

ENVIRONMENTAL EVALUATION — PRODUCTS AND PROCESSES

I. PURPOSE

This bulletin assigns responsibilities and describes the procedure for conducting environmental impact assessments of new products and processes before commercialization is approved and of existing products and processes as significant changes in application or manufacture are undertaken.

II. POLICY

The Organic Division recognizes the need for control and reduction of environmental degradation and thoroughly assesses the impact of proposed products and processes on the environment before commercialization and of proposed changes in existing product usage or manufacture.

III. SCOPE

This bulletin applies to proposed new products, new formulations and new applications of existing products.

This bulletin also applies to new processes and to process and/or equipment modifications when the proposed change is estimated to increase either the total volume or the concentration of any

DSW 332954

component in the water effluent or air emission streams: (1) by 25% or (2) any lower percentage increase which might exceed prescribed limits for any components of waste streams, or (3) any change from zero. Changes in water, nitrogen, oxygen or carbon dioxide concentrations are exempt from these considerations.

IV. RESPONSIBILITIES

A. PRODUCT EVALUATIONS

1. Director,
Business Group

Shall be responsible for assuring that no new product, new formulation or new application of an existing product is commercialized by his group unless a positive environmental impact assessment has been determined.

2. Manager,
Research & Development

Shall be responsible for pursuing, through his Research Group Leaders,

the assessment of the environmental impact of new products, new formulations or new applications of existing products which are conceived within the Research function.

3. Manager,
Commercial Development

Shall be responsible for pursuing, through his Project Managers, the assessment of the environmental impact of new products, new formulations or new applications of existing products which are conceived within the Commercial Development function.

4. Sales Director

Shall be responsible for pursuing through his Product/Market Managers, the assessment of the environmental impact of

DSW 332956

new products, new formulations
or new applications of existing
products which are conceived
within the Marketing function.

5. Manager,
Environmental Protection

Shall be responsible for
coordinating the product enviro-
mental evaluation activities in
the division.

B. PROCESS EVALUATIONS

1. Director,
Manufacturing

Shall be responsible for assuring
that no new process or change in
process is accepted for operating
manufacturing facilities until
a positive environmental impact
assessment is determined.

2. Manager,
Research & Development

Shall be responsible for
initiating, through his Research
Group Leaders, the preliminary

DSW 332957

environmental evaluation of the process or process change conceived within the Research function and for participating in subsequent more definitive evaluations.

3. Manufacturing Manager Shall be responsible for initiating, through the General Superintendents, Technical Services and the Guest Superintendents, the preliminary environmental evaluation of the process or process change conceived within the Manufacturing function. He shall also be responsible for initiating the more definitive evaluations made before implementation of those projects handled by Manufacturing.

4. Engineering Manager Shall be responsible for initiating, through his Project Managers, the more definitive evaluations made before implementation of those projects handled by CED.
5. Manager, Environmental Protection-Manufacturing Shall be responsible for coordinating the process environmental evaluation activities in the division.

V. PROCEDURE

A. PRODUCTS

1. The Research Group Leader, Commercial Development Project Manager, or Product/Market Manager, who is primarily responsible for the development of a new product, new formulation or new application of an existing product, must initiate a preliminary environmental evaluation as soon as the proposed product is identified and the end uses visualized by completing

DSW 332959

data sheet EC-201 (Appendix A) after conducting a literature search and consulting with others. He forwards copies of data sheet EC-201 with a statement of his principal sources of information, environmental problems visualized, probable end uses, and a request for a preliminary evaluation to the Medical Director and to the Manager, Environmental Protection.

2. The Medical Director will respond regarding the environmental problems foreseen and information required before samples are forwarded to potential users.
3. Upon receiving Medical Department concurrence, the Research Group Leader, Development Project Manager or Product/Market Manager involved may release shipment of samples.
4. Based on the results of the preliminary environmental assessment, the Research Group Leader, Development Project Manager or Product/Market Manager concerned will arrange for appropriate studies; e.g., toxicity,

biodegradation, to develop additional environmental information.

5. Before commercialization, the Research Group Leader, Development Project Manager or Product/Market Manager concerned must initiate a final environmental evaluation by completing data sheet EC-202. He forwards copies of data sheet EC-202 (Appendix B) with a listing of the principal sources of information, the intended product uses and a request for an environmental evaluation with intent to commercialize to the Medical Director and to the Manager, Environmental Protection.
6. The Medical Director will respond regarding the environmental acceptability, restrictions or additional information required.
7. When a positive environmental assessment is achieved the Business Director will approve commercialization.
8. The Manager, Environmental Protection, will maintain suitable records, issue appropriate reports and coordinate the environmental evaluation activities to

DSW 332961

assure that assessments are processed thoroughly and quickly and that new products, new formulations and new applications of existing products meet the standards of environmental acceptability.

B. PROCESSES (NEW OR CHANGED) AND EQUIPMENT MODIFICATIONS

Intent

This procedure applies to all new processes and process and/or equipment modifications which are estimated to increase either the total volume or the concentration of any component in the water effluent or air emission streams by:

- (a) 25% or more, or
- (b) any lower percentage increase which may cause exceeding emission or effluent regulations (or Monsanto standards, if more stringent) by any component of the waste streams or
- (c) any change from zero.

Changes in water, nitrogen, oxygen or carbon dioxide concentrations are not significant and are therefore exempt.

Steps applying to new processes and/or process changes are detailed in 1 through 7 below. Steps applying to equipment modifications (or de-bottlenecking) where no process changes are involved are detailed in 4 through 7 below.

1. The Research Group Leader, General Superintendent, Technical Services, or Guest Superintendent, who is primarily responsible for the development of a new process or process change, will arrange for a preliminary environment evaluation review (see CED Procedure #602, Section V Procedure - Research LP & EC Review, pages 2, 3 of 7). This will be made along with a loss prevention review and will be coordinated with the Director of Safety and Property Protection. An Environmental Control Review Check List (EC-27, Appendix C) will be used to insure that all pertinent items are considered.

DSW 332963

2. A report summarizing the review and defining problems requiring particular attention during subsequent

process development work is prepared and copies are sent to appropriate division management and to the Medical Director, Director of Safety and Property Protection and Manager, Environmental Protection, Manufacturing.

3. Appropriate comments resulting from this review are included in the Suggested Procedure or Tentative Process which will be used during the development period.
4. Following the decision to implement the process or process change and/or in cases involving equipment modifications, three definitive environmental evaluations are made along with the loss prevention reviews. (See CED Procedure #602, Section V Procedure, pages 3, 4 and 5 of 7.)
 - a. Pre-project review - made prior to preparing the appropriation request.
 - b. Project design review - made after the appropriation

has been approved and the process design is sufficiently advanced.

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

5. These evaluation reviews are initiated by the appropriate project manager or engineer. Representatives of concerned groups including plant, division and CED personnel participate. The Environmental Control Check List, EC-27 (Appendix C) is used as a guide. Plants will develop and implement "Environmental Review" procedures similar to present "Safety Project Reviews" for their Operations on Procedure Manuals. Reports summarizing the evaluations are sent to all participants, appropriate division management, Medical Director, Director of Safety and Property Protection and the Manager, Environmental Protection, Manufacturing.

DSW 332965

6. Appropriate comments resulting from these definitive reviews are included in the Tentative Process, Interim Process or Standard Manufacturing Process.
7. The Manager, Environmental Protection, Manufacturing, will maintain suitable records, issue appropriate reports and coordinate the process environmental assessment reviews to assure timeliness and thoroughness.

VI. REFERENCE PROCEDURES AND BULLETINS

Corporate Procedure	- Evaluation of Proposed New Products and Processes.
CED Procedure 602	- Loss Prevention and Environmental Control Reviews.
Organic Division Bulletin 0-18	- Procedure for Toxicological Testing.
Organic Division Bulletin 0-36	- Process Documentation.
Organic Research Reference OR-16	- Suggested Procedures.
Organic Research Reference E-10	- Tentative Process.
Organic Manufacturing Procedure Procedure OM-13	- Standard Manufacturing Process.

DSW 332966

BULLETIN

Data Sheet EC-201

NEW PRODUCTS

Preliminary
Environmental Compatability Assessment

The following Environmental Compatability Assessment Scheme includes some procedures similar to those now used by the Medical Department to assess the potential hazard of new materials to humans. This systematic scheme is being adopted to ensure insofar as possible that our products are not hazardous to the public or the environment.

The scheme is designed to elicit the information needed to protect people who come in contact with large or small amounts of a material, occasionally or continually, and all aspects of the environment which may contact or accumulate it or its degradation products. It takes the form of a series of questions to be asked about the material which can be answered simply "yes" or "no". However, as will be obvious from consideration of the questions, considerable knowledge will be required to provide satisfactory answers.

As provided for in corporate procedures (D-II-8 in Management Guide), the division in the company responsible for a new product must obtain a preliminary environmental evaluation, as soon as the proposed product is identified and the end uses visualized.

To initiate this evaluation the individual responsible for the product consults the literature and obtains the best answers he can by consultation with others and completes data sheet EC-201. He sends this to the Medical Department along with a statement of his principal sources of information and a request for a preliminary environmental evaluation.

The Medical Director will respond as to the environmental problems foreseen and information required, if any, before sending out trial samples.

DSW 332967

STLCOPCB4079543

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	or	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.

DSW 332968



BULLETIN

Data Sheet EC-202

NEW PRODUCTS

Final Environmental Compatibility Assessment

As provided for in corporate procedures (D-II-8 in Management Guide and Medical Department Bulletin EC-201) the division in the company responsible for a new product must obtain a final environmental evaluation before commercialization.

To obtain this evaluation, the individual responsible for the product reviews the Preliminary Environmental Compatibility Assessment (EC-201) form, consults the literature, obtains the best answers he can by consultation with others, and completes Data Sheet EC-202. He sends this to the Medical Director along with a statement of his principal sources of information, the intended product uses and a request for a final environmental evaluation with intent to commercialize.

The Medical Director will respond as to the environmental acceptability, restrictions, or additional information needed, if any, or if unacceptable, the reasons why.

DSW 332969

STLCOPCB4079545

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 the final or end product 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.

	<u>If</u>	<u>Go to:</u>
1. Is the material so physiologically inert that there need be no concern about health hazards to humans?	Yes No	4 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 No	4 -Do Not Sell

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

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

- | | <u>If</u> | <u>Go to:</u> |
|---|--|---------------|
| 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
No | 8
9 |
| 8. Recognizing the hazards to plants and animals, can procedures be devised at reasonable costs to render the material innocuous? | Yes
No -Do Not Sell | 9 |
| 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 devised 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? | | |

DSW 332971

MONSANTO COMPANY

**CENTRAL ENGINEERING DEPARTMENT
SAFETY & PROPERTY PROTECTION**

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ENVIRONMENTAL CONTROL CHECK LIST

DSW 332972

REFERENCE: EXHIBIT C, CED Procedure 602, Loss Prevention & Environmental Control Reviews

*Form EC-27 - Copies available from Office Supplies Department
General Offices, St. Louis*

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

DSW 332973

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?

DSW 332974

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 connections 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"?

DSW 332976

STLCOPCB4079552

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 carburetor 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 draw-back 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?

DSW 332977

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

DSW 332978

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.

DSW 332979

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

DSW 332980

STLCOPCB4079556

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.

DSW 332981