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LIST OF ATTENDEES

Public Hearing on Application of the United States Air Force for a Permit to Incinerate Herbicide Orange at Sea

Washington, D.C. - April 7, 1977

Air Force

Col. Gale D. Taylor, Kelly AFB, TX
Capt. James T. Goodwin, Kelly AFB, TX
Col. Walter W. Melvin, Jr., Brooks AFB, TX
Dr. Billy E. Welch, Brooks AFB, TX
Maj. James W. Tremblay, Kelly AFB, TX
Maj. Chuck Bullock, SAF/ILE, Washington, DC
Maj. Ronald D. Burnett, USAF/SGPA, Washington, DC
Capt. Gary D. Hawksworth, USAF, Washington, DC
Walter W. Barrett, HQ, USAF, Washington, DC
S. G. Laney, USAF/SGPA, Washington, DC
Ronald R. Whisler, HQAFLC, Dayton, OH
Thomas R. Dempsey, USAF, Washington, DC
A. Belous, USAF, Washington, DC
Grant Reynolds, USAF, Washington, DC

EPA

George J. Moein, EPA Reg. IV
David A. Eberly
W. Wade Talbott
Harold R. Day
Scott Slesinger
Virginia Gibbons
Harvey L. Warnick
Harry W. Trask
Eugene P. Crumpler
Carolyn K. Offutt
Raymond F. Krueger
Nathan Chandler
Kerrigan Clough
William Beller
T. A. Wastler
Lisa Friedman
Russel Wyer

Congress

Tom Houston, House Government Operations Ctee.
Thomas J. Payne, House Government Operations Ctee.

Federal Agencies

George L. Kinter, Dept. of State
Thomas M. Constant, Panama Canal Company
James J. Comiskey, GAO

State Agencies

Glen Wood, Jr., Ms. Air & Water Pollution Commission
Jackson, MS

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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Public Hearing

"Incinerate Herbicide Orange at Sea"

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Thursday, April 7, 1977
9:40 a.m.

Hearing Room 2117
401 M Street, S.W.
Waterside Mall
Washington, D.C.

- - - - -

Hearing Officer: Mr. Brian Molloy

Accompanied by: Mr. Kenneth E. Biglane, Director, Oil and Special Materials Control Division, EPA, Washington, D.C.; and

Dr. Ronald A. Venezia, Sanitary Engineer, Industrial Processes Division, Industrial Environmental Research Laboratory, Research Triangle Park, North Carolina

HEARING OFFICER MOLLOY: Good morning.

Can everybody hear me? No? Is that better? Can you hear me in the back?

Good morning. I am Brian Molloy, Director of the Environmental Protection Agency, Water Enforcement Division. On my right is Mr. Kenneth Biglane, the Director of the Environmental Protection Agency's Oil and Special Materials Control Division. And on my left is Dr. Ronald A. Venezia, who is a Sanitary Engineer, Industrial Processes Division, at EPA's Environmental Research Laboratory, Research Triangle Park, North Carolina.

This is the third session of a public hearing. The first two sessions were held in Honolulu, Hawaii and San Francisco, California during 1975. The purpose of the hearings were to receive information on the application of the United States Air Force to dispose of approximately two and a quarter billion gallons of a chemical known as herbicide orange by incineration at sea.

The Air Force has applied to the Environmental Protection Agency for a permit pursuant to the Marine Protection Research and Sanctuary's Act of 1972 to burn the material about 120 west of Johnston Island in the Pacific Ocean.

EPA has reviewed the information made available by the Air Force and other interested parties and has made a tentative determination to issue a research permit to the Air Force that would allow approximately 4200 metric tons of the material to be incinerated under certain controlled conditions.

The conditions as set forth in EPA's tentative determination are as follows: one, the incineration will take place within a disposal site. The disposal site coordinates were set out in the Federal Register notifying you of this hearing.

Two, the emission rates will not be in excess of one-tenth of one percent of the total amount burned.

Three, the herbicide orange will be removed from the storage drums and located on the incineration vessel in such a manner that no TCDD escapes to the environment in measurable quantities. And the process of removal of herbicide orange shall employ the best available technology.

Four, the drums from which the herbicide orange is taken will be triple rinse with solvent prior to disposal or otherwise clean to a degree equal -- I am sorry -- equal degree by jet rinsing and the rinses will be added to the waste to be incinerated.

Five, the carrier will maintain a combustion temperature in each incinerator of at least 1200 degrees centigrade.

Six, the feed rate of the herbicide orange into the combustion chambers will be optimized to maintain stated temperature at combustion efficiency.

Seven, applicant and the carrier shall maintain a seal automatic monitoring device for constant review of the operating temperatures of the incinerators.

Eight, the applicant will employ such other monitoring procedures as are requested by the Environmental Protection Agency.

A final determination to issue or deny the research permit or to issue another form of ocean disposal permit will be made as soon as practical after this hearing at the receipt of public comment on the proposal. At the first session held in Honolulu, we heard testimony from the Air Force on the incineration itself, the selection of the site, the monitoring provisions and the methods of removing the material from the drums.

Testimony was also received from representatives of Micronesia and environmental groups which tended to oppose the location of the site. Additionally, testimony was received from the owner of the incineration vessel, the Vulcanus.

And the testimony received during the second session of the hearing in San Francisco resulted in the hearing's temporary adjournment until such time as the Air Force had sufficient data to demonstrate that there was no feasible alternative of the disposal of herbicide orange by sea incineration, taking into account the possible risk associated with storage and transportation of the herbicide orange and the use of the recovered constituents.

The alternatives of reprocessing herbicide orange were presented at the hearings based on general information which indicated that a potential for reprocessing did exist which might destroy dioxin in the process or concentrate it into readily disposable matter.

The Air FOrce has undertaken investigations regarding the feasibility of reprocessing herbicide orange. The results of these investigations are the subject of today's hearing. The subject of today's hearing will also include a statement by the Air Force as to the procedure that it will follow in burning herbicide orange should the research permit be issued.

The rules of today's hearing are as follows: this is an informal hearing and there will be no cross examination. Written questions from the floor should be handed to one of the ladies by the door who will try to have -- and we will try to have all germane questions answered given the constraints of time today.

Everyone speaking should identify themselves by name and affiliation. The order of speakers as far as practical will be first the Air Force, second the

Environmental Protection Agency and this will be followed by comments from any elected officials, then comments from any state and local agencies, comments from any groups and finally comments from any individuals.

If anyone has a time problem he should make his problem known on the registration card and then we will try to shift the order if we can.

We would appreciate it, if possible, if any statements could be made in writing and then summarized when speaking. We are making a transcript today. If you have a written statement, please give it to the court reporter and also to the panel.

We are keeping the record open for one week from today so that any comments or documents received by next Wednesday afternoon will be considered before a final determination is made.

Finally, the people who operate this room have asked that no food or drinks can be brought into the room. So, please, if you have them, remove them.

I would like to call now on Mr. Kenneth Biglane, who has an opening comment to make. Mr. Biglane.

MR. BIGLANE: Thank you, Mr. Chairman.

In late 1974 and early 1975 the technology of ocean incineration of certain chemical wastes were introduced into this country. Extensive tests on the affects of oxidized byproducts on the air and in the environment and incineration efficiency were conducted by EPA, universities and others in connection with the 1974-75 ocean incineration organochlorine waste in the Gulf of Mexico.

Since that time additional research has been conducted in order to better understand the relationship between local short-term uses of the environment and the potential for long-term impacts of ocean incineration. Thus far, as you will hear, the results of our research programs have been encouraging.

We have advanced measurably the level of our understanding of incineration technology and we expect to proceed today on the basis of that understanding. We are a lot more confident today as opposed to two years ago that this technology can be used to safely dispose of highly toxic wastes.

However, we intend to pursue our understanding of this unique capability to safely dispose of chemical materials so that adequate guidelines can be prepared for each type of waste that comes to our attention for disposal.

Although the efficient destruction of toxic waste is one way of protecting our environment, we are also mindful that the safe re-use of so-called waste products is also a desirable goal. Our shortages in energy and other products will continue as the world increases its demands for goods and products.

Until the technology for safe re-use of all such materials is advanced, we must seize upon interim measures in order to protect our fragile environment. Ocean incineration represents just one such measure and we are dedicated to developing those programs and criteria that assure its safe application.

Mr. Chairman, that concludes my remarks.

HEARING OFFICER MOLLOY: Thank you, Mr. Biglane.

I would like to indicate before we start that we have received a letter from the National Wildlife Federation dated April 5th, 1977 from Kenneth S. Camlin, counsel. This letter and the attachment to the letter will be placed in the record.

I would like now to call on Dr. Billie E. Welsh, Deputy Director, United States Air Force, School of Aerospace Medicine, Brooks Air Force Base, San Antonio, Texas. Dr. Welsh.

DR. WELSH: Thank you very much, Mr. Molloy. It is a pleasure to be here at this continuation of the hearing that we started in Washington In February of '75 and tracked through Honolulu and San Francisco.

I think I would compliment you in your choice of previous places to hold the hearing.

Since the previous hearings in April of '75 presented Air Force actions related to the disposal of the material through early '75, I will touch on these aspects this morning only to the extent necessary to give you a perspective of the actions that have occurred since that point in time.

First, we should recognize that herbicide orange is an equal mixture, approximately 50-50 by volume, of two commercially available agricultural products, the butyl esters of 2,4-dicchlorophenoxyacetic acid and 2,4,5-trichlorophenoxyacetic acid, or as we commonly refer to them, 2,4-D and 2,4,5-T.

There are some 15 companies with registration for products which contain mixtures of the butyl esters of 2,4-D and 2,4,5-T. In general, these products are not as concentrated as herbicide orange, but one is nearly identical containing 42.6 percent of 2,4-D and 42.2 percent of 2,4,5-T.

In April, 1970 the U.S. Department of Agriculture, Department of Health, Education and Welfare and the Department of the Interior suspended certain uses of 2,4,5-T. Concurrently, the Department of Defense suspended the use of herbicide orange in Vietnam.

As a consequence of this suspension the Air Force acting as the agent for the Department of Defense was left with some 1.5 million gallons of orange herbicide in Vietnam and 0.8 million gallons of orange herbicide at Gulfport, Mississippi.

Following that suspension in April 1970, in September 1971, the Department of Defense directed the Air Force to return this material from Vietnam and to dispose of it in a safe, efficient manner. Subsequently, in April 1972 the material stored in Vietnam was moved to Johnston Island pending a final decision on the method of disposition. About 800,000 gallons stored at Gulfport already sited for shipment to Vietnam was held there in storage at that site.

From 1971 to 1974, the Air Force investigated a variety of both recovery and destructive techniques as possible means of herbicide disposition. Of the techniques investigated, however, only high temperature incineration was sufficiently developed to warrant further investigation.

In December 1974, following in-depth studies of various incineration methodologies, the Air Force filed a final environmental impact statement with the President's Council on environmental quality proposing the ultimate disposal of orange herbicide by destruction aboard a specially designed incineration vessel operating in a remote area of the Pacific Ocean, west of Johnston Island.

The EPA held a public meeting in Washington, D.C., in February 1975, public hearings in Honolulu and San Francisco in April 1975 to consider an ocean incineration permit application submitted by the Air Force in accordance with the Marine Protection, Research and Sanctuaries Act.

During these sessions, testimony was presented which indicated that techniques might have been developed for chemically reprocessing the herbicide to remove unacceptable quantities of 2,3,7,8-tetrachlorodibenzo-P-Dioxin or TCDD. At the April meeting, it was concluded that the option for use/reprocessing should be further explored as a means of disposition prior to proceeding with destruction of the herbicide.

Since that time, a reprocessing technique using coconut charcoal -- activated carbon -- has been demonstrated by a company known as Agent Chemical, Incorporated or ACI, as I will refer to them in my presentation. ACI has conducted pilot plant studies in Gulfport, Mississippi at the Naval Construction Battalion Center where the herbicide is stored. These studies were not without problems.

Initially, ACI attempted to demonstrate both a reprocessing technology and an incineration technology which would result in ultimate disposal of the contaminated carbon.

The plan called for totally incinerating the carbon and its plastic canisters. However, during two separate attempts using plastic canisters containing uncontaminated carbon the incinerator failed to perform, as expected.

After these failures, ACI proposed to eliminate the incineration phase and to use steel canisters which could be disposed of via burial in a Class I landfill. At that time, ACI provided letters which indicated that these carbon containing steel conisters could be buried in a Class one landfill and that the requisite permits could be obtained.

On this basis a third test was authorized in June-July 1976. During which we processed -- or Agent Chemical Company processed approximately 1,000 gallons of herbicide in our mind very successfully via the charcoal adsorption technique.

The ACI technique which was shown to reduce the unacceptably high concentrations of TCDD in the herbicide,-- and I might add parenthetically here that unacceptably high concentrations in this context is in excess of 0.1 milligrams per kilogram of TCDD. Their technique indicated that it was effective and that one would have every right to expect that a product containing less than this 0.1 milligrams per kilogram would result in a full scale reprocessing.

This degree of reduction in the TCDD concentration would be sufficient to render the material registrable for sale and use. The process, however, would generate TCDD-laden charcoal housed in steel canisters. As many as 1,000 of these canisters, each approximately ten feet long and 30 inches in diameter and each containing more than one-half ton of charcoal, could be generated by a reprocessing action involving the entire stock of orange herbicide.

Based on the results of the ACI pilot plant studies, the Air Force, in October of 1976, filed an amendment to its final environmental statement of the disposition of orange herbicide and in this amendment proposed the sale of the orange herbicide for reprocessing with the TCDD-laden charcoal in the steel canisters being under federally controlled, interim, recoverable storage until an environmentally acceptable method of disposal for the charcoal and canisters could be developed and demonstrated.

Many comments received on the amendment suggested that a defined solution was needed for destruction of the contaminated charcoal and that this should be done concurrently, if not before reprocessing was to proceed any further.

As an attachment to the record, I present a copy of the amendment as well as a copy of the comments we received on the amendment.

These comments, plus other data that we obtained subsequent to filing the amendment, indicated the need for a thorough review of the overall herbicide orange disposal project. As a result of this review, it was concluded that reprocessing was not a feasible, timely, cost effective, or environmentally acceptable alternative to incineration at sea. The bases for this conclusion are as follows:

The only potential benefit to the reprocessing option is that it would return the herbicide to beneficial use. This action requires sale by the Government and would provide a monetary gain to the Government. However, this gain would be more than negated by the costs of solving the various problems that would be generated by implementing the reprocessing action.

I would like to run through a few of the major problems that this would generate.

First, it would require a rather significant commitment of natural resources including up to 700 tons of new steel canisters, 640 tons of charcoal, 125,000 gallons of diesel fuel, labor and materials necessary to construct a storage facility and labor and fuel necessary to ship and store the steel canisters and charcoal itself.

Second, current redrumming operations have generated approximately 5,000 gallons of contaminated diesel fuel used to rinse the emptied drums. Reprocessing, if implemented, would require that each emptied drum be rinsed with approximately two gallons of diesel fuel. This action would yield approximately 85,000 gallons of contaminated diesel fuel or about 30,000 at NCBC and 55,000 at JI.

It has been suggested by the contractor that this contaminated diesel rinseate could be used as a diluent for the reprocessed herbicide. However, the acceptability of such an approach was never resolved. Thus, to implement reprocessing, a secondary disposal action likely would be required to dispose of about 90,000 gallons of contaminated rinseate.

Third, reprocessing would require the Department of Defense to locate, identify, develop and dedicate for an indefinite period of time an interim storage site and facility for the TCDD-laden canisters. Due to recent events involving TCDD, most notably the industrial accident in Seveso, Italy, the existing public and political atmosphere would make this task extremely difficult to accomplish.

The recent problems associated with storage of the 12 small canisters, each less than eight feet long and approximately four and a half inches in diameter, generated during ACI's pilot plant studies demonstrated the severity of this problem. The states of California and Oregon refused to allow disposal by commercial firms in a Class one landfill.

Subsequently, when the Air Force assumed control and initiated action to remove these canisters from Oregon, the States of Washington and Utah expressed strong -- and I underline strong opposition to allow the canisters to even pass through their states on the way out.

As a result, we put the canisters on Johnston Island as an interim measure using dedicated airlift at a cost of more than $30,000 just to solve that particular, in our minds, very small problem. It seems only reasonable to assume that storage of 1,000 large canisters would encounter even more problems.

Johnston Island is a bird refuge, and the Department of the Interior, for example, has suggested that storage of canisters generated by reprocessing at that location would not be viewed as a favorable decision. Even if an acceptable storage site could be found, the development of such a facility to store this would be costly and added to the total problem.

EPA has stated via letter that the contaminated charcoal would be considered as pesticide-related waste and thereby would require storage in compliance with the provisions of 40 CFR 165.10. Estimated cost of developing such facilities ranges from somewhere on the order of a quarter of a million dollars to about a million and a half for an enclosed storage.

Fourth, should the problem of locating, identifying, developing and dedicating a storage site and facility be solved, transportation of the canisters and other wastes constitutes another costly and complex problem with potential environmental overtones.

Cost would vary depending on both the location of the storage facility and the mode or modes of transportation used. As planned, the selection of the storage site would have been done before the start of reprocessing. The selection of a site for the future ultimate disposal of contaminated carbon, however, could not be made until the methodology of disposal was developed. It is very possible that the ultimate disposal site would not be the storage site. If this proved to be the case, the steel canisters would again have to be transported, thus adding another significant cost.

Fifth, and possibly the most significant, is that reprocessing would require that we investigate, identify, test and validate a method for the ultimate disposal of the contaminated charcoal. Following this, there would be the requirement to locate, identify, develop, test and finally operate an ultimate disposal facility.

The optimistic view of incineration experts is that a minimum of four to five years time and five to ten million dollars would be required for the development and operation of such a facility. In addition, environmental monitoring and addition, environmental monitoring and additional transportation costs could be expected.

In summary, it is our judgment that a satisfactory reprocessing method which solves the total problem has not been demonstrated and is not feasible. The charcoal adsorption reprocessing would simply trade one storage problem for another and the new storage problem would be more difficult and costly to solve than the present problem.

For this reason, the DOD has decided to terminate its investigation of reprocessing and pursue the disposition option of incineration at sea. This method is environmentally acceptable, available, timely, cost effective and capable of accomplishing ultimate disposal of the herbicide and its contaminant.

Accordingly, the Air Force has requested the EPA to reconvene this hearing for the purpose of issuing a permit. A copy of the letter that we sent to the Administrator of EPA is submitted for the record. During the remaining portion of this presentation, I would like to address the major actions associated with this incineration and describe the environmental monitoring and contingency plans involved.

As an overview, we consider the herbicide will be transferred from 55 gallon drums and loaded with drum rinseate aboard the incinerator ship. Drums will be rinsed, crushed and stored until transported to an open-hearth furnace for destruction. Herbicide transport and drum activities will be environmentally monitored. Spill prevention and contingency control plans are on hand if needed. The incineration aspects of the operation itself will be closely monitored.

In short, the entire operation will be monitored not only to identify problems, if they should arise, and provide the necessary insight to take corrective action, but also to document the overall efficiency and safety of the operation.

Some of the procedures that we will use have been outlined in an operations plan developed by Air Force Logistics command and this is submitted to you for the record.

I would like to go into a bit more detail now on the major aspects of our proposed action, first, dealing with the herbicide drum rinsing, crushing and disposal.

We have something on the order of 15,000 drums of material at Gulfport and 25,000 drums at Johnston Island that will require disposition in an environmentally acceptable manner. EPA's "Recommended Procedures for the Disposal of Pesticides Containers and Residues," 40 CFR 165.9, are

are applicable and will be followed in this action. From the available disposition options outlined in 40 CFR 165.9, we have determined to recycle the drums as scrap metal.

The dedrum facilities at the respective sites have been designed to allow herbicide removal and drum rinsing to proceed continuously. The dedrum facilities have been constructed to allow herbicide and rinseate to be pumped to bulk haulers.

The drums enter the system, are opened, drained, rinsed, and again drained. Subsequently, the drums will be crushed, placed in temporary storage, and then shipped to a steel manufacturing firm for recycle. Drum rinsing and rinsing quality assurance procedures, drum crushing, ultimate disposal, and interim storage will now be discussed for us in just a moment.

Looking first at drum rinse -- well-drained empty drums will be rinsed to comply with EPA triple rinse procedures as outlined in Mr. Molloy's opening statement. At Gulfport, the inverted drums will be given a spray rinse with two gallons of diesel fuel and then allowed to drain for an additional two minutes. At Johnston Island, the drained drums will receive two separate spray rinses with one gallon of diesel fuel, each rinse being followed by a two-minute drain period.

Both drum rinsing procedures have been shown to remove

95 percent or greater of the herbicide residue; have been reviewed by the EPA and have been judged to be equivalent to the EPA triple-rinse procedures. Letters on this, Mr. Molloy submitted to you for the record.

Additionally, based on discussions that we have had with the EPA we will implement and carry-out a quality assurance program during the actual procedure itself using first good supervision to insure that things are done as they are supposed to be done; and, secondly, to check on the supervisors, we will have the quantity of the herbicide removed from randomly sampled drums, tested, evaluated and compared to the results of the EPA triple-rinse procedures.

If, for any reason, the quality of drum rinsing falls below acceptable values, we have the necessary data and capability to modify our procedures as we are going through.

The crushing of the drums will be done almost immediately at the site. They will be crushed to approximately one-third or less of their original size. Crushed drums at Johnston Island will be bailed, palletized and placed in storage on the existing stabilized drum storage facility until such time as they are transported for ultimate disposal. At Gulfport, the crushed drums will be placed in an enclosure on the stabilized storage site, again, until ultimate disposal.

I have used the word ultimate disposal a couple of times. In our minds, ultimate disposal would be accomplished by a recycle of the steel drums in an open hearth furnace at a temperature of about 2900 degrees Fahrenheit. The material will be held at this temperature for several hours.

Since the EPA requirements imposed on land-based pesticide incinerators require that the material being destroyed be burned at about 1800 degrees Fahrenheit for a minimum of two seconds, it can be safely assumed that the melting operation will readily and easily destroy the insignificant amount of pesticide that could remain in an individual drum.

Sale and recycle of these drums to a steel manufacturer will be accomplished by the Defense Logistics Agency in accordance with applicable federal regulations governing scrap metal sale. The crushed drums will be turned into the Defense Property Disposal Office servicing the respective facilities at Gulfport and Johnston Island.

Those organizations will accept accountability at the time of turn-in, but physical custody will remain with the turn-in activity, that is, Navy Construction Battalion Center and Johnston Island until the sale of the drums has been accomplished, and the drums have been removed from the site.

One additional requirement will be involved and that an Air Force certification that all EPA criteria applicable to the drums have been met. A copy of this certification will accompany the turn-in documents of this particular waste.

Additionally, the Department of the Defense and the EPA have agreed to cooperate in identifying a suitable steel plant for the recycle of this scrap metal. As appropriate, contact with state and local authorities will be effected through the proper regional EPA Office of Solid Waste Management Programs.

I would like to say just a word about storage of these drums pending destruction. Crushed drums will be placed in interim storage at the respective sites. In both cases, the interim storage site will be a designated part of the area presently used for the storage of herbicide orange.

We do not anticipate that there will be any potential for adverse environmental impact due to the thoroughness of the rinse procedures and due to the fact that the storage location will satisfy the major provisions of 40 CFR 165.10.

These provisions include: controlled and limited access; designed to preclude impact of water supplies, ground water and surface water, and; are dedicated solely to the storage of these drums.

The next area in our procedures I would like to touch on would be the transfer operations.

The transfer of the herbicide from the approximately 15,000 55-gallon drums at Gulfport and 25,000 drums at Johnston Island will be accomplished in specially designed dedrumming facilities. At the Gulfport facility, we will have four dedrumming lines operating producing a dedrumming rate of approximately 1,000 drums per day. The material will be loaded into tank cars and carried by rail to the dockside for loading onto the Vulcanus itself.

The cars will be moved under the control of the onsite project director and transportation office in accordance with prescribed procedures of movement of this type of material. These include such things as reduced speed, guards at crossing and proper labeling of the cars.

We anticipate that we will have six cars being loaded at the site and six cars will be at the pier being off-loaded to the vessel. The transfer of the herbicide to the vessel will be accomplished by pumping from each car with positive step-by-step procedures to prevent any spills in the process.

Additionally, we are restricting loading of the ship to daylight hours. The dedrumming at Johnston Island will be similar to that at Gulfport except for the fact that we will utilize USAF R-5 refueler vehicles rather than rail tank cars.

Obviously, in an operation of this proposed magnitude there is a potential for human error to come in. We have instituted or will institute a land based monitoring program to document and support what we are doing.

Our present plans call for this monitoring support to be provided by a contractor under direct on-site supervision of personnel from our occupational environmental health laboratory. We look at this particular monitoring program, land base monitoring, as having two primary purposes. One, to insure a maximum of worker safety, that is, the industrial hygiene-type monitoring. And second, to document the degree of any environmental impact.

The industrial hygiene monitoring will include regular inspections to insure proper utilization of personal protection equipment and the use of "personnel air samplers" to determine and document worker exposure to herbicide vapors.

The environmental monitoring will include collecting and analyzing air, water, soil, and sediment samples to determine presence and concentrations of constituents of the herbicide. Biomonitoring, using selected plants and animals, will be conducted continuously to identify herbicide-induced response, especially the effects of chronic exposure to very low concentrations of herbicide.

In addition to this, the existing flora and fauna around the operational sites will be observed regularly for any evidence of herbicide-induced response.

Since the two sites of operation, Gulfport, Mississippi and Johnston Island in the Pacific Ocean are widely separated, the type of analytical support we will use for these two operations is somewhat different.

At Gulfport, the U.S. Department of Agriculture Environmental Monitoring Laboratory there at Gulfport, the Wright State University Laboratory in Dayton, Ohio, the Occupational and Environmental Health Laboratory at Kelly Air Force Base will provide the support necessary for that operation.

For the operation at Johnston Island, the Air Force will establish at Johnston Island an on-site laboratory to facilitate rapid analysis of the materials collected. The Wright State University Laboratory will again be a participant as well as the Environmental Health Laboratory at Kelly.

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DR. WELCH: We have available for you and will provide as a supplement to the record more details dealing with this localized biomonitoring program that we have underway.

Let me just say that we anticipate that this project will have no significant environmental consequence. The monitoring program that we developed is a completely comprehensive plan that will thoroughly evaluate all aspects of the herbicide orange transfer operation at most storage locations, will yield factual documentation on the presence or absence of environmental impact, and in my judgment a very important facet of our plan is that it will provide a basis for taking corrective measures during the operation itself in the event that such corrective measures would be called for.

So it is not just a historical documentation of things that did occur. It is a dynamic plan, able to influence what occurs.

Another area that has received considerable consideration and is of importance is the area of spill prevention control, or special contingency plans and notification procedures. These have been worked out in conjunction with the Environmental Protection Agency and the U.S. Coast Guard, the overall operation. That is, loading of the vessel, movement of the vessel ___

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will be under the direction of the Air Force project director or his deputy. Spill prevention and countermeasures will be the responsibility of the Air Force on-the-scene coordinator who is also predesignated on-the-scene coordinator as defined in the national contingency plan. This individual, the on-scene coordinator, will be located at Gulfport and Johnston Island during operations at those particular sites.

In the event of a casualty to the ship or a spill incident at Gulfport or Johnston Island, an ambient operations center at those locations will receive and retransmit all notifications as required and serve as a situation room for subsequent operations.

The Air Force Logistics Command Transportation Control Center will assume this function while the vessel is at sea. In addition, a U.S. Government representative will be aboard the ship at departure at Gulfport until departure. He will document the submission of reports and any unusual occurrences.

This contingency plan identifies five phases of the disposal operation and goes into them in great detail. The land-based de-drumming effort at Gulfport, the movement of the tank cars to the dock area; second, loading the herbicide onto the M/V Vulcanus; third, ocean movement from Gulfport to the Panama Canal Zone, from Panama to Johnston

js3

Island, and at sea during incineration; fourth, transit up the Panama Canal itself; and, fifth, and finally, operations at Johnston Island. It describes the precautions that will be taken during each phase of the operations to prevent a spill. And in the unlikely event that a spill occurs in the harbor, it will be treated as a major spill regardless of the quantity. And as a consequence, the appropriate government agencies and activities will be notified.

The plan outlines the measures to contain the herbicide to recover any quantity of spill in the vicinity of the de-drumming sites at the dock area and onboard the vessel at Gulfport and Johnston Island.

A supply of clean-up equipment and material will be available for use at the de-drumming site along the route to the dock area, at the dock and onboard the vessel. In addition, an empty tank car, or tank truck in the case of Johnston Island, will be prepositioned on the adjacent spur track to serve as an emergency receptacle for recovered spill material.

The plan also contains a listing of the U.S. Government activities and commercial salvage firms to be called on for assistance.

While the vessel is at sea responsibility for the vessel and herbicide including disposition of the cargo

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rests with the master. To the extent that circumstances permit, he will coordinate any action contemplated by the Air Force project manager and the Military Sealift Command. This will include such things as transfer of the cargo to another vessel if practicable, incineration, or as a last result, jettison. Recovery of jettisoned herbicide at sea will be impractical.

During the canal transit the vessel is under the operational control of the Panama Canal Company whose contingency spill pollution plans will be observed. The Air Force will, of course, coordinate and render any assistance to Canal authorities to insure compliance with these plans.

The contingency plan also will contained a detailed list of agencies to be notified in the event of a casualty to the ship or the herbicide and will provide for a daily situation.

We are submitting to you a copy of the contingency plan to elaborate on the points that I have just made.

During the earlier public hearings there was some public concern voiced regarding downwind concentrations of pyrolyzates from the ship incinerator stacks. Just to set the stage for us, the nearest downwind areas are approximately 2,000 kilometers from the designated burn area.

To try to address some of these concerns the Air jb5 Force contracted with TRW to predict theoretical downwind concentrations of TCDD, 2,4-D, 2,4,5-T and hydrochloric acid gas. Of particular concern to us was, number one, whether the plume would produce pollutants of any significance; and, second, would these pollutants be of such a sufficient concentration that they could be measured and monitored.

I won't attempt to go into the mathematics and the detailed technical description that accompanies the report on this. That we will submit to you for the record. Let me just say that we focused in very strongly on TCDD inasmuch as the concern has been expressed regarding the toxicity of that material and gave less rigorous treatment to 2,4,-D and 2,4,5-T.

The results of the analysis show that the TCDD released from the Vulcanus during incineration will have only a small impact on the environment. Using the worst case meteorological conditions -- and I would like to underline worst case meteorological conditions, such things as windspeed of 6 meters per second -- plume ground level centerline concentrations from this worst case using a worst case production of TCDD 0.537 grams per hour, we see a prediction of 1314 picograms per cubic meter at 5 kilometers downwind. At 70 kilometers downwind this concentration drops off to 104 picograms per cubic meter. And at 100 kilometers it drops off to 30 picograms.

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To carry this out to 150 kilometers and you see a maximum concentration predicted under this worst case set of circumstances of 1 picogram per cubic meter.

Now I have thrown a bunch of numbers at you, and I would like to underline once again that this represents the worst case conditions.

In actuality, at the prescribed emissions rate ambient concentrations may be very, very much less because of several things. The effective stack height may well be greater than the 24 meters chosen for this particular analysis. The atmosphere may not remain stable for more than a few hours. An unstable atmosphere will enhance plume dispersion. The plume may interact with the ocean surface, and the plume may meander considerably over long transport distances which would further increase the plume dilution.

Furthermore, and very critical to this is that the source amount of TCDD will actually be about 1/20th of the number that was used in the calculation; 1/20th due to the fact that for the worst case condition we took the highest value of TCDD ever monitored, ever identified in any of our herbicides and said that that is all -- that is typical of all of the herbicides. Our data actually indicate that the average concentration of TCDD is approximately 1/20th of that.

Finally, the interaction of the plume constituents

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such as TCDD, 2,4-D and 2,4,5-T with sunlight would further degrade the concentration of these materials.

Now directly south of the burn area some 1600 kilometers away we find Howland, Baker and Phoenix Islands. The next closest land masses to the southwest are the Gilbert Islands, some 2200 kilometers, and the Marshall Islands, some 2000 kilometers. As our foregoing analysis indicates, the plume will be well diluted by the time it reaches these distant land masses, if it ever gets that far. The sea-air interaction may well deplete the plume much faster than atmospheric dilution. The TCDD levels at such distant locations would be nondetectable by existing sampling methods.

Both 2,4-D and 2,4,5-T, which are the main constituents of herbicide orange, are expected to occur at much higher concentrations in the atmosphere based on this theoretical analysis.

Again, using the worst case conditions at 100 kilometers downwind of the source ambient levels would be on the order of 106 nanograms per cubic meter, and peak concentrations may occur at 1500 kilometers downwind on the order of 10 nanograms per cubic meter. This approximates out to about a part per trillion or so. And even in this worst case condition, it is still less than the concentrations known to produce critical damage in the most sensitive of

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plants. And its order of magnitude is below accepted toxicologic values for levels of exposure to these types of compounds.

I think that our analysis of this, supplemented by the report that we are submitting for the record, combined with the past data that is available on incineration and the stack monitoring, which I would like to discuss before I close, lead us to conclude that the operation is safe, the levels of pollutants rapidly reach a level of nondetectability and that the operation can be adequately monitored by using onboard the ship monitoring techniques with positive feedback into the incineration process.

With that in mind, I would like to conclude our discussion by moving to the shipboard monitoring aspect.

Calling to your attention that the Vulcanus is a chemical tanker of about 4770 deadweight metric tons, she is outfitted with two incinerators aft of the bridge. Each incinerator is designed to work independently and can burn at the rate of 10 to 12 metric tons per hour per incinerator. It takes approximately nine days to burn a full shipload of waste.

In operation the furnaces are preheated with fuel oil to a minimum of 1200 degrees Centigrade, Wastes are fed to the incinerators using the injection pumps connected to the tanks. The feed rate is regulated to maintain desired

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temperature; that is, in excess of 1300 degrees Centigrade, by manually adjusting the valves to the pump. If for any reason the temperature in the incinerator drops below the required temperature, the waste supply is automatically shut off.

During the incineration of the herbicide orange aboard the Vulcanus, the combustion product effluent stream from the incineration will be sampled by means of probes inserted into both incinerator stacks to extract combustion products. To monitor the important gaseous species in the process; i.e., oxygen, carbon dioxide, carbon monoxide and hydrocarbons, ceramic probes installed in both stacks will divert the gases to an online monitoring system set up for this gas analysis.

For more comprehensive characterization, however, of the combustion effluent chemical species and for specific hazardous herbicide constituents, a water cooled probe capable of traversing one of the incinerators; that is, being moved across the stack of one of the incinerators, will divert a representative portion of this effluent stream to two sampling trains.

These trains that we will use, one developed by the Air Force, which is a benzene impinger train previously tested and proven effective for sampling TCDD; and, second, a modified EPA Method 5 train, which incorporates a sorbent trap and which has been used extensively for general trapping of organic compounds in commercial incineration process streams.

The protocols for sampling and sample analyses represent a comprehensive and coordinated effort involving the Environmental Protection Agency, the Air Force people, TRW personnel, Battelle Columbis Laboratories, and Wright State University in Dayton, Ohio. Sampling techniques have been developed and tested by both the Air Force during previous projects involving herbicide orange and by TRW to specifically monitor shipboard incineration.

Analytical procedures for 2,4-D and 2,4,5-T utilizing routine gas chromatography will be conducted by Battelle in our laboratory on Johnston Island. High resolution TCDD analyses will be performed by Wright State University using gas chromatographic mass spectrometry techniques developed specifically for and thoroughly tested during previous projects involving herbicide orange.

We plan to conduct six tests aboard the Vulcanus for each burn. Five will be during the burning of the orange and one will be for background purposes. Each test will be about three hours long and the time being selected due to limitations of the benzene trains and the need for time to clean the trains and prepare them for the next run.

The samples collected in the benzene train will be jsl1

analyzed for the three main orange herbicide components after the ship has docked. The samples collected on the sorbent material will be analyzed at a later date for other components which may have been emitted by the combustion process.

Now to monitor the performance of the incinerator, a separate ceramic probe will be inserted in each stack on the ship. The lines leading from these probes will go to a common gas conditioner system. Attached to this system will be a series of instruments to continuously monitor the operation of the incinerator.

A hydrocarbon analyzer, carbon monoxide monitor, carbon dioxide monitor and oyxgen monitor will be used to determine the performance of the incinerator and calculate the combustion efficiency of the unit. The manifold will have a valve attached to it to enable us to monitor either incinerator. During the sampling runs, the continuous instruments will be on the unit being sampled.

In addition to this type of monitoring, we will also have a gas chromatograph onboard the ship to be used to evaluate the destruction efficiency of the incinerator. Benzene samples gathered, as outlined above, will be injected into the gas chromatograph to evaluate the destruction efficiency.

Of the techniques that we have outlined, the gas chromatograph onboard the ship is the one unit that has not yet been tested in the same manner as the other online instruments have been. That is, aboard ship.

The continuous instruments will not be operative 24 hours per day but will be during the course of each incineration, monitoring the burn on a random schedule.

Now we have talked about gathering samples, we have talked about some onboard monitoring. Let me say just a bit about what we do with the samples that we gather and do not monitor onboard the vessel. Do not analyze, I should say.

When the vessel returns to Johnston Island following the first burn, the real time analytical results necessary to assess combustion efficiency -- that is, those things that we did onboard the ship, oxygen, carbon dioxide, carbon monoxide, hydrocarbons -- will be immediately available. The data results will be there.

The stack samples that were gathered and passed through the benzene train will be taken to the laboratory on Johnston Island, aliquoted and samples contained for 2,4-D and 2,4,5-T analyses. These should be available within 24 to 48 hours after the vessel docks.

Additionally, samples for TCDD analysis will be packaged and taken by air from Johnston Island to the Wright State University laboratory near Dayton, Ohio. Arrangements have been made to insure that these samples will be delivered

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to the laboratory within 72 hours after the Vulcanus returns to Johnston Island after the first burn. Analytical results should be available within 48 hours thereafter.

This series of results will then be delivered to the Environmental Protection Agency for evaluation. We would suggest during the course of an evaluation and gathering of the data that the Vulcanus loading for the second burn be initiated with the proviso stopping at a preselected point of approximately one-half shipload.

EPA evaluation of the results of these analyses should be used, obviously, to determine the acceptability of the research burn. Based upon all of our previous work, we are confident that these results will be acceptable. We suggest that the precise nature of the permit for the subsequent two burns, however, be dependent upon EPA's evaluation of the results of the research burn.

Should the analyses of the test burn results reveal that the thermal destruction is less than that desired, we would like to leave consideration for a second research permit, being able to modify incinerator operating parameters in such a manner that, if necessary, thermal destruction could be increased and enhanced.

In conclusion, Mr. Malloy, I would like to emphasize to you and call to your attention a couple of things. One, just to recognize the fact that this has not been strictly jal4

an Air Force operation. It has not been strictly an operation involving engineers, or biologists, air pollution people. It has been a team effort. This team over a period of time has been composed of people from the federal government, state government, industry, academia. It covers disciplines that are almost as broad as a university catalog and with people that have been dedicated and extremely well-qualified to carry out their task.

Our interest in the disposal of this product, we think we have expended a considerable amount of time and resources investigating various aspects of it, including the reprocessing aspect. Initially, we viewed reprocessing with hope and promise. However, after careful evaluation, we have only concluded -- or we have concluded that reprocessing would only trade a problem that we know how to solve for one that we do not know how to solve.

In our judgment, incineration at sea offers the most timely, efficient, economic, and environmentally acceptable method for the ultimate disposition of this herbicide. We feel that the operation can be carried to a successful completion without -- and I repeat without significant impact on the environment or on the health and well-being of man.

We recognize and understand the emotionalism that surround it. Nonetheless our data and our conclusions lead us to say once again that we request, respectfully request a favorable response from the EPA on our request of ocean incineration permits, so this problem of rather long-standing can be resolved once and for all.

Thank you very much.

MR. MOLLOY: Thank you, Dr. Welch. I have a few questions. The first one is you mentioned that a government representative will be onboard the ship from Gulfport through Panama. Could you sort of explain what that person's duties will be and then why is he not going to be on the ship from Panama to Johnston Island?

DR. WELCH: Well, in terms of the duties that we would envision him being there, would be a reassurance, as it were, that the procedures, reports are being carried out as we envision them to -- you know, in the event that communications were to be lost for some period of time he, indeed, could be a government representative onboard the ship that could report back to us as to exactly what happened and what went wrong with communications during that time period.

He would have, obviously, no duties as it relates to operation of the vessel, how the vessel is operated, how it is under the control of the master of the vessel. He would just be an observer there. And you, me, or anyone else that is interested in the project, he would give us an

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objective, unbiased opinion.

Being in the commercial business we felt that by having such an individual onboard the ship from Gulfport down to the Canal and through the Canal, we would at that point in time have sufficient knowledge and data on how things were moving and that it was not necessary to have someone continue to ride the vessel from there to Johnston Island.

We have not yet identified who this individual is, or what. We are thinking about starting a travel agency, you know, putting this up as a pretty good deal.

MR. MOLLOY: Is there any specific reason, though, why he couldn't go from Panama to Johnston Island on the vessel?

MR. WELCH: I know of none.

MR. MOLLOY: You mentioned that if for any unforeseen reason it was required to jettison the herbicide from the vessel that it would be impossible to recover. Do you know if it has ever been necessary to jettison the material being burned from this particular vessel in the past?

DR. WELCH: It has been indicated to me by the owners of the vessel that there has not been a requirement to jettison the cargo.

MR. MOLLOY: On the monitoring during the burn I understand that you are proposing that we do not have ambient

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air monitoring and water monitoring at the site during the burn.

DR. WELCH: That is correct.

MR. MOLLOY: And I realize that we will have some further discussion of the monitoring later on. But specifically, do you know how far on the air side it would -- you estimate it would be before the TCDD would be nondetectable using your calculations, say, the worst case or an average case?

DR. WELCH: Offhand I don't have that number. We can calculate it and provide it to you in a few minutes.

MR. MOLLOY: OK. And, finally, at the end of your presentation you discussed the analysis that would be done on Johnston Island and then additional analysis that would be done in Ohio.

And, if I heard you correctly, we were talking about 72 hours to get the samples to Ohio and 48 hours, is that correct, to make the analysis in Ohio?

My question is why does the Air Force propose that we begin loading the vessel during that five-day period?

Well, I think for several reasons. I should have indicated and did not that obviously by the time that the vessel gets back to Johnston Island we will have a pretty good idea of what the onboard the ship instrumentation is indicating. And then what we are doing is tying down initial, or more definitive, information about looking for 2,4-D and 2,4,5-T and TCDD specifically in the stack effluents.

Making the assumption that the onboard data indicates a high degree of efficiency, 99.9 or higher percent efficiency in terms of the burn, we feel that that would indicate very strong likelihood that the D, T, and dioxin data would also be in the same bank. And due to the fact that it costs money for the vessel to sit, we feel that loading could be initiated and then if the results do not confirm the D, T and TCDD destruction in the same manner as the onboard instrumentation did, you could dilute the material with diesel fuel, for example, change the burning properties and improve the efficiency of the burn. Make other modifications in terms of the rate of the burning or such things as that in a second research effort, if that was necessary.

MR. MOLLOY: Do you have an approximate cost of what it would cost the government to have the vessel sit there unloaded?

DR. WELCH: I would prefer to furnish that to you independently inasmuch as the owners of the vessel and representatives of the vessel are in the room and negotiations are scheduled for next week.

MR. MOLLOY: Thank you.

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MR. BIGLANE: Dr. Welch, have you solicited the views of the appropriate state agencies and in particular the state of Mississippi on your off-loading plan or your loading plans in Gulfport?

DR. WELCH: Mr. Biglane, we have initiated a fairly, I would say, very close relationship with the state of Mississippi, their air and water pollution control commission and are in the process of working these plans in concert with them.

Due to the fact that some of the plans have only just been finalized, they have not seen the final version at this point in time. As they went through the stages, however, we have been in contact with them on the development of the plans and certainly it is our intent that they be worked very closely with those people.

MR. BIGLANE: Thank you, Doctor.

HEARING OFFICER MALLOY: Thank you, Dr. Welch.

I am now going to call on Lisa Friedman, an attorney with the Office of General Counsel and EPA Headquarters.

MS. FRIEDMAN: I would like to explain for the record the difference between professional ocean dumping and incineration permit and research ocean dumping and incineration dumping permits.

EPA regulations permit the issuance of research op2 permit ocean dumping or incineration at sea for a period of up to 18 months for any material except certain materials specified with EPA regulation where the disposal is part of a research project and where a scientific merit of the project outweighs any potential environmental damage resulting from the disposal.

Organohalogen compound may be disposed of in connection with the research permit if they are rapidly rendered harmless by physical chemical or biological processes in the sea provided that they will not make edible marine organisms unpallatable and will not endanger human health or that of domestic animals.

Special ocean dumping permit may be issued for a period of up to three years and only for materials which satisfy EPA ocean dumping criteria. A special permit for incineration at sea may be issued only where studies have been conducted on the weight, the incineration method, the vessel and the site and the site has been designated as a site for incineration at sea in accordance with EPA site designation regulations.

HEARING OFFICER MOLLOY: Thank you.

The next speaker is Mr. Birch J. Matthews who is the Project manager of the Hazardous Waste Incineration Project, TRW Company. He is a consultant to the Environmental Protection Agency.

MR. MATTHEWS: Thank you.

I am not sure that this mike is on. Is it?

HEARING OFFICER MOLLOY: Yes.

MR. MATTHEWS: My name is Birch Matthews. I am with TRW Incorporated in Redondo Beach, California. I am and have been the project manager for a series of commercial incineration programs under the sponsorship of EPA.

And, Mr. Chairman, as an attachment to the record, I would like to submit an interim report on a recent ocean incineration of an organochlorine waste onboard the M/V Vulcanus. In this context, I propose to orally summarize the results today of information and data gathered during this incineration test.

A research burn of 4100 metric tons of chlorinated hydrocarbon chemical waste was conducted onboard the incinerator ship M/T Vulcanus during the period of 5 March through 13 March of 1977. During this period, a total of 126 hours of continuous burn time was recorded. The burn took place in a designated area in the Gulf of Mexico under the provisions of permit number 750D008E dated 15 October 1976 and issued by the United States Environmental Protection Agency.

The waste burned was acquired from the Shell Chemical Company's Deer Park, Texas, plant and through analysis was found to have the following elemental chemical

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composition: at about 30 percent carbon; four percent hydrogen -- I am rounding these numbers off, incidentally -- nitrogen content was 0.012 percent; the sulfur was extremely low, it was 0.009 percent and the chlorine content was 62.6 percent.

Organic compound identification of the waste was accomplished using gas chromatigraph/mass spectroscopy analytical methods and it revealed the following: more than 80 percent of the waste was composed of mixed mono-, di-, and tri-: chloropropanes, chloropropenes and chloroethanes.

In addition, there was about two percent tetrachlorobutene and approximately three percent chlorobenzene. The remaining constituents were numerous and all were present at levels of less than one percent. The ash content of this waste was measured to be approximately 0.02 percent. The gross heating value was about 6900 btu per pound.

During the waste incineration process, the starboard incinerator on the Vulcanus was sampled using a traversing 15 foot water-cooled probe aspirating incinerator effluent gas through a sampling train consisting of a glass filter for particulate; a resin sorbent trap for organics and a series of impingers for inorganics.

And I would like to interject here that the diameter of the stack on the Vulcanus at the point where we sampled was approximately 11 feet and, therefore, we could traverse across the diameter of that stack with our 15 foot probe.

Our sampling rates were typically about three cubic feet per minute for durations of two to two and a half hours each. In addition, the sampling system was used to acquire grab samples in Tedlar Bags to trap low molecular weight gas species.

A total of three such sampling runs were conducted during the waste incineration burn. In addition, a fourth run was made while the incinerator was operating on fuel oil which was done for the purposes of comparing the effluent of the fuel oil burn to the effluent species from the waste burn.

These samples are now being prepared by TRW for analysis. We expect the preliminary results to be available on or about 13 April 1977.

In addition, during seven different time periods, three of which were concurrent with the aforementioned sampling runs, on-line analyzers were used to monitor the incinerator combustion process. These data, together with temperature data and waste feed rates provided by the ship's personnel, facilitated on-board performance evaluation of the incinerator.

In addition to incinerator wall thermocouple

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temperature measurements and flame temperature determinations using an optical pyrometer, on-line analyzers were used to monitor: total hydrocarbons, carbon monoxide, carbon dioxide, nitrogen oxide, and oxygen concentrations at the stack ends.

For the total waste burn, the average hydrocarbon emissions ranged from 7 to 55 parts per million. Nitrogen oxide emissions ranged from 75 to 134 parts per million. The oxygen concentrations averaged from a minimum of 5.9 percent to a maximum of 11.7 percent. Carbon monoxide values averaged between 17 parts per million and 40 parts per million. The percent of CO_2 varied from 8.8 percent to 11.7 percent.

All right. Now, based upon the CO and CO_2 measurements, the combustion efficiency throughout the monitoring process averaged 99.97 percent. The minimum combustion efficiency calculated was 99.92 percent.

Temperature measurements using an optical pyrometer indicated flame temperatures ranged from 1390 degrees centigrade to 1710 degrees centigrade. Flame temperature measurement correlations were made with periodic 24-hour per day wall temperature measurements which indicated by this correlation that the flame temperature was always in excess of 1200 degrees centigrade.

Using a range of furnace gas temperatures

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from 1200 degrees centigrade to 1700 degrees centigrade, we calculated gas residence times to be a maximum of about 0.9 seconds at 1200 degrees centigrade and a minimum of approximately 0.7 seconds at 1700 degrees centigrade, based upon the calculated total stack gas emission rate.

In addition to the quantitative data that we have available at this moment, we also made qualitative observations. With regard to the plume characteristics, the following is a brief resume of observations made during the entire research burn duration.

The incinerator plume from the Vulcanus was typical of the combustion of an organochloride. Under conditions of high humidity and a fairly strong breeze -- by that I mean greater than six meters per second -- the plume was observed to touch down 100 to 200 meters downwind of the ship. Now, this behavior was observed to be general over a range of 999 to 1009 millibars with relative humidities in the 75 to 96 percent range and the wind velocity of five to 17 meters per second.

When the wind velocity decreased below five meters per second and the relative humidity fell below 75 to 80 percent, the plume became diffuse, stayed aloft, and often became invisible. At this time the addition of ammonia gas through a standpipe located between the incinerator stacks and at the plane of the stacks produced a visible plume of ammonia chloride. The plume could thus be traced when conditions prevented droplet condensation involving HCl gas.

At times of low humidity and high, parenthetically, greater than five meters per second wind velocity, addition of ammonia gas to the effluent gases from the stack made the plume visible and showed the now to be expected fumigation or touch down on the water surface.

Conversely, when the humidity was high -- in other words, above 75 to 80 percent -- and the wind velocity was low, the plume was voluminous, white and dense and remained aloft. Under these conditions, now, touch down on the water surface was not observed for an estimated five to ten miles

Some combinations of wind velocity, wind direction and ship attitude result in contact of the plume with the decks of the ship. Even when the plume was not evident, it was occasionally possible to detect the presence of hydrogen chloride or HCl using Drager tube analysis.

By experimentation, however, it was determined that matching the ship's speed to a vectored velocity of the wind in the ship's direction produced a plume which remained aloft and which resulted in HCl values on the ship of zero.

At all times, the plume was observed to be free of any noticeable black or sooty particulate. Similarly,

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and colors of flames beyond the incinerator were never observed.

With regard to the burner operation, the typical flame produced by the burners was bright, intense, white in color, free of dark areas and free of sputtering. In other words, it appeared to be stable. A periodic inspection of all burners was maintained by ship personnel. Burners were cleaned periodically, and they generally yielded a black coke or tar as obtained from the nozzle of the burner.

The sample of this material was given to TRW for subsequent analysis. This analysis is as yet incomplete.

In the area of safety procedures, it was noted that the Vulcanus has written safety procedures which were documented. Insofar as observed, these procedures were followed throughout the incineration process. Of particular interest was an emergency waste feed shutoff system.

This apparatus automatically actuates the closure of valves feeding waste to the incinerator burners. The shutoff system utilizing an incinerator wall thermocouple sensor was demonstrated to work during shutdown portions of the waste incineration cycle, and found to be satisfactory. The incinerator wall thermocouple sensing device was set to preclude operation at a correlated flame temperature of less than 1200 degrees centigrade. By this, I mean the mp10 correlation between the wall temperature measurements and the optical pyrometer readings.

The ocean environment in the designated incineration area in the Gulf was examined by scientists of the Tereco Corporation at College Station, Texas, 7 and 8 March, 1977. The results of this investigation will be reported separately by Tereco Corporation to the Environmental Protection Agency.

All right. What conclusions can I draw from the results that we have to date?

Pending final chemical analysis and evaluation of the effluent grab samples, the following interim conclusions are presented based upon quantitative on-line analyzer data and temperature data, as well as qualitative observations noted during the research burn: one, calculated combustion efficiencies were all in excess of 99.9 percent during the research burn.

Two, Observed flame temperatures were always in excess of 1380 degrees centigrade. The on-line analyzer data indicated that oxygen concentrations were consistently equal to or greater than four percent.

Oxides of nitrogen emissions averaged 88 parts per million which is consistent with conventional emission levels for low nitrogen content fuels, which this was.

The plume characteristics were satisfactory

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in that ship and wind velocity magnitudes and vectors could be established whereby fumigation of the ship could be avoided, and plume touch down on the water surface was observed between a few hundred meters and several miles aft of the vessel.

Incinerator operation appeared normal and no emergency or malfunction conditions occured. The emergency waste shut-off system was demonstrated to function properly. The safety procedures were established and were observed to be implemented.

The TRW sampling and monitoring system functioned as designed.

Thank you.

HEARING OFFICER MOLLOY: I have got a question or two.

Do you feel that of all of the constituents in the research burn were destroyed at roughly the same efficiency?

MR. MATTHEWS: Which efficiency are you talking about? I want to distinguish between combustion efficiency and what I would term a destruction efficiency of the organic constituents in the waste.

HEARING OFFICER MOLLOY: Well, let's say the destruction efficiency.

MR. MATTHEWS: I can't quote you destruction efficiency at this point in time because the analysis for any opl.2

residual organics is in process at TRW.

I would make the observation that with the type of combustion efficiencies we calculated from the on-line analyzer data, I would expect excellent destruction efficiency.

HEARING OFFICER MOLLOY: Do you have any reason to believe that herbicide orange would not behave in the same way if it was burned in the Vulcanus?

MR. MATTHEWS: The conditions we observed and monitored on the Vulcanus exist at that time, I think the herbicide orange, which is of a higher btu value than this waste, will be effectively destroyed.

HEARING OFFICER MOLLOY: Thank you. We will take a ten minute break and be back at a quarter after eleven.

end 3

(Recess)

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Tape 3# 4

HEARING OFFICER MOLLOY: We are going to start again.

We have been asked to enforce the "no smoking" rules in here. And as one of the great offenders, I guess we will be required to do so. So Mr. Biglane and I have agreed to stop smoking and everyone else is going to be required to stop smoking.

The next speaker is Dr. Willis E. Pequegnat, President of TerEco Corporation, College Station, Texas.

Doctor, if you will use the lectern.

DR. PEQUEGNAT: Thank you, Mr. Molloy.

I have a presentation which involves some stills which you probably can't see but hopefully. When I learned that a professionally taken film would not be available for presentation today, I did bring one of our little -- I should say very unprofessional Super 8 millimeter films to show you a little bit of what the devices I am going to describe look like in the Gulf of Mexico about three weeks ago so as to give you some idea of what we are talking about.

Sometime ago when Shell Chemical Corporation did its first burn through the Vulcanus of certain kinds of organochlorine waste in the Gulf of Mexico, TerEco was called upon to do a rather simplified look at certain changes in the upper levels of the seawater system.

And later through the Environmental Protection js20 Agency's Oil and Hazardous Materials Control Division and through that the Marine Protection Branch of EPA, we did a somewhat more thorough look at certain changes that might occur in the upper levels of the water.

During these tests we realized that what we were really missing in all of this was a look at chronicity or chronic effects, those that might take some time to develop. And also there was the problem of how if you see a patch of water exposed to some kind of air material, air-carried material which is settling up, how do you know a few days later or even a few hours later that you are dealing with essentially the same water organism mass that you were dealing with before?

Well, there are various ways you could obviously tag this. But there are things that we needed to do. We wanted to put certain kinds of experimental animals into these. We wanted to deal with certain kinds of organism, and where we had some standard laboratory referral, as well hopefully as dealing with species there at the scene which we generally call indigenous species for the lack of a better term.

But, anyway, through them, the sponsorship of EPA and the division and branch that I have just mentioned, we have been developing such a procedure. And in this we have come up with devices which we call biotal ocean monitors, which js21 are essentially very large nylon, monofilament mesh containers which are of more than one size.

We are dealing particularly today with a 21-foot diameter devices that are about 50 feet in depth or length which will enclose, say, roughly 100,000 gallons of water, although they are not enclosing it in the usual sense. They are letting the water move as it will but the organisms stay behind.

We have mesh sizes that differ depending on what we wish to monitor. We have a way of hanging within these larger ones a smaller unit which contain then organisms from the size of phytoplanktons a few microns, say, 80 to 120 microns in diameter up to -- and sea urchin embryos, which we have used, on up to organisms that are of fish size.

Now I would like to just have you see these bio-ocean monitors, and we might just pass these around right at the moment for the panel to take a look at. And then I would say that if that little film works, we will have that and it will give some of you the ideas.

OK. During this present unit burn of the organochlorine waste from Shell, which were burned by the M/V Vulcanus, TerEco had an independent vessel which launched these biotal ocean monitors --It is not a simple job, really, but not terribly difficult either -- on the 7th and 8th of March. And we retrieved them on the 14th of March.

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And then the organisms were either processed aboard the ship that we were using, which was a Statewave 125-foot flat-bottom vessel which acted like a cork compared to the sedate and serene operating Vulcanus which acted like a cement platform. Two of my people went aboard the Vulcanus and were overwhelmed with the stability of that platform, whereas this round-bottomed state vessel that we had was really giving most of them a little mold mare (ph.).

The organisms that we used in these biotal ocean monitors during this particular test were Mytilus edulis, which is a phytoplankton mussel, clam, bivalve -- whatever you wish to call it -- which was used primarily because it is a bissus (ph.) thread producer. Of course they are very good eating as you perhaps know. We did not use them for that purpose. But at any rate they produced bissus threads through what is known as the bissal (ph.) gland or the pital (ph.) gland.

Now this gland formation, disogenesis (ph.), if you wish, these are very high protein structures, is very sensitive to certain kinds of organochlorine waste.

Secondly, we used Strongylocentrotus, one of the sea urchins. And there we used the freshly fertilized eggs embryos for detection of any kind of calcium precipitation, since these are sea urchins and do have calcified skeletons which appears rather early as rods in the development of these

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things. We also used a native phytoplankton, Skeletonema Costatum -- the spelling will be supplied later. And we also used two species of a well-known fish, where I think you do have to have laboratory reference -- Fu ndulus similis and Fundulus gradis.

These then were subjected to certain kinds of tests; some aboard the vessel, others in the laboratory. And the tests are not completed entirely yet.

Now the kinds of things we were doing was not to demonstrate acute problems, remember, but chronic problems. And we cannot wait in the interest of economics we cannot wait two to three weeks perhaps in all instances to watch the development of these.

So our hope, and we are developing a protocol, it is not yet complete, that we could get indications of potential changes which if not reversed could result in rather severe difficulty for marine organisms in the exposal zone which might be the upper meter or two of the water. Who knows?

I am not sure of how the mixing would go in this scene.

We then have done the following: We have looked at three enzymes; catalaid (ph.), ATPA and cytochrome P-450, in which the first two we would expect a reduction and in the third we would expect an increase if we were going to have j324 untoward effects.

We have also looked at the organism, particularly the mussel and the fish from a standpoint of rather total histopathological indications and are in process of looking at whole tissue histochemical changes. These are not yet done. However, we do have some results which I will quote on in a moment.

We have done this in the mussel. We have looked at the gill, or tetatem (ph.); we have looked at the bissal bland -- b-y-s-s-a-l -- and the digestive gland.

In the fish we have looked at liver, stomach, kidney, gonad and gill. And we have done routine sectioning. We have done light microscopy; we are in the process of doing electron microscopy, both transmission and scanning. But these, the results are not yet complete.

Now in addition to these, we have looked at some metal indications. We have analyzed the mussel and the fish for chromium, lead, cadmium, iron and zinc. We have also -- and this, I may say, I will give you some results in a moment -- this we have done by flame technique only, and we will have to use flameless for the lead and chromium, coming up shortly.

Now in addition to this, we did through the standard gas chromatography -- well, not quite standard but gas chromatogr aphy, we have done a look at organisms from js25 the standpoint of incorporation of any residual waste material into the tissues of fish and mussel.

So these things, then, have been done.

As far as the phytoplankton is concerned, the Skeletonema costatum, what we have done there we removed aliquot samples from the biotal ocean monitors on successive periods. And took then samples from those; put them into standard culture medium; illuminated them for four hours; and then preserved them. And we are making counts to determine whether or not there is a fallout or fall off in the rate of division of these organisms. And those counts take quite a lot of time.

Again, it takes time to pull this all together. But some things were done very rapidly and other things take more time, so we don't have the absolute, definitive results on this kind of thing absolutely completed.

Now what we did find are these things. In looking at the organism, the fish, for example, the gas chromatography, we found we had -- we used exposed amounts of material to give some kind of background and got what you might call a fingerprint label on the waste material itself in the laboratory. And then we exposed fish to rather small concentrations of material -- rather large, really -- and obtained a fingerprint against the pure waste, that which was incorporated within the fish tissues. And then we used these

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as background against which to compare with both control and exposed fishes that were brought in from the field.

Now in the field we used two units of BOM -- "bombs" if you will -- one into which we put organisms that will be exposed to the plume from the Vulcanus, the plume fallout. And, two, a control BOM where the organisms which are compatible, a unit litter mate, you might say, are not exposed to the plume product.

And so we would talk about exposed versus controlled in each of these categories.

Now these results I emphasize again are preliminary. They are not yet subject to what you might call rigorous interpretation.

In the fish, thus far, all tissues were normal except in the kidney where sections were found with some glomerular (ph.) shrinkage. Now there was shrinkage. The volmus (ph.) capsule was expanded. There was base afilia (ph.) intrusion. This is subject to interpretation, but this is the only thing.

The other tissues were found to be relatively normal. There are in all of these things parasitic things but not in the kidney situation. But compared to the control we are not talking about now and not/other any aberrancy.

In terms of the mussel, the byssal gland has not been thoroughly sectioned and studied as yet. But in this

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the byssal threads were easily disengaged from the gland in the exposed whereas they were not so, because they are a holding device, in the exposed mussels. Also the gills were in the exposed very bright in color, bright orange or deep brown, as compared to the normal light tan in the controls.

Now we must realize that we have correlations but we don't have conclusions that can be based on correlations. We have to have -- know causation is going to be related to this kind of thing, so we have to have some kind of further laboratory check on these things.

The metal results indicate, with the exception of chromium and lead where we can't give you any result at all, indicate the cadmium and zinc, the differential between the control and the exposed is insignificant in the iron and this is enigmatic. There was a major increase in the iron in the exposed organisms, for what reason we do not know.

As far as the enzymes are concerned, in the cataloids, no difference between the controls and the exposed. As far as ATPAs which might be responsive to biphenol change, the first metal, no significant difference. But in the cytochrome P-450 there was a threefold increase in this enzyme. And at this time it would be premature to draw any kind of conclusion from this. The reason being that there could be, perhaps, some extenuating circumstances of which we are at this moment unaware, until we have time to do a little js28 more lab work on this particular control versus exposed material.

In the gas chromatograph results, the results were low. Down to no significant change, but down to the resolution level at which is roughly in parts per billion. And so we feel that we have to have a calibration marker which we did not have available. We have got to have either 1,2,3-trichloropropane or another pure material that we can calibrate against, which was obtainable from one source and we were unable to get it in the time that it was available between returning on the 15th of March to the laboratory and preparation for this present hearing.

Now I would like to show you, if we may, I have a little film here. I have not seen this. I know what is on it, hopefully, and I am not sure where it will start. But it should show -- it might even show the Vulcanus burning, I think possibly. If you have never seen that, it is rather dramatic at night. Remember this is Super 8, it is not professionally done and the sea states were calm during one minor stage in this burn period and then they were a little bit rough during the rest.

There is a biotal ocean monitor during the calm period -- relatively calm period. You will see the antenna flag. We have a radio beacon on it and we have a strobe. You can see the net going down into the water relatively clear. And by the way, we hope to use indigenous species, and this is a good burn site from that point of view, because we did not get indigenous species of significance.

But you can see there the bag going down into the water from the flotation device. As you can see others hanging inside of the unit.

This is very calm for this time of year in the Gulf, and it was a window of calmness that didn't last too long. It was not possible to do too much work on our vessel during the high storm period, so you will only see a somewhat rougher period than this during the burn.

There is the flame shooting out of Vulcanus, if you can see that. If you look below that to the right, you might see our strobe flash every once in a while. Now that is not very dramatic. My wife couldn't move this thing, but you can see the light of the Vulcanus and you can see the flame coming out of one of the incinerator stacks.

I guess you can see both of them but it is not too clear.

Now this won't last long, but you can see the one; it is not absolutely calm at this period. I don't know that I saw the strobe flash. There we see -- you see a four footer over there just beyond these. These are free floating. Remember this is very deep water out here. And we are sub-sampling out of them with a Thoidiadd (ph.) and

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we have to maintain as little stress as possible so we do feed these organisms at our laboratory. We do not leave them to the mercy of finding food for themselves within that enclosure, although the mesh will permit phytoplanktons in particular and detridal (ph.) material to move into the mesh.

Those, interestingly enough, although the wind was from the southeast these were drifting east-southeast. They are one of the best current monitors that we've got.

There we are getting a little rougher water now. You see they ride quite well, actually. It is getting a little rougher. I am sorry we didn't get pictures during the roughest period but it would be a little bit shocking to you, although nothing like we experienced in the Gulf of Alaska with 50- or 60-foot waves there. But these are only 8 to perhaps 10 1/2 feet.

But a storm -- not a storm -- well, a windstorm is building up at this time.

We can trace these things for about 27 miles when the radio beacon is working well. And they are going with the water. This is the whole idea, that these units will encase the organisms, go with the water, and, presumably, they will expose the organisms to what would happen to the organisms if there are any of significance in the site where the plume is falling.

Thank you, Mr. Chairman.

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HEARING OFFICER MOLLOY: Thank you, Doctor. I have a few questions. When will all your tests be completed and these final conclusions, these tentative conclusions, anyway, be available?

DR. PEQUEGNAT: Today is the seventh of April. I would assume -- I was basing an original estimate to Mr. Hassler, who is the project officer, that we would have a lot of this in ten days, which we did. But I will say it will take two more weeks before the electron mycrostebe can be done on those tissues that look suspect.

Now, I may point out that the mussel clam, as pointed out by personnal in EPA as being perhaps a very good organism for sensitivity tests and that is why we are using that and that is what I want to see on the scanning electron microscope. I would say within two weeks or less.

HEARING OFFICER MOLLOY: And would that be your conclusions also, or just the tests?

DR. PEQUEGNAT: No. I would think that we would derive those within a short period since we know that what we are looking for, either degenerative change or not.

HEARING OFFICER MOLLOY: Although you were looking for chronic changes, did you notice any acute effects?

DR. PEQUEGNAT: I would like to phrase it this way: what we saw -- and I failed to mention and I am glad that you asked the question because it gives a little more cp2 complete picture -- what we have seen thus far, particularly in the enzyme work, I ought to describe that a little more.

When fish were taken from the control and exposed -- and that was the exposed biotal ocean monitor you saw there -- when they were taken from those, they were immediately sectioned, disected and the livers removed and frozen. Those livers are the ones that gave the high values.

We then brought exposed fish live back to the laboratory and maintained them in their original acquarium and we sampled those on pursuant day intervals. And we found cytochrome P450 levels return to baseline within the fifth day.

One might call that an acute effect because it apparently occurred rather rapidly, but it was a reversible acute effect and not one that -- we don't know whether if you left them out for another week or two weeks that they would have suffered irrepairable damage, irreversable damage.

HEARING OFFICER MOLLOY: Were there any other of these effects that appeared to you to be irreversable?

DR. PEQUEGNAT: That is being looked at now. We took some time to prepare these samples for the histochemical and histological, histopathological analysis and these are being done by specialists, I may say. ANd, as a matter of fact, the panal analyses were done

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by Dr. B.J. Presley, who works with us and the organochlorine by Dr. C.S. Giam, who is an authority on these techniques.

I think that we have found nothing there that we can say is not reversable because after the initial were found, we have then taken mussels and fish from the laboratory and prepared the sections, but they have not been studied, so I don't have that definitive information. It will be forthcoming shortly, though.

HEARING OFFICER MOLLOY: On the question of indigenous species, I am a little bit confused there.

When you had the movie on, did you say that the species that you had in the BOM were indigenous to the area?

DR. PEQUEGNAT: No. I would make that clear. No. They are not, except for sceletonema costatum which can be found rather widely in the marine environment which is in culture in our laboratory. We hoped to get perhaps a sargasm community organisms where we might take a dykaped crustacean, perhaps a fish, perhaps one of the crabs that is known to be there and use those as our indigenous form, but we did not see any sargasm community either in the trip out or while there.

And more than that, the coast guard plane with EPA personnel onboard who flew over for half an hour or

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more and took pictures of our activities and so on and then of the Vulcanus, had aboard Dr. Robert Hickory from Region Two, Dallas, who is a biologist and he, too, was looking for it and reports that even from his air scene he didn't see it.

There was some rather sparse zooplanktons and then a fish through the group, but it was so rough there was no chance at night of using attractance to get them and so this was not possible.

But this is known as a rather sparse fauna area.

HEARING OFFICER MOLLOY: Would you say that the conclusions you draw then would have to be modified to some extent by the fact that you couldn't use entirely indigenous species?

DR. PEQUEGNAT: No, I would think not. As a matter of fact, I am troubled by this kind of thing for a long time. They might have to be modified, but I think that it is absolutely necessary when one is attempting to do studies of this type that he have reference which are standardized.

For example, if we were to take some of the fishes that might be captured there and brought them into the laboratory to look at them at all in any kind of test or put them into these things, they are so ill-suited for confinement that the tests would be, I think, under considerable doubt because of the great physiological stress

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placed on these things through this confinement.

So I feel that as we go on -- and that is the reason I expended the types of organisms that we used -- as we go on, we must not completely abandon organisms that are adapted to the laboratory confinement and thus are at ease, so to speak, during the time of testing.

So, if one were to obtain mullet, for example, or go further anchoba in the area or any number of flying fish which do exist perhaps in the area, it would be, I think, not a good test because they are not aclimated to the one thing that they have to do and that is stay in confinement in order to be exposed properly.

HEARING OFFICER MOLLOY: You indicated that you had used these monitors in the Gulf of Alaska, is that right?

DR. PEQUEGNAT: No, I have not. I said I have been in the Gulf of Alaska and experienced waves. But the monitors have only been used in the Gulf of Mexico.

HEARING OFFICER MOLLOY: And could you --

DR. PEQUEGNAT: This program is rather, too.

HEARING OFFICER MOLLOY: Could you outline -- I admit this is sort of off the cuff -- the problems that you might see in doing the same type of program, say, in the Pacific?

DR. PEQUEGNAT: Well, it would depend on the mode of transport available. If air transport, the trip is eight hours from Dallas, Texas to Honolulu, which is not a significant period of time from the standpoint of maintaining organisms because the drive from College Station to our embarkation point in the Gulf of Mexico takes almost four hours with a truck or better.

So, air transport is not serious. The other thing that would be important to have, of course, and thus might be a problem if it cannot be arranged would be to have a certain laboratory facility available to do some of these things while near the area, either in Honolulu or on the Island or something of that sort.

These are the things that I foresee. Now, we have made some study of the Johnston Island area in the past and, of course, the Air Force has a rather comprehensive environmental statement on this. We are not sure, however, of the density of organisms that might be available from the standpoint of effective,appropriate,indigenous forms, if any there.

So that might be a problem, if this is problematic, but we could certainly take these organisms and others, even perhaps from the Honolulu area to such a sea. But there would be these kinds of problems.

HEARING OFFICER MOLLOY: And can you foresee any great time constraint?

DR. PEQUEGNAT: As to which part? The constraint is --

HEARING OFFICER MOLLOY: On getting the animals and plants together perhaps and getting the equipment to the Pacific?

DR. PEQUEGNAT: No, Mr. Chairman. This perhaps is no more a serious problem than preparing it for transport on the truck. I wish that they had included in the film the staging that goes on in trying to get these organisms. See, we have to take hundreds of fish in the back of our laboratory building area and you arise at four o'clock in the morning and get everything ready to go and you have got to get it down there about the time the ship leaves.

But, in other words, it is no more difficult to stage it for that kind of thing, I suppose, than it would be to go aboard ship. People have always asked -- may I say, and maybe this is a little off the point, but it really gets at it, people say is there a Department of Oceanography where we live in College Station, 150 miles from the ocean? How can that be? At Texas A&M they have a department of oceanography. We say, you know, if you are five miles from the source of your equipment and your organisms and you have got to load a truck in order to get it there, it doesn't make that much difference.

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HEARING OFFICER MOLLOY: Thank you. Do you have any questions?

MR. BIGLANE: Dr. Pequegnat, I would like your characterization of this technology. You have worked in this area now for just a short time. But as a biologist, I am excited over measuring insults in the marine environment by use of more than just what some have characterized "pickle jar" methods, that is, enclosing an organism in a container and adding some kind of pollutant and in 24, 48, 96 hour period attempt to define for humanity just how potent that material might be or could be.

I would like your characterization of this type of technology. Have we advanced in a measurement tool at all with this kind of development?

DR. PEQUEGNAT: Mr. Biglane, I believe that we have, we hope we have. We have been working with, although rather very informally and periodically with personnel in EPA in terms of organisms that are effective organisms to demonstrate what we want.

Gulf Breeze Laboratory, Dr. Dalnemo, in particular, has been raising an organism known as mysidopsis bahia which is a small crustacean, shrimp-like crustacean. These, I think, are going to make very excellent monitoring organisms.

We now have them cultured in our laboratory and are learning much of their habits and how we can feed them

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and maintain them and we find that what we hope to use here is a very interesting test known generally as [illegible] charge system which has been used in microbiology, but not in metazona organisms. And we need now to -- since this has been a rather short period we really have been into this program -- we need now to bring up the laboratory examination of these things to a point where we have got a field calibration for the results.

So, I would say that we are making pretty definite advanced strides and I know that EPA is, as well. We are the only ones that have the biotal ocean monitor in this program that you people have aided us in developing and, yet, we hope that others will be able to make use of them as time goes on.

We have also developed one now which is only the prototype model for a bathiclock and that will be examined by you people before long and, hopefully, we will be given a green light to go ahead with that.

So the state of the art is improving and I think we are out there somewhere on the forefront.

DR. VENEZIA: I have a couple of questions for you, also.

How long was the plume from the Vulcanus in contact with the monitor?

DR. PEQUEGNAT: I am not certain of my ground in

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terms of the levels. Perhaps Mr. Matthews can give me an input on this. I think that the human nose can detect hydrogen chloride at about six parts per million; is that about right?

MR. MATTHEWS: Interesting question because we have had arguments about whether you could smell it or sense it. I think that you are approximately correct.

DR. PEQUEGNAT: Okay. Well, although our personnel were equipped with safety masks and so on, some of them insisted on being sure they were exposing it properly by continually smelling it. So, I can say that for quite a period of time -- I cannot be absolutely sure of it because the plume is not that readily visible under the atmospheric conditions that generally have existed at the Gulf -- but for a period of time, sufficient to be equivalent to that would occur if the biotal ocean monitor hadn't been there.

DR. VENEZIA: Did you make organic analysis of the water?

DR. PEQUEGNAT: We did not.

DR. VENEZIA: Thank you.

HEARING OFFICER MOLLOY: Thank you, Dr. Pequegnat.

We are going to go out of schedule here a little bit. We have an airplane problem and if I can find my card that I have just lost -- here we are. I am going to call on opil Glen Wood, Jr., Executive Director of the Mississippi Air and Water Pollution Commission to make a statement on behalf of the State of Mississippi.

While Mr. Wood is coming up, I have an annoucement. We have a problem. Somebody mistakenly took the only copy we have of Mr. Matthews' statement and so we would like to make copies of it. So if the person who took this by mistake could return it to us, we will promise you a copy.

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HEARING OFFICER MOLLOY: Mr. Wood?

MR. WOOD: Thank you, Mr. Molloy. I appreciate the opportunity to appear before this hearing to make some comments.

I am Glenn Wood, Executive Director of the Mississippi Air and Water Pollution Control Commission. I have prepared a very statement in support of issuance of this permit.

However, before I read that statement, I would like to make some very brief remarks -- remarks which I have been very hesitant to make, unless you feel that the State of Mississippi has been less than objective in its review of the proposal which is before this hearing this morning. Let me assure you that such is absolutely not the case. We have not only been objective, I feel that we have borne the brunt of extreme public concern and criticism for some seven years while the scientific determinations could be made, while all of the proper and necessary procedures could be followed to insure that the method which is being proposed was the best method.

Let me assure you of one more thing. We do not have another year in which to continue to view this matter objectively. That is simply not available to us. In fact, I am not real sure how we have gotten by the last three years, but it has been with a great deal of forbearance and a great

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deal of objectivity on the part of the State of Mississippi who has been involved with the Air Force in trying to come up with a viable alternative.

I make these remarks because most of the concern, indeed, all that I have heard expressed here this morning has been in regard to the transportation of this material to its disposal site. The prevention of spillage enroute and whether the effects of incineration of that material could indeed be measured. I should like to point out to you that 800,000 gallons of this material have been stored for seven years in the very center of a highly-populated area immediately -- immediately surrounded by recreational waters on all sides. For every person in this room, there are 100 people who live in the immediate vicinity of these 15,000 drums of herbicide orange. These drums which are stored outside in an environment which causes them to deteriorate and have to be replaced periodically, and an environment where the temperature exceeds 100 degrees Fahrenheit for considerable periods of time regularly.

These people are concerned about emissions and spillages which occur continuously. I trust that you will be equally concerned with their protection, as well as with the proper ultimate disposal of this material which I certainly am.

The State of Mississippi fully supports the proposal

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presented by the Air Force which is the subject of this hearing. Mississippi Air and Water Pollution Control Commission has been fully involved in efforts to develop a viable alternative and we are convinced that further efforts in that direction from this point in time would be irresponsible and would cause the continuance of a situation which presently represents a substantial threat to the welfare, if not to the health and safety, to the citizens of our state.

We have reviewed the proposed plans as presented here by the Air Force today, by Dr. Welch, and we feel that their people are highly competent and are prepared to handle this matter in a safe and responsible manner to an acceptable conclusion.

We urge the prompt issuance of the requested permit by the Environmental Protection Agency.

Thank you.

HEARING OFFICER MOLLOY: Thank you, Mr. Wood.

Thank you.

MR. WOOD: Thank you.

HEARING OFFICER MOLLOY: The next speaker this afternoon is Mr. Bruce Turner who is a meteorologist and is on detail to the Environmental Protection Agency, Research Triangle Park, North Carolina.

MR. TURNER: Mr. Chairman, my name is Bruce Turner.

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I am employed as a meteorologist with the National Oceanic and Atmospheric Administration, Department of Commerce, and am on assignment to the Environmental Protection. On that assignment I serve as chief of the Environmental Applications Branch, Meteorology and Assessment Division, Environmental Sciences Research Laboratory, Office of Research and Development, Environmental Protection Agency.

In that capacity I am primarily concerned with dispersion of air pollutants and their resultant concentrations as released from both point and area sources.

I have reviewed the report, "Atmospheric Dispersion Analysis of Effluent from the M/T Vulcanus," dated April 1, 1977, prepared by TRW. I believe this has been submitted earlier this morning. The material is pertinent to a determination of air pollutant concentrations resulting from incineration at sea. I would agree with the authors that the assumptions made are conservative; that is, likely to overestimate concentration levels compared to what is likely to occur in a real atmosphere.

In order to determine if the numerical results in the report were correct, I first recalculated the emission rate of TCDD from one incinerator stack using the assumptions given in the report, and obtained a value of .537 grams per hour, the same as given in the report.

I then calculated concentrations at various distances downwind under very conservative assumptions,

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likely to overestimate concentrations. These assumptions include low height of release and dispersion parameters comparable to moderately stable conditions over land. This would correspond to a smooth sea surface with air temperatu-es somewhat above the sea surface temperature.

The results obtained from these independent calculations were consistent with the results given in the report. Therefore, I feel that the estimates given in this report are reasonable state-of-the-art estimates, and because of the assumptions made are likely to be much higher than concentrations actually occurring in the atmosphere.

One additional comment regarding the ship's operating procedures that has a bearing on the dispersion of air pollutants released from the vessel. The vessel being underway during incineration will, under most circumstances, serve to further dilute the released materials. The movement of the vessel should be in a general direction into the wind, to prevent encountering a previously released portion of the plume.

Also, if this direction of movement can be, not directly into the wind but at a slight angle, even as small as 10 degrees to the wind direction, this will serve to continually move the point of release in the crosswind direction, resulting in shorter times of exposure to plume centerline concentrations at any point downwind for the situations where the wind direction remains quite steady with time. This effect is greatest under adverse meteorological, poor dispersion, conditions.

And I have a written statement to that effect to submit for the record.

HEARING OFFICER MOLLOY: Thank you. Thank you, Mr. Turner.

The next speaker -- in fact, the only speaker that has so indicated that they would like to talk is Maureen Hinkle, Pesticide Monitor, representing EDF, National Audubon Society and National Wildlife Federation.

Is she here?

MS. HINKLE: Thank you very much.

I am glad to be here on behalf of theEnvironmental Defense Fund, the National Audubon Society and the National Wildlife Federation.

EDF is a nonprofit coalition of scientists and lawyers and others interested in finding scientific solutions to environmental problems. EDF has been concerned with the adverse effects of 2,4,5-T since March 22, 1972 when we petitioned EPA to suspend all registrations containing 2,4,5-T.

Our concern with problems associated with the use of 2,4,5-T continue, as the substantial question of safety in regard to 2,4,5-T have yet to be rebutted. And there is

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increasing evidence of residues of dioxin in animals.

The National Audubon Society is one of the oldest and largest conservation organizations with a worldwide membership of over 350,000, and a well-established history of concern about pollution of the marine environment, as well as pesticides in the ecosystem.

The National Wildlife Federation is the nation's largest nongovernmental conservation organization, 3.5 million members and supporters. The Federation has followed very closely the federal ocean dumping program for over four years, has been instrumental in bringing ocean incineration under EPA regulatory control, has participated heavily in the review of previous ocean incineration operations, and has been involved in many of the proceedings and deliberations concerning agent orange which have lead to today's hearing.

The disposal of agent orange is a matter of great environmental significance because, as we all know, the contaminant known as TCDD is present. We have participated in the hearings, we have commented on the environmental impact statement, and then, as now, our support of approval of the research permit is expressly conditioned by our insistence that as in the case of the Shell Chemical Company permit, every aspect of the incineration process and its aftermath be followed, measured, supervised, and evaluated, and that the operation be aborted at the first sign of anyting untoward.

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The Shell incineration of organochlorines and other test studies support the anticipated efficiency of destruction by incineration and negligible environmental impact from exhaust vapors.

We believe that technical problems involved in a full-scale incineration of agent orange have been anticipated and resolved to effect efficient and relatively safe destruction of agent orange, providing the following conditions are met:

The first is that combustion temperatures exceed 1246 degrees Centigrade, unless some other combination of combustion temperatures and all oxygen rates are determined prior to incineration which are found to result in more complete and efficient destruction of agent orange waste.

Two, combustion efficiencies are closely monitored to insure that the maximum emission rates of TCDD, 2,4,-D or 2,4,5-T will not be in excess of 0.1 percent of the corresponding amounts in the agent orange waste.

The Federal Register notice did say average and we think this should say maximum.

Three, that stack samples are collected periodically or continuously and used to demonstrate that the toxic components of concern were, in fact, destroyed. If the assumed percentage is not reached, any second permit would need to modify conditions of incineration to achieve j39 the requisite combustion efficiency.

Four, that failsafe measures are provided for safety of personnel both onboard ship and in the transfer and transport of the herbicide. Medical examinations should also be provided for all personnel involved before and after the program.

Five, contingency plans have been established in case of mechanical malfunction. And these have already been gone through. We feel competent enough.

Six, the 45,000 fifty-five gallon drums are rinsed with diesel fuel, crushed, smelted and recycled within a specified, reasonable period of time, with appropriate consultation and coordination with relevant local authorities.

Seven, accessory materials and contaminated soil from the storage vicinity are properly disposed of.

Finally, we are concerned about what appears to be an aspect of expediency surrounding this research permit hearing. We hope the Air Force is not so tired ofthis problem that the easiest way out has been selected, or that convenience will be allowed to dictate the progress of the entire operation.

All aspects of the disposal should be given the most conscientious and careful attention. The extreme hazard of the agent orange, as well as residues remaining in the drums

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and accessory material must be considered at every step. The responsibility for the entire operation is the Air Force's, as directed by the Secretary of Defense in 1971 and subject to review and supervision by EPA.

If this research test run -- If in this research test run combustion efficiency does not reach the target 99.9 percent or other problems ensue, the remainder of the agent orange may well require other disposal methods.

Properly controlled incineration at sea appears to be a relatively safe method of disposal of the agent orange. However, without adequate safeguards the advantages of at sea incineration rapidly diminish.

We appreciate this opportunity for comment and support the proposal under the above-indicated circumstances as environmentally sound, consistent with the law, and compatible with what we believe are the best interests of the public.

Thank you.

HEARING OFFICER MOLLOY: Thank you.

We have no more indications that anyone would like to speak. Is there anyone who forgot to indicate on the registration card that they would like to speak this afternoon?

(No response)

HEARING OFFICER MOLLOY: Did we ever get the one copy returned?

OK.

Dr. Welch, you would like to speak?

MR. WELCH: In response to the question that you asked regarding the level of detectability away from the ship, based on our quick calculations the worst case conditions that have been used in these predictions we would anticipate nondetectability 20 kilometers or so away from the vessel. And under the average case we would anticipate nondetectability at about 5 kilometers.

HEARING OFFICER MOLLOY: Thank you.

Well, if there are no other people who would like to speak, I just again reiterate that the record will be held open until next Wednesday afternoon for any written comments that anyone would like to make.

And this hearing is adjourned.

(Whereupon, at 12:22 p.m., the hearing was adjourned.)