus their current status vs. local regulations should be checked. In addition, they should be considered as likely candidates for future regulations.

f. Others

The U.S. Public Health Service Drinking Water Standards may also be referred to as a likely source of future regulations.

g. Are chemicals which are objectionable because of their odors or lachrymatory properties properly contained or treated to avoid pollution and/or citations based on "nuisance" regulations? This includes potential problems due to discharge to city sewer systems.

B. Atmospheric

1. Is dispersion intended as the prime means of meeting acceptable concentrations in the ambient air? If so, are there other sources of similar discharges in the vicinity which should be considered, and is this method reasonable based on current and anticipated regulations?

2. Will the discharge of the gas in question combine with other materials in the atmosphere to form an undesirable effect, i.e., ammonia and HCl to form an ammonium chloride "haze"?

3. Are undesired liquids (mists) or particulates entrained in the vent or relief stream or will they form after discharge? Particulates must not only meet local regulations but must not create a poor public image or nuisance.

4. Will the stream be colored, i.e., will it draw attention to itself, such as NO_2?

5. Are large quantities of water vapor being discharged and if so, is the discharge located so as to avoid visibility and icing problems, especially outside of our plant boundaries?

6. What are the potentials for paint damage from either regular or emergency discharges? Are special considerations justified?

7. Will "breathing" of process equipment or storage tanks carburet unwanted vapors into the environment?

C. Combustion Process, Including Flares and Incinerators

1. Have all fuels (and wastes to be flared or incinerated) been analyzed? What will be the products of combustion? Are acid gases, i.e., HCl, SO_3, NO_x, formed?

2. Flue gases should be reviewed closely as possible pollution sources, including flares.

3. If flares are to be used will a "smokeless" type be required? Is the flare sized for emergency conditions (this is particularly important for toxic gases to insure complete destruction). Have drawback problems (due to condensation of gases) been considered when handling hot gases? Are continuous purges required? molecular seals? knockout drums?

4. If incinerators are to be used, are scrubbers necessary? If so, is the scrubber effluent a source of pollution? Is an auxiliary fuel required, special pilot lights? Are materials present in the waste stream or auxiliary fuel which will affect refractory life, i.e., calcium or sodium?

5. Has heat recovery been considered?

D. Liquid Discharges

1. Can a local city or area treatment plant handle liquid wastes? What are economics? What limits in quantities or waste composition would be imposed? i.e., pH, phenols, solids, chromates or heavy metals, toxicity, inorganic salts.

2. By-Products

Are there recoverable products in the plant waste streams? Can process recycle by-products? Can special plant waste streams (solvents, alcohols, etc.) be sold for re-processing?

3. Spill and/or Fire Water Control

What is the effect on waste treatment in the event a sprinkler or deluge system is operated? Are special considerations justified?

Are special provisions necessary for controlling possible spills, especially of liquids with high pollution potentials? Examples:

Pump seal leakage

Dikes for storage tanks

Selective collection of storm water

Provision for early detection

Are environmental control provisions compatible with safety requirements?

Are spills required to be reported to a pollution control agency? i.e., effect on potable water supplies. Does the plant make a spill report to the plant manager?

4. Sewer Systems

Are segregated sewers necessary for:

Storm water
Cooling water
Sanitary wastes
Concentrated or general process wastes

Are process area floor drains connected to process sewers? Are sewer grades compatible with existing and future sewers?

Are special materials of construction required for:

Acid or caustic wastes

Solvents

Plasticizers

Temperature

Solids or scaling

Are in-battery facilities (API separators, surface condensers, settling basins, etc.) required for:

Oil - many waste treatment systems will not accept oil

Flammable materials

Solids

Concentrated organics

Odors or lachrymators

pH adjustment

Temperature reduction

4. Are facilities provided or necessary to prevent discharge of solvents, etc. to the sewer which might result in explosive vapors in the sewers?

6. Toxicity

Does the discharge contain toxic concentrations of any materials (use the 96-hour mean tolerance limit as a guide)? If so, what special precautions are necessary and/or provided to protect personnel who might be required to enter sewers? Will the ultimate plant discharge exceed this 96-hour MTL toxic limit and if so, how does this compare to existing or anticipated regulations? Also, is there any potential of fish kills as a result of this discharge, keeping in mind other potential sources and the possibility that similar chemicals may be present upstream of the plant.

7. Storm Water Contamination

Has possible contamination of storm water runoff been properly considered? i.e., curbing potential spill areas for drainage to process sewers. If so, has the waste treatment system been designed to accept wet weather surge? Or, if plant effluent is tied into a local city or area sewer system for treatment will they accept contaminated storm water?

8. Barometric vs. Surface Condensers

Are surface condensers justified over barometric condensers in the light of environmental control requirements and economics?

9. Decanting

Decanting operations where a water layer is to be drained to the sewer should be considered as a potential source of high losses. This should be reviewed carefully and automatic monitoring considered to minimize losses from these areas.

10. Temperature

Effluent temperatures should be considered carefully vs. existing and potential regulations.

E. Solid Discharges

1. If solid wastes are to be landfilled, is the landfill properly designed and approved?

Can toxic materials be properly handled? (This question must also be considered in the case where our wastes are landfilled by others on a contract basis.)

Should selective landfills be employed to provide for possible future reclaiming operations?

2. Open burning should not be considered as a means of disposal unless specifically allowed by local regulations.

III. REGULATIONS AND PERMITS

A. As a general guide the lowest governmental subdivision issuing regulations are those which must be met. The

local plant can best verify the status of regulations affecting their area.

B. Have all potential discharges been checked against existing discharges and existing permits? Will new or revised permits be required?

C. Are there tax credits or tax depreciation allowances which apply to the cost of waste treatment?

D. Should federal or state grant money be sought?

IV. RECEIVING STREAMS

All new plant sites should consider carefully the details of the surrounding environment and the potential effect of the plant on this environment. Air quality, potentials for inversions and stream parameters such as type, minimum flow, history and use all must be considered.

V. POLLUTION CONTROL FACILITIES

All major pollution control facilities should be listed, including their design capacity (specify limiting design parameter) and the expected loading.

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2. NOW WRITE A REPORT -- summarizing your review, and defining major problems which need attention during later development work. Send it to appropriate division management, the Medical Director, the Director of Safety and Property Protection, and the Manager, Environmental Protection, Manufacturing. Ask for comments.

3. IF YOU GET ANY APPROPRIATE COMMENTS, include them in the Suggested Procedure or Tentative Process to be used during the development period.

4. FOLLOWING THE DECISION to implement the process or process change, the project engineer (along with representatives of plant, division and CED) will initiate a

   a. pre-project review - made prior to preparing the appropriation request.

   b. project design review - made after the appropriation has been approved and process design is sufficiently advanced.

   c. Pre-startup review - made when the plant operating manual is completed and before plant startup.

   Use the environmental control check list as a guide.

   The final reports will be sent to all parti[illegible] appropriate division management, Medi[illegible] Director of Safety and Proper[illegible] Manager, Environmental Protection,

5. INCLUDE ANY APPROPRIATE [illegible] Tentative Process, Interim Pro[illegible] Manufacturing Process.