NIOSH Comments to EPA

COMMENTS OF THE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
ON
THE ENVIRONMENTAL PROTECTION AGENCY'S
REQUEST FOR COMMENT ON
REGULATORY APPROACH OF MICROBIAL PESTICIDES

Docket Control No. OPP-50668

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety and Health

5/15/89

The National Institute for Occupational Safety and Health (NIOSH) offers the following comments in response to the issues raised by the Environmental Protection Agency (EPA) concerning regulation of microbial pesticides under the Federal Insecticide and Rodenticide Act (FIFRA) [54 FR 7026].

OVERVIEW OF NIOSH POSITION

Under the Occupational Safety and Health Act of 1970, NIOSH has been given a number of responsibilities, including the identification of occupational safety and health hazards, evaluation of these hazards, and recommendation of standards to regulatory agencies to control the hazards. One of the methods by which NIOSH meets these mandates is to evaluate existing or new technologies to determine if there are any occupational safety or health hazards associated with the technologies. Particular attention is directed to new or existing technologies that have high growth potential, such as biotechnology.

To date, NIOSH has conducted a number of studies and developed several reports in the field of biotechnology that EPA may find relevant for developing regulations for microorganisms under FIFRA. These reports are:

1. NIOSH Perspective on Commercial Recombinant DNA/Biotechnology Development [Pauker 1981]

2. Medical Surveillance of Biotechnology Workers: Report of the CDC/NIOSH Ad Hoc Working Group on Medical Surveillance For Industrial Applications of Recombinant DNA [Landrigan et al. 1982]

3. The Biotechnology Industry [Landrigan et al. 1983]

4. Industrial Hygiene Characterization of Commercial Applications of Genetic Engineering and Biotechnology [Elliott et al. 1983]

5. Perspectives on Opportunities Toward a Hazard Free Bio-processing Environment [Elliott et al. 1987]

6. Gypsy Moth Control Project [Health Hazard Evaluation Report No. 85-309-1739]

7. Occupational Biohazards: A Review [Dutkiewicz et al. 1988]

8. Control Technology Assessment of Enzyme Fermentation Processes [Martinez et al. 1988]

9. Quantification of Airborne Endotoxin Levels in Various Occupational Environments [Olenchock 1988]

10. An Exposure Characterization of a Large Scale Application of a Biological Insecticide, Bacillus Thuringiensis [Elliott et al. 1988]

This overview primarily concerns workers who may be exposed during release of microorganisms in the environment, however, it should also be noted that workers may also be exposed prior to this phase. For example, microorganisms prepared for release in the environment will be grown utilizing fermentation techniques and the potential for worker exposure during this phase also exists. In addition, workers may be exposed during the research and development phase where microorganisms are isolated from nature or developed using genetic engineering techniques. Although the types of hazards (i.e., pathogenicity, toxicity, and allergic reactions) probably are the same as those discussed below for deliberate release, the risk and potential for exposure may vary from phase to phase.

Risk to Workers During Environmental Release

In the case of chemicals, hazard identification is based on observed endpoints such as undesirable acute or chronic effects. However, when considering the potential negative health effects to workers exposed during environmental release of microorganisms, the endpoints are not always that clear. In general, the potential occupational hazards related to environmental release of microorganisms can be divided into three categories based on the following criteria: (1) the pathogenicity of the microorganisms, (2) the potential sensitizing effect of the microorganisms or their cellular components and by-products, and (3) the toxic effects of any constituents that may be contained in the final formulated product that is dispersed such as endotoxins, stabilizing agents, or dispersing agents [Lisella and Herring 1988; Manufacturing Chemist 1986; Elliott et al. 1986; Dutkiewicz et al. 1988].

It is not anticipated that microorganisms that are known to be pathogenic to humans will be used to develop products for environmental release. However, the potential for microorganisms, especially genetically altered organisms, to cause disease should be examined prior to environmental release when workers may be exposed. Also, there are other endpoints that should be examined, such as immune diseases including such as hypersensitivity pneumonitis and asthma which result from individual immunologic sensitization to microorganisms, their cellular components, or metabolic products. In

addition, the toxic properties that may be associated with components of the final formulated product, such as endotoxins, should be examined.

NIOSH recommends that workers who may be exposed to microorganisms during environmental release receive preemployment and periodic follow-up medical examinations. The basis for this recommendation is discussed in detail in the enclosed publication by Landrigan et al. on the Medical Surveillance of Biotechnology Workers: Report of the CDC/NIOSH Ad Hoc Working Group on Medical Surveillance for Industrial Applications of Recombinant DNA. In brief, the primary purpose of these examinations is to identify conditions which may place a worker at heightened risk of work-related illness. Fitness for employment must be established on an individual basis for each underlying medical condition.

Potential for Worker Exposure

The potential exposure of workers to microorganisms or formulations developed for environmental release will depend upon a number of factors. These factors include (1) the mechanisms used for delivery of the microorganisms, such as the use of hand sprayers or airplanes, (2) the composition of the final product (e.g., liquid, granule, or powder) and whether or not it must be mixed prior to application, (3) the size of the area to be treated as well as the intended use of the microorganisms, (4) the capability of the microorganisms to survive and multiply in the environment, and (5) the quantity of microorganisms released.

The greatest potential for exposure to large numbers of microorganisms appears to be during the application of the product. Exposure will vary with the method of application, composition of the formulated product, and use of the product. Microorganisms that are used as pesticides will be released into the soil or onto plant surfaces while those used for pollution control will be released into sewage and water [Johnson and Robinson 1984] or contaminated soil [Ghosal 1986]. Microorganisms used for oil or metal recovery will be released into ore or oil fields [Moses and Springham 1982; Curtis 1983]. Once the microorganisms have been released, workers may still be exposed. For example, in agriculture, farmers and transporters of treated products may be exposed. The amount of exposure in this case will depend primarily on the ability of the microorganisms to survive and multiply following release.

RESPONSE TO SPECIFIC QUESTIONS IN NOTICE

1. Scope of genetically modified microbial pesticides subject to notification, and

2. Review of nonindigenous microbial pesticides at small-scale.

To properly assess the risks posed to workers by environmental release of microorganisms, it is important to address the concept that naturally occurring microorganisms or their products are safe and that genetically manipulated organisms or their products are inherently hazardous or unsafe. For example, aflatoxin is a product that is naturally produced by molds and is one of the most potent carcinogens known. Just as naturally occurring microorganisms are not all necessarily safe, genetically modified organisms are not necessarily hazardous.

Another factor that must be considered when addressing the potential hazards of microorganisms released into the environment is that the degree of change in the genome of the microorganism does not necessarily correlate with physiological properties that this change in genome confers [Sharples 1984]. Slight changes in the genome can cause large differences in the microorganism's properties. Also, different strains of an organism vary in their pathogenicity to humans. For example, several strains of Escherichia coli are known to produce diseases, such as septicemia, while other strains are not known to produce disease [Selander et al. 1986].

NIOSH does not differentiate between the risks associated with naturally-occurring microorganisms, genetically selected or altered organisms, and inter-genetic organisms. Also, because of the potential differences in the phenotype of different strains of a microorganism, each strain should undergo risk evaluation. Therefore, from an occupational health standpoint, NIOSH recommends that all microorganisms should be evaluated by EPA for possible health effects prior to the potential exposure of workers. Also, additional risk analysis should be conducted if there is a change in the composition of the final formulated product or if there is an alteration made in the genotype of the microorganism from that previously evaluated.

In brief, whenever the deliberate release of either natural or genetically manipulated microorganisms into the environment is contemplated, the potential risks to workers should be based on the specific organism, its properties, and the other constituents of the final formulated product. A case-by-case approach is particularly relevant for genetically modified microorganisms because casual relationships between genome structure and functional properties are unknown.

3. **Establishment of independent expert review groups (Environmental Biosafety Committees) patterned after the National Institutes of Health's Institutional Biosafety Committees.**

NIOSH commends EPA in its attempt to provide public input into the review process. However, the concept, as presented by EPA in the December 2, 1988, draft proposal to regulate products of biotechnology, to develop Environmental Biosafety Committees (EBCs) gives the appearance that EPA is delegating its regulatory responsibilities to the EBCs. Therefore, NIOSH recommends that EPA alter its proposal to ensure that accountability and oversight are maintained by EPA and that institutional, geographic, and public interests are properly addressed.

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