ENVIRONMENTAL PROTECTION AGENCY

Public Hearing, held pursuant to notice, upon application of the United States Air Force for a permit under the Marine Protection Research and Sanctuaries Act of 1972 for the ocean incineration of Herbicide Orange, held in the Legislative Auditorium, Hawaii State Capitol, Honolulu, Hawaii, on Friday, April 25, 1975, beginning at 9:30 A.M.

BEFORE: MR. J. BRIAN MOLLOY HEARING OFFICER
Acting Deputy Assistant Administrator for Water Enforcement, EPA

MR. KENNETH BIGLANE
Director, Division of Oil and Special Materials Control, EPA

DR. JAMES MAC KENZIE
Chief Pesticides Program Branch, EPA Region 9

DR. HENRY ENOS
Director, Equipment & Techniques Division
Office of Monitoring Systems, Research & Development
EPA Headquarters

EPA HEARING PANEL

ALSO PRESENT: JAMES A. ROGERS, ESQ.
Office of the General Counsel, EPA

T. A. WASTLER
Chief, Marine Protection Branch

H. TRASK

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MR. MOLLOY: Good morning.

My name is Brian Molloy. I am the Acting Deputy Assistant Administrator for Water Enforcement for the Environmental Protection Agency, Washington, D.C.

The hearing today is convened to receive information and consider the application of the Air Force for a permit under the Marine Protection, Research and Sanctuaries Act of 1972 for the ocean incineration of Herbicide Orange.

On my right, Mr. Kenneth Biglane, Director of the Division of Oil and Special Materials Control, EPA, Washington, D.C.

On my immediate left is Dr. James MacKenzie, Chief of the Pesticides Program Branch of EPA, Region 9 Office, San Francisco, California.

And on the far left, Dr. Henry Enos, Director of the Equipment Techniques Division, Office of Monitoring Systems of the Office of Research and Development, EPA Headquarters in Washington, D.C.

Before I go on, I would like to ask Mr. Biglane to make a few opening remarks.

Mr. Biglane.

MR. BIGLANE: Thank you, Mr. Chairman.

As the Chairman identified, my division is the

Division of Oil and Special Materials Control, and I would like to relate to you just a few of the activities that we do. It is within this division that the oil spill response program for EPA is housed, also in charge of the Environmental Impact Statement for Water Programs, and then we have the ocean dumping program.

With us today is Mr. T. A. Wastler, taking to our left, who is Chief of the Marine Protection Branch of that program.

The reason I asked the Chairman to let me have a few minutes is, I want to report to you that the Congress is quite interested, as you know, in this program. Mr. Wastler and I spent about an hour and a half, over one hour and a half yesterday, and before two subcommittees of the House of Merchant Marine and Fisheries Commission responding to questions from this group about the ocean dumping program of the United States.

Their questions ranged, of course, from concern over resources available to the Environmental Protection Agency and other federal agencies involved with conducting this program. They were also quite interested in the new technologies that are coming before us now, and ocean incineration certainly is one of the newer technologies.

This is the second public display in which

ocean incineration will be discussed, and the third one, as you know, is scheduled for San Francisco on Monday. And I can accurately report that the Congress is concerned that alternatives be found to the disposal of wastes in the oceans, and have penetrating questions on what is this country doing to look for alternatives, as opposed to disposing of these wastes in our marine waters.

I think today you are going to hear some of these alternatives.

As we know in our ocean dumping program, if there are viable alternatives, feasible alternatives to the disposal of this material, either by incineration or any other way into the marine environment, then those procedures should prevail.

And again, I think as the testimony unfolds, we have tried to show you, we have tried to bring the problems associated with these kinds of materials directly to the public.

This country manufactures more and more chemicals each year. We are ending up with very highly toxic substances. We found long ago that just merely leaving the disposal of these materials to the land environments or to the air environments or to the marine environments, damages will occur. We must be very careful in the

controlled release or depositing of any of these materials into any of the environments.

Mr. Chairman, now with this concern statement behind me, I recommend that we proceed forward.

MR. MOLLOY: Thank you, Mr. Biglane.

I have just a few introductory remarks, and I will leave most of the technical information to be discussed by other people later on.

As I said before, we are here today to receive information on the application of the Air Force to dispose of approximately 2⅓ million 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 Sanctuaries Act of 1972 to burn this material about 120 miles to the west of Johnston Island.

EPA has reviewed the information that has been made available by the Air Force and other interested parties, and it has made a tentative determination to issue a research permit to the Air Force that would allow approximately 4200 metric tons of this material to be incinerated in the ocean under certain controlled conditions. They are not too long. I will read those conditions that we would impose, or we have tentatively agreed to impose on any permit issued to

the Air Force.

"1. The incineration will take place within the disposal site.

"2. The emission rates after the burn will not be in excess of one-tenth of one percent.

"3. The Herbicide Orange will be removed from the storage drums and loaded on the incineration vessel in such a manner that no TCDD escapes to the environment in measurable quantities. In the process of removal of Herbicide Orange it shall employ the best available technology.

"4. The drums from which the Herbicide Orange is taken will be triple rinsed with solvent prior to disposal or otherwise cleaned with equal degree by jet rinsing, and the rinses will be added to the waste to be incinerated.

"5. The carrier will maintain a combustion temperature in each incinerator of at least 1400 degrees centigrade.

"6. Feed rate of the Herbicide Orange into the combustion chambers will be as low as possible and not in excess of 12 metric tons per hour for each incinerator.

"7. The applicant and the carrier shall maintain a sealed automatic monitoring device for constant review of the operating temperatures of the incinerators.

"8. The applicant will employ such other

monitoring procedures as are requested by the Environmental Protection Agency."

That is a tentative determination. A final determination will be made by the Environmental Protection Agency following this hearing and any subsequent sessions of this hearing, and the receipt of any public comments concerning this proposal.

As Mr. Biglane mentioned before, a major consideration that EPA must take into account before a permit is issued is the question of whether there are any feasible alternatives to the incineration. We expect several statements to be made today on these alternatives.

The rules for today's hearing are as follows:

First of all, this is an informal hearing and there will be no cross-examination of witnesses. Written questions, though, may be presented from the floor. If you will write out any questions you have and hand them to one of the ladies in the back of the room, we will try to have all germane questions answered, given the problems of time if we run into those problems.

Everyone speaking should use the lectern to my left, and should identify themselves by name, and affiliation if that's appropriate.

The order of speakers, as far as practicable,

will be, (1) any introductory remarks by the Environmental Protection Agency; (2) the Air Force presentation as they see the problems; (3) we have a statement on EPA policy on pesticide herbicide disposal. Then (4), we would like to have any elected representatives of federal, state or local governments to speak, followed then by any federal, state or local governmental agencies. After the governmental agencies are through, we would like any representatives of groups, and then following that any specific individuals.

Now, there may be a problem with time, and so if anyone has a time problem, if they would make that problem known to one of the ladies in the back of the room we can probably try to juggle that as best we can.

We would appreciate it if any statements you made were in writing, and then you can just summarize these statements when speaking.

We will have a fifteen-minute break at about eleven o'clock.

Finally, we are making a transcript of today's proceedings, so that if you have a written statement and you have it available, please give a copy of the statement to the Reporter who is sitting next to the lectern to make it a little easier for him.

So with that, I think we will now begin formal

statements.

I would now like to call on Mr. James Rogers, an attorney, Office of General Counsel of EPA Headquarters, who will discuss the law under which we are operating here.

MR. ROGERS: Thank you, Mr. Chairman.

My name is Jim Rogers. I am a lawyer with EPA, and I would like to take a few moments to help provide some more background for this hearing, and to give a brief outline of the law as viewed by the Staff under which EPA operates.

As the Chairman indicated, the statute which governs the proceedings is the Marine Protection, Research and Sanctuaries Act of 1972. This Act was passed in October of 1972, and was amended in March of 1974 to make it consistent with the convention on the prevention of marine pollution by dumping of wastes and other matter.

This is the second application for use of an incinerator ship that has been processed by EPA. The first was the application of the Shell Chemical Company to incinerate in the Gulf of Mexico troublesome organic chloride wastes generated by its Deer Park, Texas facility.

EPA held three separate hearings on that application, and the hearings resulted in the granting of two research permits and one interim permit to incinerate those wastes. The same ship that conducted those incinerations will be used by the Air Force if the permit is granted

under this proceeding.

There are two reports that have been produced as a result of the Shell experience. One is by the Shell Chemical Company. The other is by EPA, and I would suggest and offer at some point in this hearing that we include these in the record.

It may be useful to quickly mention the nine statutory criteria that must be considered before an ocean dumping permit can be granted. These are in Section 102-A of the Act, and I am going to paraphrase them.

The first criterion is the need for the proposed dumping.

Second is the effect of such dumping on human health and welfare.

Third is the effect of such dumping on fisheries resources, shellfish, wildlife, shorelines, et cetera.

The fourth is the effect of such dumping on marine ecosystems.

The next is the persistence and permanence of the effects of dumping.

The sixth is the effect of dumping particular volumes of concentrations of materials.

And they go on.

It should be noted that when the Act refers to

dumping, this has been construed by EPA as meaning disposal by whatever form in the ocean, purposeful disposal.

The first statutory criterion, the need for the proposed dumping, leads to a major consideration that would be discussed today, and that is whether there are possible alternatives to the ocean incineration of these wastes.

As Dr. Welch and other witnesses will testify to today, there has been under intensive consideration by several agencies, agencies of the government, possible reprocessing of Herbicide Orange into useful pesticides which are currently registered by EPA's Office of Pesticide Programs and are in quite some demand.

Later on there will also be mention made of the EPA pesticide regulations, which encourage the reuse of material so as to avoid destroying of valuable resources.

And finally, there is one potential issue in this case that has not been finally resolved, and that is whether or not the combustion products that may result from the incineration of Herbicide Orange would result in the disposal of a chemical or biological warfare agent, as that term is used in Section 102-A of the Act. The tentative determination of the EPA Staff is that at the present time, and considering the minute quantities, if any, of unburned material that may be discharged into the environment, it is

unlikely that there would be a violation of the Act; although, as the Chairman said, this is strictly a tentative determination and is subject to evidence that is put forth at this hearing.

Thank you, Mr. Chairman.

MR. MOLLOY: Thank you, Mr. Rogers.

Before we go on, I have two documents that I would like to enter into the record.

The first is the Environmental Protection Agency Notice of Receipt of Application and Tentative Determination. This is the full text of the tentative determination that I read from before.

Secondly is a draft for the report entitled, Disposal of Shell Chemical Company Organic Chlorine Waste By Incineration at Sea, prepared by the Environmental Protection Agency Office of Water Program Operations, Division of Oil and Special Materials Control, April, 1975.

I would like to emphasize that this is a first draft of a report, and we anticipate that there will be at least some modifications to that report as it gets further finalized. When those changes are made, and if a more complete draft is prepared along with the final draft, that will also be entered into the record of this hearing.

With that out of the way, I would like to call

on the Air Force representatives. The first speaker today will be Dr. Billy E. Welch, who is the Special Assistant for Environmental Quality, Office of the Secretary of the Air Force in Washington, D.C.

Dr. Welch.

MR. GRANT REYNOLDS (Assistant General Counsel, USAF): Mr. Molloy, while Dr. Welch is taking the lectern, may I make a couple of remarks?

MR. MOLLOY: Yes, sir.

MR. REYNOLDS: I am Grant Reynolds, Assistant General Counsel of the United States Air Force.

We would also like to note that the record consists of the permit application by the Air Force with a 500-page Environmental Impact Statement attached thereto.

MR. MOLLOY: That is fine with me. That is the document in front of me here, and it is so noted and it is entered into the record.

MR. REYNOLDS: Thank you.

As you know, we have in addition to the permit application, eight witnesses with which we propose to cover each of the points discussed by Mr. Rogers, plus those in the tentative permit application.

The first witness is Dr. Welch, who is a Special Assistant for Environmental Quality, Department of

the Air Force.

MR. MOLLOY: Thank you.

Dr. Welch.

DR. WELCH: Mr. Chairman, thank you very much.

Good morning, ladies and gentlemen.

I would like to briefly recount some of the history regarding Orange Herbicide and summarize Air Force actions relating to disposal of this material in order to put this problem into the proper perspective.

First, we should recognize that Herbicide Orange is an equal mixture (50:50 by volume) of two commercially available agricultural products - namely 2,4,Dichlorophenoxyacetic acid and 2,4,5-Trichlorophenoxyacetic acid - or as we commonly refer to them - 2,4-D and 2,4,5-T. Herbicide Orange consists of what is chemically called the normal butyl esters of those two compounds. There are products registered by the EPA for use in this country, 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.

In April 1970, the U.S. Department of Agriculture, 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 Orange

Herbicide. As a consequence of the suspension of some uses of 2,4,5-T, the U.S. Air Force, acting as the executive agent for the Department of Defense, was left with 1.5 million gallons of Herbicide Orange in Vietnam and approximately 0.8 million gallons of Herbicide Orange 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. Following that particular direction, the Air Force published a draft environmental statement in January 1972, stating that incineration appeared to be the best way of resolving the problem, and that we had numerous studies under way. Due to the fact that these studies were under way and had not yet been completed, it was felt that the impact statement should be held in abeyance until the studies were completed.

As a result of that, the material that was stored in Vietnam was moved in April 1972 to Johnston Island for storage, pending a final disposal decision.

Since that time, the Air Force has conducted or caused to have conducted or assisted in conducting many studies to look at the various means for disposing of this particular material. The results of these efforts have

been documented in the environmental impact statement which is a part of our permit application. I will quickly outline these studies for the benefit of those who have not reviewed the statement. We conducted incineration tests ranging from static tests in the laboratory, to small scale laboratory tests, to drum size tests conducted for the Air Force at a commercial facility on the West Coast.

The results of these studies indicated that the butyl esters of 2,4-D and 2,4,5-T acids are destroyed between 550-700 degrees Centigrade, and the tetrachlorodibenzo-para-dioxin or the TCDD is destroyed between 980 and 1000 degrees Centigrade.

In addition to the incineration studies, we looked at the potential for use. This particular material is not a registered herbicide; and, for it to be utilized, it would have to be registered or reprocessed into some other material that would be useful.

At this point, somewhere in mid-1973 to early 1974, when we were looking at this particular problem, 2,4,5-T was considered to be a material that had perhaps a limited lifetime in terms of acceptability for use, and indeed the EPA had planned to hold public hearings in June 1974 to evaluate the overall use of 2,4,5-T in this country. These public hearings were subsequently cancelled with no

decision being reached due to the lack of sufficient information on which to base decisions.

We looked at deep-well disposal. We looked at the prospect of putting the material in nuclear test cavities, at the prospect of burying it, and at microbial reduction with subsequent destruction of the dioxin. We also looked at the concept of chlorinolysis, which is complete chlorinization of the molecule producing phosgene, carbon tetrachloride and hydrochloric acid.

We examined rather extensively the concept of soil biodegradation. This particular concept relates to putting the material into the soil and allowing the soil micro-organisms to handle the biodegradation of the material, thus breaking it down.

We also looked at the question of returning the herbicide to the manufacturers. In March 1972, we contacted the original manufacturers of the herbicide and inquired if they had any interest in the material. We inquired whether they could reprocess it to remove the TCDD and subsequently reuse the herbicide. This created what might be known as a wide wave of disinterest at that particular point in time. Subsequently, in August 1974, following EPA's decision in June 1974, we contacted the manufacturers again with the same type of results. They

reported they did not have the capability nor the interest to reprocess this material.

In May of 1974, we published a draft environmental impact statement in which we stated that incineration appeared to be the best way of destroying the material. Further, it was stated that incineration at a remote site was preferable to incineration in the Continental United States.

Accordingly, we said that incineration on or west of Johnston Island would be preferable. We looked at incineration at sea west of Johnston Island as having the least prospect of causing environmental damage. Incineration on Johnston Island is feasible and could be handled by building a facility that would be environmentally acceptable; but this option has the opportunity for potentially greater impact than incineration on the high seas.

When we filed the draft environmental impact statement, the EPA position was that incineration on the high seas was not covered by the Ocean Dumping Act, or the Marine Protection, Research and Sanctuaries Act referred to earlier. Over 400 copies of the draft environmental impact statement were distributed. An LO-2 rating was given by the EPA. The LO indicates they lacked objection to the proposal. We did receive comments from others, and I will

speak of those after finishing the chronology.

Subsequently, in December 1974, we published the final environmental impact statement. Again, we said that our primary option was incineration on the high seas west of Johnston Island or approximately 970 statute miles west of Hawaii. From the proposed site of incineration downwind, it is approximately 1200 statute miles to the next land mass, which is the Marshall Island Group. The usual ocean currents and the wind move from Hawaii to Johnston Island and, thence, away from Johnston Island and from Hawaii.

In the interim, between the filing of the draft and final statements, the EPA reversed their prior position and ruled that incineration on the high seas was within the purview of the Marine Protection, Research and Sanctuaries Act. On January 9, 1975, the Air Force requested that the EPA issue a special permit for the incineration of three loads of Herbicide Orange west of Johnston Island.

The EPA on February 19, 1975, conducted a public meeting in Washington, D.C. to consider several legal and factual issues that the EPA felt might arise in connection with processing the Air Force application. The issues, which the public was asked to comment upon, were:

1. Whether feasible alternative methods of

disposal exist.

2. Whether Herbicide Orange is a "chemical" or "biological warfare agent" within the meaning of the Act, and whether it retains this character following incineration.

3. Whether incineration of Herbicide Orange at high combustion efficiency is compatible with the Act, assuming the compound is a warfare agent.

4. Whether adequate techniques exist with which to monitor the incineration of Herbicide Orange.

5. Whether incineration is a feasible and environmentally safe means of disposal of Herbicide Orange, and

6. Whether the disposal site requested by the Air Force is an appropriate location for incineration of this waste.

Approximately 60 persons were present at the public meeting, including representatives of the National Wildlife Federation, the Environmental Defense Fund, and the Center for Law and Social Policy, which represents the Friends of the Earth and the National Audubon Society.

In regard to the first point concerning feasible alternatives, I have previously enumerated a list of alternatives which we have already studied. A

modification of our direct use alternative is presently being evaluated. In November 1974, even before we filed the final environmental impact statement for incineration, we proposed to the EPA a concept of disposal that involves destruction only of the contaminant, dioxin or TCDD as we referred to it earlier. It was proposed that qualified chemical companies would be requested to submit information outlining how they would chemically modify the Herbicide Orange to produce another form of 2,4-D and 2,4,5-T. In the process of modification, the dioxin would be destroyed or removed. The EPA responded affirmatively in January 1975 and provided a list of companies they felt would be capable of modifying the herbicide and removing the dioxin. The Air Force supplemented the list by once again requesting the original manufacturers to express their interest. A total of 24 solicitations were mailed. Indications of interest have been expressed by some chemical companies. Those that appear to have proposed feasible reprocessing techniques have been requested to demonstrate their techniques on a pilot plant scale. We are actively pursuing this potential disposal option.

The second point concerns whether Herbicide Orange is a "chemical" or "biological warfare agent" within the meaning of the Act and whether it retains this character

following incineration. Within the meaning of the Marine Protection, Research and Sanctuaries Act, Herbicide Orange is a chemical warfare agent. I emphasize within the meaning of that Act. There is specific legislative history indicating that herbicide compounds intended for use in warfare activities are regarded as chemical warfare materials, dumping of which is prohibited.

This leads to the third point: Given that Herbicide Orange cannot be "dumped," is ocean incineration compatible with the Act? We do not consider that the Administrator is barred from issuing a permit for the incineration of Herbicide Orange upon the ocean. Based on our analysis presented in the Final Environmental Impact Statement and upon the success of the VULCANUS when it incinerated chlorinated hydrocarbons in the Gulf of Mexico and upon independent analysis of our conclusions, it cannot be reasonably anticipated that any constituent of Herbicide Orange will be detected in the mixing zone of the ocean environment. In testimony of the public meeting in February 1975, a representative of the Center for Law & Social Policy stated that the combustion products do not retain chemical or biological warfare characteristics. At the same meeting, the National Wildlife Federation indicated the conditions they considered necessary to insure a safe burn

and then stated that incineration, under the indicated circumstances, would be consistent with the law. The point is - they were aware of the legislative history, as well as the Air Force proposal, and concluded the Air Force proposal was consistent with the law.

Monitoring of the incineration of Herbicide Orange was raised at the public meeting. Monitoring was again raised in the announcement of this public hearing. Our environmental impact statement explained the details of our sampling train and presented data to demonstrate a high recovery efficiency for 2,4-D and 2,4,5-T. We felt confident that dioxin would be trapped in our benzene impingers if it was present, but we did not present quantitative data to support our contention. We have recently completed experiments to verify the efficiency of recovering dioxin. The sampling train consists of a quartz probe which will be placed through the sampling port on the stacks of the VULCANUS and into the stack exhaust. A 50-foot heated teflon line will carry the sample to our impingers. Based on our experiments, we can say that our train is capable of detecting the presence of 2,4-D, 2,4,5-T and dioxin in the stack exhaust; that the teflon line, when properly heated, will transport the constituents from the stack to the benzene impingers; and that the train will essentially

pick up 100% of the constituents entering the probe.

The second point on monitoring regards the marine environment. The notice of the public hearing stated: "The applicant shall also present evidence at the public hearing as to its capability to monitor for TCDD, 2,4,5-T and 2,4-D in the immediate marine environment <u>during incineration</u>." I emphasize "during incineration." There are no instruments that we know of which will allow monitoring the ocean water for these constituents in real time during the incineration. We do have the capability to analytically determine the presence of 2,4-D, 2,4,5-T and TCDD in a properly collected sample of sea water. We would use a technique comparable to that of the DOW Chemical Company during our analysis. This type of monitoring should not be necessary, as we have demonstrated the efficiency of stack monitoring and will be able to detect these constituents and determine that the permit conditions are being complied with.

The fifth point as to whether incineration is a feasible and environmentally safe means of disposal has been answered by the studies conducted and reported on in the environmental impact statement process, by the tentative determination of EPA to issue a permit for incineration of a shipload of Herbicide Orange, and by the

support of the environmental groups at the February public meeting. However, the point of this hearing is to insure that undisclosed facts do not exist. The Air Force has, of course, already concluded that incineration on board the VULCANUS is an environmentally acceptable means of disposal. Based on the comments received on our draft environmental impact statement, most reviewers have come to the same conclusion.

The final point raised for discussion at the public meeting concerned the appropriateness of the selected disposal site. The EPA, in their discussion of the proposed designation of the site, stated that the proposed site is typical of tropical open ocean areas which are unproductive parts of the oceans. They also drew a comparison with the Gulf of Mexico site previously used by the VULCANUS, for which it was concluded that incineration was found to have no impact on the marine environment.

We have once again reviewed a number of references, including information obtained from the National Oceanic and Atmospheric Administration's Environmental Data Service and from NOAA's National Marine Fisheries Service. This review indicated that the information presented in the environmental impact statement is correct and that the productivity of the general area is low. We know of no

reason why such an area would not be suitable for ocean incineration.

It would seem appropriate at this time to discuss the comments provided to us by the State of Hawaii, Office of Environmental Quality Control. The Environmental Center of the University of Hawaii was primarily concerned because the Environmental Statement did not contain all of the biological background information we had accumulated for Johnston Island. It was unfortunate that the reviewer felt we were not being responsive to the ecological aspects of Johnston Island. We specifically commissioned the Smithsonian Institution to study the Johnston Island ecology. The complete report was and is available, but its volume simply precluded its publication under the same cover. We therefore published only the summary of the report - said summary also being prepared by the Smithsonian Institution. The Environmental Center also expressed doubt, which is not necessarily shared by the Air Force, about incineration on Johnston Island and favored use of the VULCANUS.

Our proposal is to incinerate the herbicide using the vessel. Incineration on Johnston Island is feasible, but we consider this option to be less environmentally acceptable than ocean incineration. The commenter concluded regarding ocean incineration, "I foresee the

deleterious consequences of this alternative as being minimal."

The Chemistry Department of the University of Hawaii also provided comments. They felt the herbicide should be processed by the original manufacturers to obtain useful chemicals. As I have previously pointed out, we have tried at least three times to interest the manufacturers to no avail. We have, however, recently obtained indications of interest from companies regarding our reprocessing proposal, which I have also discussed. If there is a feasible, environmentally safe way to reprocess the material, we will certainly pursue that aspect.

Concern for adequate monitoring of the vessel was expressed. Here, too, I feel my previous comments regarding the type and efficiency of monitoring served adequately to indicate our concern that the vessel be adequately monitored to demonstrate the efficiency of incineration. The requirement for properly handling the emptied drums was pointed out. We will spray wash all the drums we empty in order to remove the remaining herbicide. The dedrumming operation will be conducted in a specially designed facility so that any spill will be contained. We believe this operation can be conducted without damage to the environment.

The Hawaii Department of Agriculture recommended that controlled incineration be used for disposal. They preferred incineration at sea and said, "No significant detrimental environmental effects can be expected from this method of disposal." It was further indicated, should incineration on Johnston Island be selected, that a biological monitoring protocol should be developed. It is certainly our intent to conduct detailed monitoring before, during and after incineration should Johnston Island be selected as the disposal site. We will have a monitoring program under way during the dedrum operation to document the environmental safety of this operation.

These comments of the State of Hawaii, along with others, were included and addressed in our final environmental impact statement filed in December 1974.

We distributed over 200 copies of the final environmental impact statement. We have had one set of written comments from the Environmental Protection Agency. We have had one verbal comment from the Center for Law and Social Policy on the final environmental statement.

My point in mentioning this is to indicate to you that this particular public hearing we are having today is not to discuss a problem that just surfaced, not

to discuss something that the public has not had an opportunity to be interested in or had an opportunity to comment on. It is our contention that we have documented the environmental problems relating to this particular situation and that these environmental problems are the same whether a permit is required or whether one is not.

In the announcement of this public hearing, there were a number of points addressed which are expected to be permit requirements. Each of these will be mentioned and commented upon very briefly.

Incineration will take place in the designated disposal area. When a permit to incinerate Herbicide Orange at sea is issued, we will stipulate, in any contract we negotiate for ocean incineration, that incineration will occur within the designated boundaries.

The emission rates of TCDD, 2,4-D or 2,4,5-T will not be in excess of 0.1% of the total amount of the respective constituents in the Herbicide Orange waste.

This also is a situation which bears discussion. While we are confident the research burn will demonstrate that the above limits can be achieved - what if it does not? Of what significance should it be? Let me run through a few figures. Our herbicide has an average concentration of 2 ppm of dioxin. For our some 24,000,000

pounds of herbicide, we calculate that about 48 pounds of dioxin is to be incinerated. In complying with the conditions I mentioned previously, no more than 0.1% emission is allowed. Thus, a total of 0.048 pounds of dioxin will be emitted during our total time of burn over an area of about 66 by 138 statute miles or 9117 square miles or 5,834,861 acres. If this dioxin were spread over the entire burn area, an application rate of about 8.2×10^{-9} pounds of dioxin per acre would result, or expressed another way, about four micrograms per acre. Now assume in standard weed control work that about two pounds of herbicide are applied per acre and that the dioxin concentration is 0.1 ppm, which is the current EPA criteria. Calculation will result in a figure of about 90 micrograms per acre. Our dioxin will be deposited in the middle of the Pacific, in an area known to be unproductive. We can place only four micrograms of dioxin per acre due to incineration; but, in standard agricultural practice, an amount more than 20 times as much (90 micrograms) would be allowed on the land areas of the United States. The Council for Agricultural Science and Technology, in a report on phenoxy herbicides, said that - and I quote - "The amount of TCDD distributed in the United States in 2,4,5-T is probably no more than eight ounces annually.

This material is distributed over approximately five million acres at a rate of about 50 micrograms per acre. . . ." Again, we see that the permit restrictions will limit the amount deposited on an unproductive area to only four micrograms. Here again, my point is that while we will still comply with the 0.1% requirement, we should be aware that more dioxin is allowed to put on the ground in the U. S. than we will be putting into the Pacific Ocean. And, of course, if the burn area were larger, the amount per acre would be even less.

I believe the next point that was raised regarding removing the Orange from the drums and loading of the vessel in a safe manner has been covered, as has the requirement to rinse the drums. We will have spill prevention control measures, absorbent material in the event of a spill, curbs to prevent run-off and specially designed facilities for dedrumming and rinsing. These permit requirements will be no problem and have already been incorporated into our planning documents.

The carrier will maintain a combustion temperature in each incinerator of at least 1400 degrees Centigrade. The controls available on the ship were listed in the impact statement. We stated in our permit application that electric waste pumps will not operate to feed

herbicide to the incinerator burners of that combustion chamber in which the temperature falls below 1400° Centigrade. If such a condition or situation occurs, the incinerator malfunction is corrected, and the combustion chamber temperature is returned to above 1400° Centigrade with conventional fuel before any herbicide is reintroduced. Also the burners for a particular incinerator are automatically shut down if any of the following conditions fall below preset levels: the air feed pressure to a burner, the herbicide feed rate to a burner, and the flame intensity of the burner. Also, operational controls and monitoring panels are manned at all times by an engineer whose sole ship responsibility is operating and maintaining the incinerator system at the desired combustion parameters. Thus, we do not foresee this as a problem, and we will comply.

The feed rate will not exceed 12 metric tons per hour for each incinerator. We will comply with this requirement and do not anticipate any difficulty in so doing. The feed rate can be set and monitored.

A sealed automatic monitoring device for constant review of the operating temperatures of the incinerator - this presents no problem. The VULCANUS has this type of equipment installed, and its use will be

required.

The applicant will employ such other monitoring procedures as are requested by the Environmental Protection Agency. While this is generally acceptable, the words are far ranging. We assume the EPA does not intend to require monitoring, which past experience or analysis of available data would indicate is unnecessary. Likewise, we do not believe EPA would intend to require types of monitoring whose only purpose is cosmetic to make the operation look good but in reality adds nothing.

A final point that I wish to address is the loss of herbicide during transportation. The vessel is designed so that liquid cargo wastes can only be on-loaded via pumps on shore. Once loaded, shipboard pumps are only capable of discharging the liquid wastes directly into the combustion chambers. However, international regulations require that in the event the safety of the vessel and crew may be threatened, there must be some means of discharging the cargo directly into the sea. This could be effected through gravity release valves which remain officially sealed in normal circumstances. It is our understanding that release of the material has not been necessary, even operating in the North Sea, which is renown for its rough seas. Storms should not be a problem near

Johnston Island. Since 1955 there have been only two local storms and one hurricane which affected Johnston Island. Hurricane Celeste did cause in excess of three million dollars in August 1972. However, there have been only two hurricanes since 1955 which passed within 100 miles and only eight which passed within 1000 miles. Contact with the U.S. Coast Guard will be adequate to warn of any storms in the area.

The ship has been constructed according to Inter-Governmental Maritime Consultative Organization (IMCO) regulations and meets current U.S. Coast Guard requirements for carriage of cargo such as Herbicide Orange. Her double hull and double bottom provide added containment protection from collision or other marine hazard. The vessel is divided into 15 cargo tanks - none of which is in contact with the vessel's hull or bottom. Clearance between the tanks and hull is about 3½ feet - more than required by regulations. The question of "what if" regarding sinking due to a collision can logically be asked. It should be remembered that this vessel is a chemical tanker which happens, regarding this issue, to be carrying a waste. The question of sinking can be asked regarding any chemical tanker carrying a variety of cargoes, many of which are extremely hazardous. The loading and conveyance via barge

or ship of toxic or ecologically harmful cargo is a normal occurrence. The regulatory agencies have recently required vessels of this type to have double hulls for the very purpose of minimizing release of cargo due to an accident. In two years of operation, no problem has occurred with the VULCANUS. Quantification of the impact of cargo jettison or ship sinkage is not prudent because of the many assumptions required. We can make, however, some general statements. The acute toxicity of the normal butyl esters of Orange Herbicide ranges from 1-10 ppm, depending on the species of fish, pH and other factors. Generally, the normal butyl ester of 2,4,5-T has been found to be less toxic than the normal butyl ester of 2,4-D. The acid and salt forms are roughly 100 times <u>less toxic</u> than the normal butyl esters; thus, the rate of hydrolysis of the esters in Orange Herbicide is important in reducing the toxic effects. Toxicity also depends on how much Orange Herbicide is available for aquatic organisms via vigorous and continuous mixing. Laboratory studies indicate that, if Orange Herbicide were spilled in a body of water, it would sink to the bottom, depending on currents. If not greatly agitated, it would produce local effects in an area determined by the rate it would go into solution versus the rate of hydrolysis. Hydrolysis is expected to

be rapid in normally alkaline sea water.

Laboratory experiments with artificial sea water and Herbicide Orange in solution indicate that 99 percent of the normal butyl esters are hydrolyzed in 14 to 21 days in the absence of marine organisms. Using 2,4-D butyl esters in actual sea water with shrimp, plankton, and other normally occurring organisms, 99.9 percent hydrolysis will be complete in 50 hours. Data indicate that comparable results whould occur with Orange Herbicide.

Mr. Chairman, this concludes the opening statement that I wish to make at this time. We would like to present to you certain technical presentations dealing with the overall issue, and following these technical statements we will have a closing comment which will conclude our presentation.

MR. MOLLOY: Thank you, Dr. Welch.

The next Air Force speaker is Lieutenant Colonel Carlton R. Williams from the U.S.A.F. Environmental Health Laboratory, Kelly Air Force Base in Texas.

Colonel Williams.

LIEUTENANT COLONEL WILLIAMS: Mr. Chairman, ladies and gentlemen. My name is Lieutenant Colonel Carlton R. Williams. I am with the Environmental Health Laboratory at Kelly Air Force Base in San Antonio, Texas.

I have a Master of Science degree in engineering, and I am a candidate for the degree of Doctor of Philosophy at the University of Michigan.

My academic program includes mathematical modeling of national ecosystems, and also a study of incineration of solid wastes and of sewage sludges.

I have worked exclusively in the field of sanitory or environmental engineering since 1955, and I have been involved in the Orange disposal project for about two years.

I was the Air Force Team Chief on a test burn conducted at The Marquardt Company of Orange Herbicide in November of 1973. This is the largest, most extensive test incineration of Orange Herbicide which has occurred as yet.

I am a member of the Texas and the National Water Pollution Control Federation, the American Chemical Society, American Conference of Governmental Industrial Hygienists.

I am a registered professional engineer in the State of Texas.

I have a paper entitled The Incinerator Ship VULCANUS Incineration of Orange Herbicide. It includes an introduction, statement of the incineration situation, discussion of the information, and VULCANUS incineration of

Orange Herbicide, and other considerations.

You have the paper.

I. INTRODUCTION

The currently proposed action to incinerate the Orange Herbicide was initially described in the Revised Draft Environmental Statement (RDES) filed in May 1974. This statement received widespread public circulation which resulted in written comments directed to the Air Force on various facets of the disposal project. The EPA and the Marquardt Company were among the commentors, and were particularly concerned about the appropriateness of the incineration aspect of the project. All comments received on the RDES and the Air Force reply are contained in the Final Environmental Statement (FES) which was filed in December 1975. On 9 January 1975, the Air Force submitted an application for a special ocean dumping permit to the EPA, the FES was included as a part of the application. The EPA, in the 4 February 1975 edition of the Federal Register announced a "Notice of Receipt of Application and Meeting" pertaining to the above mentioned ocean dumping application and scheduled the meeting for 19 February in Washington, D.C. In the 24 March 1975 edition of the Federal Register the EPA announced a "Receipt of Application and Tentative Determination" regarding the ocean dumping

application. This notice included a "Summary of Application" and the "Tentative Determination" as regards the disposal project. The Summary of Application included:

1) a statement that written comments were forwarded to the EPA by the Marquardt Company, the National Wildlife Federation, and the United States Department of the Interior, and

2) a paragraph stating that the Marquardt Company has requested a public hearing on the application. The action by the Marquardt Company represents a total of three letters, one to the Air Force on the RDES, one to the EPA concerning the Final Environmental Statement and need for a public hearing and one to the Council of Environmental Quality requesting that a public hearing be held concerning the application. The latter two letters also requested that congnizant EPA engineers who monitored the test burn on board the VULCANUS (Shell Chemical Company project) present their findings. This action would also be most welcome by the Air Force. The National Wildlife Federation made a statement at the 19 February meeting and, as mentioned above, submitted written testimony. The National Wildlife Federation's stand on incineration of Orange Herbicide by the VULCANUS is considered favorable with certain qualifications and Marquardt's stand is

considered unfavorable. The 24 March Federal Register announcement reviewed the Orange disposal project status in a thorough manner. In addition to the letter of comment by the EPA to the Revised Draft Environmental Statement, the EPA also wrote the Air Force a letter concerning the Final Environmental Statement which, among other things, required that stack monitoring would be necessary to incinerate Orange aboard the VULCANUS.

Several commentors to the Revised Draft Environmental Statement expressed agreement with the proposed action of incineration at sea (Appendix O, Final Environmental Statement); however, in view of the situation surrounding incineration as described above, this paper has been prepared to describe the VULCANUS and substantiate the judgment that 99.9 percent Orange Destruction Efficiency can be attained. The Air Force position is comprehensively stated in the Final Environmental Statement, and the Revised Draft Environmental Statement and Final Environmental Statement have received wide distribution, therefore the Final Environmental Statement will be referenced extensively throughout this paper. Shell Chemical Company data and results from their test burn of chlorinated hydrocarbons aboard the VULCANUS in the Gulf of Mexico will also be utilized; this information was not available

in time to be incorporated into the Final Environmental Statement.

In addition, the Air Force has contracted with the firm of Arthur D. Little, Cambridge Massachusetts to perform an independent evaluation of the Air Force position on the incineration of Orange Herbicide by the VULCANUS.

II. STATEMENT OF INCINERATION SITUATION

The VULCANUS has not incinerated Orange Herbicide nor is there any data on the destruction of Orange Herbicide in a "conventional" incinerator. The Air Force has made a judgment that the VULCANUS can destroy Orange Herbicide at 99.9 percent efficiency. This judgment is based on a synthesis of the following information:

1) The results of thermal degradation and combustion of Orange Herbicide in various types/sizes of incinerative systems.

2) The results of combustion efficiency studies and ocean ecological studies from incineration of chlorinated hydrocarbon aboard incinerator ships, including the VULCANUS, and efficiency of a land-based incinerator at Rocky Mountain Arsenal Company utilized to incinerate mustard agent.

3) A comparison of the overall operational

capabilities of the VULCANUS incinerators with incineration system combustion parameters, which are known to effect essentially 100 percent destruction of Orange Herbicide.

It is the resultant judgment (99.9 percent efficiency) that is a prime factor in the concern expressed by the EPA, The Marquardt Company, and the National Wildlife Federation, and which has resulted in the EPA opting for a tentative position for a research permit instead of a special permit and scheduling of public hearings. It is significant to note that there has been relatively little concern for the environmental impact of the proposed action (99.9 percent destruction) in the comments to the Revised Draft Environmental Statement or at the 19 February 1975 meeting; in fact, the Air Force position is that the environmental impact would be minimal and deemed acceptable even if the Orange Destruction Efficiency were lowered to 99.0 percent (Part III.B.2. and III.C.5., Final Environmental Statement).

III. DISCUSSION OF INFORMATION

Thermal Degradation/Combustion of Orange Herbicide. Five studies on the thermal degradation/combustion of Orange Herbicide have been conducted and the objectives and conclusions of these studies are included as Appendix D to the Final Environmental Statement. Two

of these studies are of particular interest. The Mississippi State/U.S. Department of Agriculture report states that the normal butyl (n.b.) esters of 2,4-D and 2,4,5-T are combusted between 550 and 700° Centigrade and that 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) is completely combusted between 980 and 1000° Centigrade. The other is The Marquardt Company and Air Force study which was conducted in November of 1973; this study is included in its entirety as Appendix E to the Final Environmental Statement. This study reported the results of eight test burns with injection fuel temperature ranging from 66/63° Fahrenheit to 179/175° Fahrenheit. The relative pyrolysis efficiencies for the eight runs ranged from 99.98 percent in Run #2 which had a fuel input temperature of 98/96° Fahrenheit to 99.999 percent in several of the other burns (P.E(I-13), Final Environmental Statement). However, the Orange Destruction Efficiency, although not reported, was effectively 100 percent, i.e. no n.b. ester of 2,4-D, 2,4,5-T, or TCDD was detected in the combustion gas from any of the test runs. All of the studies in Appendix D show that undiluted Orange will sustain high temperature incineration.

Ship Combustion/Ecological Data. Appendix N of the Final Environmental Statement contains the

following studies relating to incinerator ships:

1) An extract from Professor (Dr.) Klaus Grasshoff, Kiel University, Germany, Report on Possible Effects of Burning of Chlorinated Hydrocarbons at Sea.

2) Data from the incinerator ships MATTHIAS conducted by the Bayer Corporation, Germany on "Burning of Chlorine Containing Liquid," Investigations of the Combustion Gases: 26 August 1971."

3) An ecological study conducted by the Center of Biological Studies and Research and of Oceanographic Medicine, France, on the "Effect on the Marine Environment of the Combustion at Sea of Some Industrial Wastes."

4) A French government document on "Incineration on the High Seas of Chlorinated Industrial Wastes."

5) Testimony presented by a representative of the National Research Council of the Netherlands on incineration of chlorinated hydrocarbons by the VULCANUS; this testimony was presented in the public hearing 4 October 1974 on the Shell Chemical Company's Application for Ocean Incineration. All of these documents are favorable for ocean incineration as regards combustion efficiency and ecological effects.

Documents 1, 2 and 3 listed above apply to the incinerator ships MATTHIAS, document 4 applies to the MATTHIAS I and II and the VULCANUS, and document 5 applies to the VULCANUS. The documents in paragraph 2 and 5 state measured combustion efficiencies greater than 99.9 percent. The document in paragraph 1 quotes Dr. Grasshoff as stating that "if burning of chlorinated hydrocarbons is carried out at temperatures higher than 1000° Centigrade, more than 99.9 percent of the materials are completely burnt." The document in paragraph 3 gives a favorable report on ecological impact upon the ocean environment. The document listed in paragraph 4 is favorable toward the VULCANUS, stating that it achieves essentially complete pyrolysis, but is unfavorable, in part, to the combustion in the MATTHIAS II and relates its unfavorable remarks to the MATTHIAS' inability to maintain a uniform temperature of 1000° to 1100° Centigrade. As stated above, the documents are contained in total in Appendix N and are also referred to frequently throughout the narrative of the Final Environmental Statement.

Land-Based Incinerator Data. Part V.B. of the Final Environmental Statement describes the conventional incinerator system at Rocky Mountain Arsenal which destroys mustard agent at a calculated destruction efficiency of

99.9887 percent. This is presented to further establish that conventional high temperature incinerators are capable of essentially complete destruction of waste combustibles.

Shell Chemical Company - VULCANUS. Since the filing of the Final Environmental Statement, the Shell Chemical Company has incinerated four shiploads of chlorinated hydrocarbon waste by the VULCANUS at a designated burn area in the Gulf of Mexico approximately 160 miles from Galveston, Texas. The first two shiploads were accomplished under a research permit which required, among other things, that Shell demonstrate by stack sampling the VULCANUS, a combustion efficiency of at least 99.9 percent. The data from the first burn was presented at a public hearing on 14 November 1974 in Houston, Texas, at which the EPA and Shell gave testimony that the combustion efficiency was greater than 99.9 percent. These figures were disputed somewhat at the hearing but were upheld by the EPA and Shell. The objections, however, were valid enough for the EPA to require stack monitoring on the second Shell burn. This Laboratory, EHL(K), has not received the data from the second Shell burn but has been assured that the combustion efficiency was greater than 99.9 percent; Shell was not required to perform stack sampling on the incineration of the remaining two (shipload) burns of the

Shell waste.

I understand that this report is finalized and that the data is in now.

Data presented at the 14 November hearing also indicated that temperatures of 1400° Centigrade were achieved in the incinerator fire box and that the hydrogen chloride gas exhaust did not significantly affect the pH of the water in the burn area nor could any adverse biological factors be attributed to the first burn.

The BTU rating of the Shell waste ranged from 6200-6400 BTU/pound. Herbicide Orange has a BTU rating of 10,000 BTU/pound; therefore, it is expected that high temperatures can be achieved by incinerating Orange in the VULCANUS' incinerators. In addition, since the Shell burns were generally at the maximum fuel flow rate, and the chlorine content of the Shell waste was about 65 percent compared to 30 percent for the Orange, it appears that the environmental aspects of generation of hydrogen chloride can be discounted for ocean incineration.

The favorable outcome of the Shell project is very encouraging toward predicting the capability of the VULCANUS to adequately incinerate Orange Herbicide.

The VULCANUS Vessel. The VULCANUS is described in the Final Environmental Statement and in the

transcript of the public hearing of the Shell Chemical Company's Application for Ocean Combustion. For those not familiar with the vessel, it has a length of 334' 6", breadth 45' 11" and a maximum draft of 24' 5". It has 15 waste tanks ranging in size from 115 to 574 cubic meters and carries a maximum load of 4,200 metric tons. The waste is pumped from the tanks to either of two high quality incinerators mounted on the aft of the vessel. The maximum waste fuel incineration capacity is 12.5 metric tons per hour per incinerator and the maximum air flow is 90,000 cubic meters per hour per incinerator. The waste must be liquid and pumpable; it may contain solid substances in pieces up to 5 cm in size which are subsequently minced into about 2 mm pieces prior to injection into the incinerator firebox. Each incinerator has a maximum inside diameter (firebrick to firebrick) of 4.80 meters, a total height including stack of 10.45 meters, and the volume of each is calculated to be 87.9 cubic meters. Each incinerator chamber has three rotating cup injectors manufactured by the Saacke Company, Bremen, Germany, to provide atomization and turbulence. Rotating cup injectors are excellent systems which are widely used in the incineration industry. Ross describes the rotary cup injector and states that liquids should have a viscosity of less than 750 SSU

(130 centistokes) for satisfactory atomization (Part V.B., Final Environmental Statement). The specification on the SKV Saacke burner states that the temperature of the fuel flow should be as low as possible to prevent fouling of the rotary atomizer cup; however, it should be high enough so that the fuel arrives at the burner at a viscosity of not more than about 5-8 degrees engler (38-60 centistokes). Regarding operation of the incinerators, auxiliary fuel is used to bring the incinerators up to the temperature required for the waste and then the waste is admitted to the incinerator.

The Shell Chemical Company's Application for Ocean Incineration contains a letter from the Department of Transportation, U.S. Coast Guard to the Ocean Combustion Services BV Rotterdam, The Netherland, 16 September 1974, stating that authorized cargos to be handled in U.S. ports are Herbicide Orange and chlorinated hydrocarbons. The Shell Chemical Company had nothing to do with the inclusion of Orange Herbicide in this letter; this was an independent action taken by Ocean Combustion Service.

IV. VULCANUS INCINERATION OF ORANGE HERBICIDE

In January 1974, a description of the Orange Herbicide, including its viscosity, was furnished the agent of Ocean Combustion Engineering and the Air Force was

subsequently advised by the agent that the VULCANUS was capable of incinerating the Orange; this position was verified via telecon with the agent on 14 April 1975. The VULCANUS does not have provisions for heating of the waste fuel tanks; therefore, the viscosity of the waste fuel will be dependent upon its temperature aboard the VULCANUS. The winter and summer temperature of the ocean water is $80^{\circ} \pm 3^{\circ}$ Fahrenheit and the temperature of the incinerator control room is often in excess of 100° Fahrenheit. The temperature of the Orange in the VULCANUS tanks when in the burn area cannot be predicted at this time; however, personal communication has revealed that the temperature in the storage area would be at least 80° Fahrenheit and quite possibly higher. Since the viscosity of Orange Herbicide is 26-30 centistokes at 80° Fahrenheit and decreases fairly rapidly as the temperature increases, it is expected that the rotary cup injector mentioned above can satisfactorily atomize and inject the Orange into the firebox.

In February 1974, two representatives of the Air Force visited the Ocean Combustion Services BV Rotterdam and inspected the VULCANUS. Discussion with Ocean Combustion Services personnel and the Air Force representative concluded with the judgment that the VULCANUS was capable of high temperature incineration of Orange.

With a feed rate of 12 metric tons per hour and an air flow rate of 90,000 cubic meters per hour, the dwell time, fuel to air ratio, and excess air are, as calculated by the EHLs, approximately 0.6 seconds, 0.11, and 30 percent, respectively. With a BTU content of 10,000 units per pound, it is expected that the 1400° Centigrade temperature can be maintained. These parameters are equal to or in excess of those which the Air Force considers acceptable parameters (Part II.C., Final Environmental Statement), and as quoted from the Final Environmental Statement ". . . acceptable parameters: measured combustion temperatures 2400-2800°F; dwell time equal to or greater than 0.14 seconds; a fuel to air mass ratio of approximately 0.1; and excess air greater than 30%." It is noted that the above sentence says acceptable parameters, not the Marquardt Company parameters, although it is readily admitted that the acceptable parameters are based primarily on the Marquardt-Air Force test burn conducted in November 1973. However, as stated in Part II.C. of the Final Environmental Statement, one of the main purposes of the above-mentioned test study was to obtain data on Orange incineration so that the requirements of any incinerator system designated for Orange incineration could be specified.

In view of the information presented in this paper: studies indicating that Orange Herbicide sustains high temperature combustion, studies showing that the incinerator ship can incinerate liquid waste at a very high efficiency with minimal environmental impact, and a data analysis that the VULCANUS can incinerate Orange at conditions which are deemed acceptable for destruction of Orange--it is the Air Force position that the VULCANUS can destruct the Orange Herbicide with a 99.9 percent destruction efficiency.

V. OTHER CONSIDERATIONS

Although not germane to the 99.9 percent destruction prediction, some perspectives seem appropriate:

1) Three shiploads (2.3 million gallons) is a relatively small volume of waste; it is recognized that the TCDD content should warrant consideration; however, the project is not like gearing-up to handle waste from a chemical manufacturing process which will generate wastes for discharge into the environment for many years.

2) The Orange is now stored on Johnston Island and Gulfport, Mississippi, two locations where weather conditions can become adverse to the extent that a catastrophic event could occur causing serious environmental problems. In addition, maintenance of the storage

areas to preclude any release of Orange into the environment is a continuing cost to the taxpayer.

3) The proposed action represents a "high efficiency" waste disposal action with the resultant discharge stream being emitted into a relatively unproductive/unpopulated ecosystem. While the appropriateness of such action can be discussed, it certainly should be agreed that waste streams from treatment processes should be discharged where they would do the least harm to the environment. Once such environment is the designated burn area, another good environment for discharge would be one that is already so polluted that the waste stream couldn't possibly have any further deleterious effect. However, as noted in Part V.B.3, incineration within the United States is not considered a viable alternative.

Finally, as mentioned in the introduction, the consulting firm of Arthur D. Little, Cambridge, Massachusetts has been contracted to evaluate the Air Force position as regards the proposed action; specifically, their contract was to evaluate the capability of the VULCANUS to incinerate Orange Herbicide with particular emphasis upon the probability of attaining a 99.9 percent destruction of the Orange. Their report will be submitted at this public hearing and discussed by the next speaker.

That concludes my report, Mr. Chairman.

MR. MOLLOY: Colonel Williams, before we open it up to questions from the Panel, if there are any, I would like to divert from the schedule a little bit. There are two people that indicate that they have severe time problems, so if I can just ask you to step aside for a minute or two, I would like to call both of these forward.

The first speaker who has indicated that he has a time problem is Richard Marland, who is the Director of the Office of Environmental Quality Control, State of Hawaii. Dr. Marland represents the Governor here today.

Dr. Marland, I apologize. I didn't realize that you had a time delay, a time problem.

DR. MARLAND: Thank you very much, Mr. Chairman.

I am not surprised you were not aware that we had a time problem because we didn't tell you that we had a time problem until after the presentation of the Air Force had started. We underestimated the length of time that their presentation would take.

I am Richard Marland, Director of the Office of Environmental Quality Control for the State of Hawaii.

Governor Ariyoshi has asked me to express

to you his aloha, but most particularly, to express to you his gratitude for the consideration you have shown in holding this hearing here in Honolulu today. Hawaii is indeed extremely interested in the proposal by the United States Air Force, and we are grateful to you for holding this where the people from Hawaii can present you with their views.

My own testimony relates to the Environmental Impact Statement for the disposition of Orange Herbicide by incineration prepared by the Department of the Air Force. The statement is a comprehensive, informative document that presented well-researched alternative procedures for incineration of Orange Herbicide.

Our major concerns within that Environmental Impact Statement were previously presented in our July 9, 1974 letter to the Department of the Air Force. The inclusions in this letter have been referred to by one of the Air Force officials.

Of the two options presented in the EIS, we favor incineration at sea through the use of a scrubber system with constant monitoring of air emissions for the entire process of incineration.

However, the alternative of recycling and reuse of this material does present favorable advantages.

We recommend more effort be directed toward recycling of the Orange Herbicide. In the low-key understatement process of bureaucratic writing, that could be construed as saying we are dissatisfied with the presentation of this potential in the Environmental Impact Statement, and think that it justifies far greater attention and possibly considerations as to the procedure for disposition.

This project is of great interest to the people of Hawaii. However, we deplore the fact that the Air Force provided only a limited number of copies of the Environmental Impact Statement for our review. Namely, eight copies were provided, even though we requested more. This has hindered widespread review within the State of Hawaii, probably resulting in a less comprehensive review than is warranted or desirable.

I thank you for your attention and this opportunity to supply you with our wishes.

Again, I welcome you to Hawaii, and aloha.

MR. MOLLOY: Thank you.

I would just like to indicate our pleasure at the people of Hawaii for allowing us to use this marvelous room here today.

Thank you.

The next speaker with a time problem is Tony

Hodges, who represents Life of the Land.

MR. TONY HODGES: I will try to make my remarks short and to the point, and I appreciate being fit in with the schedule. I don't like interrupting the Air Force, but it seemed like it was going to take forever.

I think it's good that you are holding a hearing in Honolulu, but I think that where you should be holding the hearing is in Micronesia, because those are the people who are downwind of this proposal, or they are the ones that will be downwind of any exhaust gases, and the whole issue seems to separate into those who live upwind and those who live downwind.

For instance, I am surprised, or I would wonder if the Air Force would propose the same disposal system if it were in fact 1200 miles upwind of the continental United States? For instance, burning it in the Atlantic with a wind moving to the west toward the eastern seaboard. I believe that the Air Force would probably not propose this disposal method of burning.

We have been told, and I have been going through the Impact Statement, and I am sure that no one sitting at the Air Force desk today is about to contradict the official Air Force position of preferring ocean burning, but we are told by the Air Force, in absolutely enormous

and I think repetitive and perhaps superfluous detail, how safe this is going to be. Well, if it's going to be so damned safe, why are you putting it out in the middle of the ocean? And if it's going to be so safe, the effluent or the gases from this incinerator ship, then why isn't it done close to a major population center? Why isn't it done close to a major agricultural center in the continental United States?

I believe that the Trust Territories, or I should say the people of the Trust Territories, would be strongly opposed to the burning of Agent Orange in any location that would be upwind of them.

The statement by the Air Force that there are 1200 miles between Johnston Island and the next island mass would be of great concern if that next land mass would be New York City. In fact, aerosols are known to be carried four -- I should say three and four thousand miles, and there was a study done on this, the carrying of pesticide aerosols, done at the University of California, Davis, and in that experiment they found that airborne pesticides, residue of it was found as far away as four thousand miles downwind.

I think that this country -- I mean the United States -- has for far too long a time played God to

the South Pacific. I think that we have far too long a time used the people of the South Pacific as guinea pigs and placed them downwind of our experiments. This is an experiment.

We obviously used it in a much stronger fashion in Vietnam itself as a defoliant, but it seems to me very, very wrong. And speaking I think morally and politically as much as environmentally, that we should -- that we would have the audacity to propose burning this upwind of the Marshall Islands and the Gilberts. There are people who live there, and there is no proof that the Air Force can offer that they will not be affected.

The hearing today, and I wasn't at the other one, seems like a bureaucratic exercise, again, with the Air Force presenting, you know, the weight of the evidence, five hundred pages of an Environmental Impact Statement, which is obviously to justify what they intend to do, anyway, and what they are trying to get EPA to do.

The State of Hawaii I think made a very good suggestion, and that is, instead of burning perhaps you should look seriously at the proposals by private industry to break the Agent Orange back down into some of the constituent parts, remove the dioxin and the other problems.

The Air Force dismisses, and simply dismisses,

the possibility of the ship sinking. That is, the incinerator ship. They say it has a double hull. Well, double hull ships go down, and this could very possibly happen out there. There is no provision for dealing with the Agent Orange if the incinerator ship should begin going down. I have seen nothing in the Impact Statement -- I haven't read it in detail -- about what the Air Force would propose to do if the incinerator ship began to go down. How would they transfer the material?

I would propose, and I say this, and it may sound facetious, but it's really quite serious. I think it brings home a point. If the Air Force feels that your proposal is so safe for everybody concerned, then I would suggest the location for the incineration would be in the courtyard of the inner ring of the Pentagon. You would then be able to monitor the possible adverse effects by the effect it had on Air Force personnel as you go from the inner ring outward. If you are so sure it's safe, then you would be willing to do it there.

If you are not willing to do it in the inner courtyard of the Pentagon -- I am assuming now that the Navy is not in the inner ring -- but if you aren't willing to do it there, then you shouldn't do it in the Pacific in an area that's upwind of people in the Trust Territories

who were not part of the Vietnam war and who are not accorded real U.S. citizenship and rights of U.S. citizens, and who had nothing to do with this at all. I don't think they should have to take one iota of risk, and I think that the Environmental Protection Agency has a very strong duty to see that the Air Force does not present one iota of risk to the people of Micronesia. And until the Air Force can convince you one hundred percent, not 99.9 percent, but 100 percent that there is no possible danger to any person or any living thing in Micronesia as a result of this project, then the Environmental Protection Agency has a duty to the people of Micronesia who are trying to become part of this country -- some of them are, certainly, under a U.S. trusteeship. You have a duty to refuse this and to make them go back and recycle it.

I admit that what I have to say does not deal with technical details, but I think it deals with what is the real issue, and that is, who is downwind of this project?

That's all I have to say.

MR. MOLLOY: Thank you, Mr. Hodges.

Given the fact that we have this material, we are stuck with it, and possibly suggesting that burning it in the inner ring of the Pentagon might be considered

facetious, but do you have any other alternatives? There will be comments later on.

MR. HODGES: Sure. There are other -- I think it should be burned in Washington, D.C., if not in the Pentagon, and I am quite serious. I think that brings the point home. If there are any risks, the people that should have to suffer the risks are the people who manufactured this material and people who used it on people in Vietnam. They should have to take the risk, not people who live in Micronesia.

For instance, there would be more people at the hearing here, I can assure you, if this Agent Orange were proposed for burning 1200 miles upwind of Hawaii. People would be here in droves, I would assure you. And I think that if you have hearings about this in Micronesia on each of the islands, or made travel arrangements for people from each of the islands in the Trust Territories to come here, that you would have a lot of testimony saying, no, we don't want to be upwind of your experiments.

And that's the real central fact, is, who is upwind and who is downwind? And they would want to be downwind, I should say, right, where they could be protected.

Where would I propose doing it? I say if you are going to burn it, and it seems to me from looking

through this, there seems to be a lack of discussion of the possibility of, you know, recycling it, breaking it back down to its constituent parts. I understand the Air Force has several proposals to do that. I think EPA has an obligation just to tell them, you know, sit tight and let's see how it is you are going to get rid of it, but not burn it. If you are going to burn it, I think the only people that should have to run the risk are people who manufactured it, and certainly Americans. And I would then come in and say, we don't want to suffer that risk, and I can't see how we can give to the Micronesians -- and there is a representative of them here today -- how we can hand this risk to them. They had nothing to do with it.

So the one thing that is absolutely unacceptable to the United States, as far as I'm concerned as a citizen of the United States, is allowing there to be any risk whatsoever to anybody, you know, who is not an American, period.

MR. MOLLOY: Are there any questions or comments from the Panel?

DR. MacKENZIE: I would just like to say very quickly, Mr. Hodges, that I will be presenting a statement later on during the course of this hearing which will deal very specifically with our considerations of the

reprocessing, if you will, recycling options. That will become part of the record of this hearing and considered by the Environmental Protection Agency.

MR. HODGES: Surely, okay. And I think, too, it would seem to me, I am not sure what legal recourse the people of Micronesia have since they have not been allowed rights in the United States Federal Courts to challenge actions of federal agencies in Micronesia in the Trust Territories, it would seem to me then that the only option open to the Micronesians would be to go to the United Nations and to have the United States, as the Trustee of that area, forbidden to act in this way toward the Trust Territories. I consider it a hostile act toward Micronesia.

99.9 percent, I'm sure the Colonel here would not like to sit downwind of that stack.

When they talk about the -- what is it, .4 grams or micrograms per acre, and they say this is less than we put on U.S. soil, well, this is not U.S. soil. These are international waters.

He is also assuming, obviously, perfect mixing. We all know there is no such thing as perfect mixing, and those are phony figures when you add them up like that. You could have a catastrophe.

If you lose one life in Micronesia, you know,

this project is murderous. If you make one person sick in Micronesia, it's wrong. In fact, if you even make them live with the psychological risk, knowing that this is going to be done and they are worried, you have hurt them, and I think that we have no right to do it. It's really that simple. It's a moral question.

MR. MOLLOY: Thank you, Mr. Hodges.

MR. HODGES: Surely.

MR. MOLLOY: Are there any questions from the Panel to Colonel Williams?

MR. BIGLANE: Yes, I have one for the Colonel.

I was reading the statement in the last paragraph. I refer to the conclusion that is drawn by you.

"It is the resultant judgment (99.9 percent efficiency) that is a prime factor in the concern expressed by the EPA, The Marquardt Company, and the National Wildlife Federation, and which has resulted in the EPA opting for a tentative position for a research permit instead of a special permit and scheduling of public hearings."

Let me say that in speaking for EPA, that I suspect we will recommend research permits be given on several future incinerations of wastes. This is a new technology. As I stated at the outset, we want to learn

from these burns. We want to learn just how acceptable to the ocean incineration will be.

In learning, I do not mean to infer at the expense of humans or of marine life and other participants in our environment, and along with these remarks, let me assure you that whatever EPA will recommend, and in the monitoring following such burns, will not be cosmetic.

Such conditions that EPA might place on a permit for incineration will be real, and there will be a great deal of thought. There already has been a great deal of thought given to the types of monitoring requirements that EPA might incorporate into a permit just for the protection of people downwind, upwind, anywhere. Because if this is going to become a technology available to this country for disposal of highly toxic wastes, then be assured whatever we do in requiring monitoring programs will be addressed to just that concern.

I really didn't have a question. I just wanted to get that on the record for clarification of this conclusion. That's all.

COLONEL WILLIAMS: Right.

I understand that in the broad sense of the new technology and emerging technology of getting data, is that -- I understand you are telling me that.

This comment was specific in the fact that we submitted a request for a special permit which does not require monitoring, and we had wondered or looked for reasons why it is a research permit, and we felt that your concern, as I said, expressed by EPA, and which you I think have just voiced as to our position and the other people's position, was that perhaps we wouldn't get it 99.9 percent.

I don't see any discontinuity between what you have said and what I have in my statement.

MR. BIGLANE: I just want to clarify that we would schedule a public hearing in any event, whether it had been a special permit or research permit. And I want to assure that we will probably issue research permits for the next several types of incineration of wastes, not just Herbicide Orange, but any other wastes that might be proposed to be incinerated at sea that is different from Herbicide Orange if we do go through that exercise and it is successful, and that waste is different from the Shell organic chlorine waste which was incinerated in the Gulf of Mexico last October.

In any type of waste we will most probably recommend the issuance of a research permit and schedule a public hearing in that matter.

MR. MOLLOY: Are there any other questions

or comments?

(There was no response.)

MR. MOLLOY: Thank you, Colonel.

LIEUTENANT COLONEL WILLIAMS: Thank you, Mr. Chairman.

MR. MOLLOY: Before we bring on the next speaker, I said we would take a break at eleven o'clock. It's ten minutes after, so we will reconvene at twenty-five minutes after eleven.

(A fifteen-minute recess was taken at this time.)

MR. MOLLOY: We can begin again, please.

We will modify the schedule a little bit, and I would like to call on Mr. Demei Otobed.

MR. DEMEI OTOBED: My name is Demei Otobed. I am representing the Trust Territory Environmental Protection Board, and at the same time the Trust Territory Government. I am the Chief Etymologist for the Trust Territory.

The Trust Territory Environmental Protection Board held its meeting in Honolulu this month and came up with a short resolution. We cannot give you a 500-page study report, so we give you only a half-page that contains our concern regarding the burning of this Herbicide Orange

in the Pacific area, and I will read it. It's very short.

The Trust Territory Environmental Protection Board, in a meeting in Honolulu, Hawaii, on April 21, 1975 unanimously resolved that:

1) The Air Force has proposed that the Herbicide Orange be brought to the Pacific Area for disposal by burning;

2) Burning of Herbicide Orange in the Pacific Area may expose the islands and the people of the Trust Territory to dangerous health hazard and environmental contamination the extent of which cannot be determined;

3) The Trust Territory Environmental Protection Board unanimously resolved that alternative methods should be sought and used which methods will not be an environmental hazard to the environment of the Trust Territory;

4) That Mr. Demei Otobed be and he is authorized by the Trust Territory Environmental Protection Board to attend the public hearing as the representative of the Board indicated and to present there the thinking of the Board as by this resolution.

Thank you very much.

MR. MOLLOY: Are there questions from the

Panel?

(There was no response.)

MR. MOLLOY: Mr. Otobed, I would like to thank you for coming all the way from the islands to Hawaii to present the views of your government on this Air Force proposal. Thank you.

DR. WELCH: Mr. Molloy, before we proceed could I make one clarifying comment?

MR. MOLLOY: Sure.

DR. WELCH: We have considered that the proposed incineration site be west of Johnston Island primarily from the point of view that approximately 1.5 million pounds of product is stored on that island at this point in time, and that had this storage site not existed, other burn sites might well have been selected. We are not lightly considering this particular site.

MR. MOLLOY: Are you saying that you are now considering other sites?

DR. WELCH: I am not saying that at all. There was some concern that was expressed by a few previous speakers that we were bringing the material to the Pacific for the aspect of the burning, and all I am pointing out is that the material currently is stored on Johnston Island, and the burn site really is adjacent to its current storage

site.

MR. MOLLOY: And have you considered other burn sites other than Johnston Island, even considering the fact that the material is now stored at Johnston Island?

DR. WELCH: We have not.

MR. TONY HODGES: Mr. Chairman, to add one thing to it, I believe that they are proposing to bring .8 million -- you know, whatever -- from Mississippi to the burn site. Isn't that right? They are proposing transporting it thousands of miles through the Panama Canal across the Pacific, this Agent Orange to the Johnston Island burn area.

MR. MOLLOY: I believe that is correct.

MR. HODGES: So he is talking about what is on Johnston Island, but again there is almost an equal amount not on Johnston Island, some five or six thousand miles away.

DR. WELCH: That almost equal amount is about 700,000 gallons.

MR. MOLLOY: Well, we can move on to the next speaker, who is Dr. Karl Bastress from the Arthur D. Little Corporation, Cambridge, Massachusetts.

DR. BASTRESS: Mr. Chairman, ladies and gentlemen,

My name is E. Karl Bastress. I am a member of the professional staff of Arthur D. Little, Incorporated, a research and consulting firm, with headquarters in Cambridge, Massachusetts.

My education includes a Ph.D. degree in aeronautical engineering from Princeton University, and I have had approximately twenty years of experience in the design and performance analysis of combustion systems. For the past seven years my work has been devoted primarily to the analysis of combustion behavior and pollutant formation in liquid fuel combustion equipment.

My colleagues at Arthur D. Little and I have reviewed the action proposed by the Air Force to use the incinerator ship VULCANUS to dispose of the Herbicide Orange.

The purpose of our review was to provide an independent assessment of the capability of the VULCANUS to incinerate the herbicide and to achieve a 99.9 percent target destruction efficiency.

Our assessment of the proposed action included three tasks:

One, a review of relevant data.

Two, an assessment of the suitability of the VULCANUS for incineration of the Herbicide Orange, and,

Three, a quantitative prediction of the destruction efficiency of the herbicide and its TCDD contaminant.

Data which are relevant to the proposed action are of three types:

1. Data on destruction efficiencies of chlorinated hydrocarbons by the VULCANUS.

2. Data on incineration of the Herbicide Orange by other incinerators, and

3. Data on hydrocarbon destruction by other combustion systems similar to the VULCANUS incinerators, and burning fuels similar to Herbicide Orange.

In reviewing these data our first observation is that destruction efficiencies exceeding 99.9 percent are achieved routinely in many types of combustion equipment burning liquid fuel, thus achieving a target level of 99.9 percent does not require an advance in the state of combustion system technology.

Our second observation is that a number of different definitions of destruction efficiency are in use. Of these definitions we have chosen the most conservative as a basis for assessing VULCANUS' performance with Herbicide Orange. This basis includes two destruction efficiency criteria; one, the destruction of all hydrocarbons,

including the major constituents of the herbicide, and two, the destruction of the minor constituent, TCDD.

With regard to the suitability of the VULCANUS for incineration of Herbicide Orange, we reviewed the potential problem areas of corrosion, suspended solvents and viscosity, and found no factors which would hinder the storage and handling of the herbicide by the VULCANUS.

We also reviewed the conditions required to destroy Herbicide Orange, and the operating conditions of the VULCANUS incinerators, and concluded that the VULCANUS is capable of destroying the herbicide.

To provide a measure of confidence in the Air Force prediction of 99.9 percent destruction efficiencies, we conducted a theoretical analysis of the combustion of Herbicide Orange by the VULCANUS. Our analysis involved a mathematical model of droplet formation and evaporation, and combustion gas mixing, which are the principal mechanisms which limit the efficiency of destruction or combustion of liquid fuels.

Using this model, we have predicted that the VULCANUS will achieve a total hydrocarbon destruction efficiency of 99.92 percent. This level of hydrocarbon destruction efficiency will assure equivalent destruction

efficiencies for the major herbicide constituents 2,4-D and 2,4,5-T.

Consideration of the uncertainties in the analysis which led to this prediction allow us to express the result in terms of probability of achieving specified levels of efficiency. Stated in these terms, we concluded that the probability of the VULCANUS achieving the target level of 99.9 percent hydrocarbon destruction efficiency with Herbicide Orange is 70 percent. The probability of achieving 99.7 percent efficiency is 90 percent, and the probability of achieving a 99.5 percent efficiency is 97 percent.

The complication of these results is that we are not 100 percent certain of achieving the target efficiency level, but we are quite confident of either exceeding this level or coming very close to it.

With regard to the TCDD destruction, nominally we expect to achieve a destruction efficiency equal to that achieved for other hydrocarbons. There are certain physical and chemical properties of TCDD which may tend to reduce its destruction efficiency, however, we do not have accurate data on these properties, and therefore cannot predict their effects with any degree of confidence.

We have developed a worst case or lower bound

estimate of 96 percent destruction efficiency for TCDD, but we expect that the level actually achieved will be near the target level of 99.9 percent.

Finally, we have identified three possible methods of increasing destruction efficiencies if the target level is not achieved during the first burn. These methods are:

1. Heating the herbicide prior to burning.

2. Diluting the herbicide with a low viscosity fuel oil, and

3. Reducing the herbicide and air feed rates to the incinerators.

Of these methods the third appears to be the most feasible.

We conclude that the proposed action is sound in that the VULCANUS is a suitable facility for incineration for Herbicide Orange. Destruction efficiencies achieved by the VULCANUS will be high, and probably will meet or exceed the 99.9 percent target level.

If this level is not achieved, any of a number of simple remedial actions can be taken to raise the destruction efficiencies to the target level.

Mr. Chairman, I have copies here of our report to the Air Force on this study which I can leave

with you if you like. I must admit to there being a number of typographical errors in the appendices to the report, so that if any of you wish to pursue the mathematical analysis which we conducted, I would suggest that you contact me for correction of these errors before you do so.

Thank you.

MR. MOLLOY: Thank you. We will put a copy of that report in the record.

I have a question.

You indicated that there were three alternative ways to increase the probability of having the 99.9 percent efficiency reached, and you said that the last one was the better of the three alternatives. Is there any reason why you couldn't technically combine the alternatives?

DR. BASTRESS: Mr. Chairman, I indicated three possible approaches, all of which would require some modification of the VULCANUS. I indicated the third as being the most feasible, not the best, because it perhaps could be done with the least extensive modification of the VULCANUS.

The VULCANUS is not, except for the alternative of mixing a low-viscosity fuel with the herbicide, the VULCANUS is not prepared at the present time

to utilize any of these approaches. It would require some modification to the ship, but we don't regard those modifications as infeasible. But nevertheless, the ship is not prepared to carry them out at the present time.

MR. MOLLOY: Do you have any idea of the cost of those modifications?

DR. BASTRESS: No, I do not.

MR. MOLLOY: I have no further questions.

Are there any other questions from the Panel?

DR. ENOS: I have a question.

MR. MOLLOY: Dr. Enos.

DR. ENOS: Did you make any calculation of the residence time in the incinerator?

DR. BASTRESS: Yes. We agree with the Air Force calculation of total residence time in the incinerator of 0.6 seconds. That is divided between a residence time in the main incinerator or chamber, where most of the mixing and incineration takes place, which has a residence time of approximately 0.4 seconds, and the remainder, 0.2 seconds is spent in the stack, which might be regarded as an afterburner. And, as I say, the residence time there is 0.2 seconds.

DR. ENOS: Thank you.

MR. MOLLOY: Thank you. There are no further questions.

The next Air Force speaker is Lieutenant Colonel Gale Taylor from the United States Air Force Environmental Health Laboratory, Kelly Air Force Base, Texas.

Colonel Taylor.

LIEUTENANT COLONEL TAYLOR: Thank you, Mr. Chairman.

Ladies and gentlemen, I am Lieutenant Colonel Gale D. Taylor. I am the Chief of the Veterinary Ecology/ Toxicology Division at the Environmental Health Laboratory at Kelly Air Force Base, San Antonio, Texas.

I have a Doctor of Veterinary Medicine from the University of Illinois. I have a Master of Science in Research Animal Medicine from Texas A&M University. I have a Master of Public Health from the University of Minnesota, and a Ph.D in Environmental Health from the University of Minnesota.

My main area of research has been devoted to toxicology, primarily environmental toxicology and environmental contaminants. I have been involved in this area since 1963, and have worked with both atmospheric and water contamination.

The title of my paper is, Description of the Proposed Ocean Dumping Site for Herbicide Orange, and there are a few typos.

Using presently available knowledge of ocean characteristics and ecosystems, it is possible to develop criteria for acceptable ocean disposal sites and examine specific locations to determine their suitability for this use. This presentation lists site criteria and describes the area designated for incineration of Herbicide Orange.

Pequegnat, in his testimony to EPA concerning the ocean dumping of incineration waste in the Gulf of Mexico, stated that the general advantages of offshelf disposal of industrial wastes are: (1) the presence of great volumes of water, (2) relatively simple water and air currents, (3) little stratification of the water column, and (4) relatively little productivity in the area. The area chosen for disposal should possess all these characteristics. This position statement will show that the area designated for the disposal of incinerated Herbicide Orange is acceptable in all aspects.

THE OCEAN ENVIRONMENT

A. General

The open ocean, particularly at the middle

latitudes, provides the best medium for the disposal of incinerated organic waste. It is one of the least productive areas of the world. It has the capacity to absorb, without deleterious effects, large amounts of degradable and inorganic wastes. What small effect occurs at the time of incineration is transient due to internal recovery of the ecosystem of the particular area and by immigration from adjacent areas.

Not all marine environments are unproductive. Estuarine and inshore waters, unlike the open ocean, are quite productive. These ecosystems may double the total production (in biomass) of terrestrial agriculture under irrigation and produce up to 30 times more per unit than the open ocean such as the proposed disposal site. Estuaries and inshore waters have the attributes of lower salinity and higher nutrients due to the inflow of fresh water and also have the advantage of shallower depths.

Disposal of materials far from land produces the least environmental impact simply because it is being put immediately into an unproductive ecosystem where it can be diluted and degraded. When materials are disposed of on land, eventually they may move through the hydrologic system to rivers, estuaries, and inshore waters where severe environmental impact may be exerted before

degradation can take place. Also bioaccumulation of toxic or hazardous materials could occur with still further adverse implications.

With the exception of a total recycling system, incineration in the unproductive open ocean is the most environmentally safe alternative of waste disposal known.

B. Ocean Food Chains

The primary producers are photosynthetic plankton. These organisms assimilate inorganic materials into organic matter. They consist mostly of microscopic diatoms and dinoflagellates although in some areas green and brown algae may predominate. These organisms are found in the euphotic zone, which in some instances may extend down to 200 or 300 meters, but the bulk of the production is in the upper 100 meters.

Crustaceans and protozoa graze upon the phytoplankton, and they in turn are fed upon by carnivores such as fish. The food chain for carnivores is a long, complex and intermingled web.

Below the euphotic zone nearly all the pelagic animals are predators. The benthic organisms are scavengers or decomposers feeding on detritus falling from the zones above them.

DESCRIPTION OF PROPOSED DISPOSAL SITE

Its Location:

The disposal site is located between 15° 45' to 17° 45' N latitude and 171° 30' to 172° 30' W longitude. It comprises approximately 9117 square miles, which, by the way, is about the size of the State of Vermont. The reported mean depth is between 4937 and 5486 meters with a minimum depth of 3575 meters and a maximum of 5568 meters. It is thus somewhat over two miles deep. It is located approximately 120 miles southwest of Johnston Island and 1200 statute miles southwest of the Hawaiian Islands. The area is generally regarded as being one of the least productive areas in the Pacific Ocean. Very little specific data is available for this particular area but several areas in the Pacific Ocean have been studied and data can be taken from these studies.

Physical Features

1. pH

High pH in the receiving medium is necessary for adequate chemical dissolution of the pyrolysis products of incineration. Among these products is HCl which would tend to lower the pH of the receiving water. Ocean water has a strong carbonate buffer system along with borate and silicon systems. The diffusion of carbon dioxide into

the upper ocean levels and biological activity at that level give the ocean an alkaline pH strongly resistant to change. In the Pacific Ocean, the pH profile shows a distinct inflection. A pH maximum of 8.2 - 8.3 in the first 100 m can be attributed to carbon dioxide diffusion and biological activity. The pH minimum of 7.5 - 7.7 occurs at 200 - 1200 m and is associated with the minimum oxygen profile and is attributed to biochemical processes. Specific values for surface pH in the area 10° to 20° north and 170° to 180° west range from 7.9 - 8.3 with the reading nearest the disposal area being 8.2.

2. Dissolved Oxygen

Dissolved oxygen is an important factor in oxidizing pyrolysis products. The presence of oxygen in sea water is due to contact of the water with the atmosphere at the sea-air interface and to the metabolism of photosynthetic organisms. The oxygen concentration present at any given time is the result of a series of biological and physical factors. The diffusion of oxygen into sea water is dependent on the partial pressure of the gas in the atmosphere, the concentration gradient in the surface layer, the atmospheric pressure, temperature and salinity. In most instances there is a maximum oxygen concentration in the euphotic zone due to diffusion

and photosynthesis, but there is a steady decline until an oxygen minimum is reached.

The vertical distribution of oxygen in the sea can be summarized as follows: (1) A well-mixed layer in equilibrium with the atmosphere and relatively uniform in oxygen content extending to the thermocline, (2) at lower depths, reactions with organic matter causes a variable decrease in oxygen concomitant with increasing depths, the minimum concentration being found between 700 and 1000 meters, and (3) lower depths may have the same or higher oxygen content due to sinking colder water originating from waters that originated from much higher latitudes.

3. Salinity

The mean surface salinity for the proposed disposal site is 34.75 parts per thousand with negligible variation over the course of a year. This value is not significantly different from average open ocean salinity taken from other parts of the world.

4. Light

Light penetration in the ocean has a great effect on the vertical position of plankton. The depth of the euphotic zone, in which the majority of phyto-plankton is found, depends primarily on the total amount

of light received and the transparency of the water. In tropical regions with high average surface illumination, the vertical distribution of phytoplankton may extend to depths of about 100 meters.

Diel rhythmic vertical migration of plankton is also associated with fluctuations in light. It is believed that this phenomenon is caused by animals moving to a zone of optimum light intensity. This causes an aggregation within certain strata. The phases of migration are described as movement toward the surface in the evening, departure from the surface at or about midnight, return to the surface near dawn, and a sharp return to normal daytime depth as the sunlight begins to penetrate the water. It is estimated the three-fourths of the zooplankton exhibit diel migration rhythms.

In general, pelagic fish follow a diel rhythm in respect to vertical distribution. During daylight hours they tend to be deeper and at night approach the surface to feed. However, due to the low standing biomass and the generally recognized low productivity, these diel rhythms are inconsequential as related to significant rhythmic increases of biomass in the mixing zone.

5. Temperature

The average surface temperature of the tropical Pacific Ocean between 10° and 20° north latitude is 26.4° Centigrade (79.5° Fahrenheit) with an annual range of about 3° Centigrade. Those are the extremes in temperature recorded in February and August. The mean yearly temperature of the surface water in the disposal area is 26.9° Centigrade (80.4° Fahrenheit) with a minimum mean of 24.8° Centigrade (76.6° Fahrenheit) and a maximum mean of 29.0° Centigrade (84.2° Fahrenheit). The vertical temperature distribution in the upper layers consists of an isothermal layer (identical temperatures at different depths), the thermocline (a layer with maximum decrease per unit depth), and a thick lower layer with slowly decreasing temperatures. The thermocline is formed by thermal energy received by the surface layer which decreases the water density thus producing a vertical stratification of progressively increasing stability. The resulting thermocline restricts vertical heat and water exchange. A strong thermocline also inhibits physico-chemical and biological vertical exchanges thus greatly affecting both the hydrographical and ecological dynamics within the area concerned. The tropical sea has a steep thermocline which has considerable influence on both

vertical exchange and animal distribution. The thermocline in the proposed disposal area is located at a depth of about 250-350 feet.

Vertical distribution of marine invertebrates may be affected by temperature in three ways: (1) Exclusion from water depths with unsuitable temperature, (2) migration to suitable thermal levels within the vertical gradient, or (3) passive transport. Accumulation or dissipation due to hydrographical conditions is vitally important in the vertical distribution of passively floating planktonic forms. Many of these individuals would be lost from the euphotic zone, thus removed from the reproducing population except that they are returned to the lighted zone by upward moving water. At the thermocline these downward movements are sufficiently retarded to allow accumulation. Vertical temperature gradients are more pronounced in the lower latitudes than at the higher latitudes, consequently, vertical distribution is influenced more by temperature in the tropical and temperate regions than in polar regions.

6. Wind and Water Currents

Wind and water currents are favorable in view of mixing and keeping materials away from land masses. The proposed disposal area lies in the westward moving

equatorial currents and the prevailing winds are from the east. The nearest land mass, the Marshall Islands, is more than 1200 miles downwind.

There are no reported upwellings in the area to bring nutrients to the surface nor does the wake of Johnston Island influence nutrient levels.

C. Biological Features

1. Biomass and Primary Productivity

Standing biomass in the proposed disposal area is extremely low. Secchi disk readings for this area are among the highest recorded in the Pacific Ocean. The high Secchi disk readings indicate extremely clear water with a sparse population of plankton.

No measurement of primary productivity is available from the proposed disposal area but it is generally regarded as low. The reasons are the low nutrient levels in the area, low standing biomass, and relatively low fishing activity.

2. Benthos Abundance

No data is available for this particular portion of the ocean; however, studies in the Gulf of Mexico estimated the total benthic macrofauna biomass, exclusive of fish, to be 0.2 gm/square meter of florafauna.

Some of the organisms reported present on

the Pacific Ocean floor were starfishes, sea cucumbers, sea urchins, echinoderms and brittle stars. In deeper areas sponges, barnacles, sea lillies and sea squirts were found along with crabs, prawns, isopods and sea spiders.

3. Commercial Fishing

The proposed disposal site will have very little impact on commercial fishing. Commercial fishermen from the Republic of Korea, Taiwan, Japan and Samoa are the ones who frequent this area most with Japanese fishing vessels comprising the majority of vessels in the area. Table 1 shows the catch of commercial species of fish in the area 10° 00' to 20° 00' north latitude and 170° 00' to 180° 00' west longitude as compared to the catch for the entire Pacific Ocean in 1971 and 1972. The northern half of this area (15°00' - 20° 00' north latitude), which includes the disposal area, is reported to be less productive than the southern half.

I won't read the chart, but it shows only a tiny, tiny percentage of the fish that are caught in the Pacific Ocean are caught in this very large area which includes the disposal site.

In view of the facts about the proposed disposal site contained in this report -- sparse

productivity, low standing biomass, acceptable physical and chemical characteristics of the receiving waters, remoteness of the location, favorable wind and water currents, and relatively little commercial fishing activity, the proposed site possesses all the characteristics described in the introduction as criteria for an acceptable ocean disposal site. It is recognized that the addition of any foreign material into a small portion of a tropical ocean ecosystem may have some effect; however, this effect will be transient, minimal and inconsequential as it relates to that ecosystem as a whole.

Thank you.

MR. MOLLOY: Are there any questions from the Panel?

DR. ENOS: I have a question, Mr. Chairman.

MR. MOLLOY: Dr. Enos.

DR. ENOS: What precautions will be taken, or what method of warning is possible to fishing vessels of the activities that the incineration vessel will be taking?

LIEUTENANT COLONEL TAYLOR: The next speaker I think can give you some better account of that than I can, although I understand that we can notify the Coast Guard, who will in turn notify their counterpart in the

other countries. This information will be broadcast to the fishing fleet, so there shouldn't be any great problem as far as announcement to these folks will be concerned that we are in the area, operating in the area.

DR. ENOS: Will that mean that fishing vessels would be excluded from the entire burn area?

LIEUTENANT COLONEL TAYLOR: I don't think I can answer that.

MR. MOLLOY: I have a question.

Is the biomass important in the degradation of the material that gets into the ocean environment?

LIEUTENANT COLONEL TAYLOR: Is it important? I think that the other processes that are involved, the hydrolysis, the fact that dioxin breaks down very quickly under UV light, are much more important factors than the biodegradation of the material. There are certain hydrocarbons that are very responsive to biodegradation. The ones that we are talking about, I think probably that the physical degradation is much more important than the biodegradation aspect.

MR. MOLLOY: What I am trying to get at is, is it possible that the fact that this area has a low biomass would result in some of the material not being degraded and being carried farther than we would anticipate?

LIEUTENANT COLONEL TAYLOR: Again, as Colonel Williams indicated a while ago, I think probably the total area and its half life would be much less in a highly polluted area where you have many, many organisms, but I think that we are still talking about quantity of material that's so low that really the difference in time because of the quantity of aquatic organisms would be inconsequential.

MR. MOLLOY: And finally, have you made any studies on the possible effects on the environment in this area to the -- which could be, since the ecosystem is so -- since the biomass is so small, could there be a severe impact on it from a spill of some sort?

LIEUTENANT COLONEL TAYLOR: I have personally not considered that as far as a spill is concerned in that ecosystem. I don't know what the results would be.

MR. MOLLOY: Thank you.

MR. BIGLANE: I have just one question for clarification.

In your introduction you quoted Pequegnat.

LIEUTENANT COLONEL TAYLOR: Yes, sir.

MR. BIGLANE: And the three conditions or four conditions, rather, that he establishes, and suggests

as being advantageous for the incineration of these types of wastes.

I would just ask the question, do you agree with his four conditions here?

LIEUTENANT COLONEL TAYLOR: I think that they are probably the best criteria that we have.

MR. BIGLANE: Thank you.

MR. MOLLOY: Are there any other questions?

(There was no response.)

MR. MOLLOY: Thank you.

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MR. MOLLOY: The next speaker is Dr. Richard Barkley, from the National Marine Fisheries Service in Honolulu.

While Dr. Barkley is walking up, I would like to say that I think we will try to break for lunch at quarter to one or something like that if that's an appropriate time when we get there, and probably take about an hour, an hour and fifteen minutes.

Dr. Barkley.

DR. BARKLEY: Mr. Chairman, ladies and gentlemen, my name is Richard Barkley. I am the Chief of the Fish environment investigations at the National Marine Fisheries Service laboratory in Honolulu. I have been with the laboratory for fifteen years.

My specialty is primarily physical oceanography.

I'm interested in classic phenomenon we call island wakes, which includes the influence which islands have on ocean currents, and in turn, the effects of the disturbance that islands have on such things as productivity.

I have a PhD. from the University of Washington, also a Master of Science Degree in Oceanography from the University of Washington.

I have published a number of papers which are pertinent. I think perhaps the most significant in this context is the Oceanographic Atlas of the Pacific Ocean which

I published in 1968. It summarized all the oceanographic data available from the Pacific up to that time.

Closer to home, there is a paper I published in 1972 entitled, Johnston Atoll's Wake, in which we looked at the details of the current system around the Johnston Atoll sea mouth.

My primary function in appearing here is simply to provide you with a little more information about the productivity in the vicinity of Johnston Island.

Literature research which I have carried out has located a few observations of productivity from the area in the vicinity of the burn site. They include seven observations in the two adjacent five degree areas, and each of these averages 0.2 milligrams of carbon produced per square meter per hour.

To put this in context, this is among the lowest values that are typically measured in the ocean anywhere.

Technically, they would fall in the lowest decile, the lowest ten percent of the range of productivity. These low values are indirectly confirmed by Secchi disc readings, which in mid-ocean provide an index of water clarity, and therefore of standing crops of plankton. Secchi disc readings for the area near Johnston Atoll, some of which I took myself, are typically about 50 meters, which can be

compared with the theoretical maximum reading of 62 meters for very clear or distilled water.

The basic reason for this productivity and high water clarity is the lack of plant nutrients, not only in the surface waters, but also in the subsurface waters down to approximately 300 meters. This subsurface water is an old surface water which sank at the subtropical convergence, about 20 to 25 degrees North, then spread toward lower latitudes beneath the surface layer. It is for this reason that upwelling and wind mixing do not cause enrichment of the surface euphotic layer, because the water brought up from below is as nutrient-poor as the normal surface waters. This condition is typical for mid-latitude ocean areas all over the world. The Sargasso Sea in the western North Atlantic Ocean is the best source for this information.

Thank you.

MR. MOLLOY: I have a question. It's in the same area that I asked the previous speaker.

Do you have any idea, perhaps, do you know if there have been any studies of the potential effect on this type of ecosystem of a spill of this material, this type of material?

DR. BARKLEY: The biota in the vicinity are not in any sense that I am aware of unique. It is simply the

biota which one finds in the mid-latitude open ocean in the less productive areas.

They are probably supplied primarily by production which occurs in lower latitudes, which in turn is fed by divergence of the Equator. So if, for example, there were catastrophic destruction of vital plankton in the few acres of the immediate vicinity of the ship, this would be replaced within a matter of days, I think, by local productivity and by mixing and invection from laterally, and presumably primarily from the southeast.

MR. MOLLOY: Thank you.

Are there any other questions or comments?

Mr. Biglane.

MR. BIGLANE: I would like to ask one.

Appropos of a question asked last week in which Dr. Pequegnat cites four criteria for consideration of the generation of these types of waste, and refreshing your memory, the first one says, the presence of great volumes of water; second, relatively simple water and air current; thirdly, low stratification of the water column, and four, relatively little productivity in the area.

I would ask you, sir, would you agree with these criteria, and if you do, would you have any more to add to them?

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DR. BARKLEY: First of all, I agree totally with all but the third. I don't think that the lack of -- or the stratification is necessarily either a positive or a negative factor. The lack of any significant stratification would cause rapid vertical mixing, which would be favorable in the sense that it would dilute the effects of any material put into the water rather rapidly. In this sense it is favorable. In another sense, it might be considered favorable to retain the material above the deeper layers of the ocean because of the upper layers of the air, which are more exposed to such process as oxidation, biological degradation and so on.

So I think that there is reasonable grounds for argument about whether a stratified or an unstratified system would be better, but I don't think this is a highly significant criterion, and I think the other three are more important and probably the most fundemental.

MR. BIGLANE: Thank you.

MR. MOLLOY: The next speaker is Major John J. Gokelman from the United States Air Force Environmental Health Laboratory, McClellan Air Force Base, California.

MAJOR GOKELMAN: Mr. Chairman, ladies and gentlemen,

My name is Major John J. Gokelman. I am

currently the Chief of the Environmental Protection Engineering Division at the Environmental Health Lab, McClellan Air Force Base, California. We are the sister lab to the one at Kelly Air Force Base.

I have a Master of Science Industrial from the University of Michigan, specialty in Air Pollution from the University of Michigan. I am also a candidate for a Doctor of Philosophy degree in air pollution from the University of Michigan.

I am a Registered Professional Engineer in the State of California, and certified by the American Board of Industrial Hygiene in Comprehensive Practice.

I have worked in environmental and industrial health since 1960, and I have worked in air pollution source sampling since 1972.

I was the Chief of the Air Pollution Sampling team that did the Air Force's monitoring work on the Marquardt study in November of 1973.

My paper is, Procedures to Evaluate Stack Emissions from Shipboard Incineration of Herbicide Orange.

This paper details the sampling and analytical procedures which the Air Force will use to monitor stack gases generated during the incineration of Herbicide Orange aboard the VULCANUS. The procedures are divided into two systems,

one to monitor Herbicide Orange components and TCDD and the other to monitor incinerator performance and obtain stack volume flow rate.

The first portion I will discuss is the herbicide components and TCDD monitoring system.

The sampling system to monitor emissions of herbicide components and TCDD is a modified version of the one described in Appendix E of the Final Environmental Impact Statement, "Disposition of Orange Herbicide by Incineration," November 1974. The modification is the insertion of a 50-foot heated Teflon line between the probe and the impingers. The shipboard system consists of a quartz glass probe in a water cooled stainless jacket, a 50-foot heated Teflon line with temperature monitor, six Greenburg-Smith impingers, a pump and a dry gas meter. The system, except for two one-inch stainless steel connectors at the ends of the heated line, is glass and Teflon.

The first three impingers have their impaction plates replaced with coarse frits. They contain 350 milliliter benzene each and trap any 2,4-D, 2,4,5-T and TCDD present in the air sample. The last three impingers have their impaction plates and tips removed. Two contain approximately 500 grams each of 60/80 mesh activated carbon and one contains approximately 500 grams of silica gel. They remove benzene and water from the sample gas before it enters the pump and

dry gas meter.

Collection efficiency tests for the original sampling system were conducted with a four benzene impinger train and a three foot glass probe heated to 180-190 degree centigrade. They indicate that the fourth impinger was not needed and that the system's efficiency is 90 per cent for both 2,4-D and 2,4,5-T. This sampling system was used to monitor the emissions from the Marquardt test burn. It performed satisfactorily under field conditions. The previously referenced environmental impact statement contains a complete report on the 2,4-D and 2,4,5-T tests and on the system's performance during actual field use.

The modified sampling system was also tested for TCDD collection efficiencies. They were conducted after publication of the final environmental impact statement. The percent recoveries were based on a 28 microgram sample to TCDD. The average line temperature was 190 degree centigrade. Samples were analyzed by dual column gas chromatograph with an electron capture detector. The detection level was 0.2 microgram total sample. These data will be confirmed by gas chromatograph/mass spectrometry at a later date. The collection efficiency for TCDD ranged between 94 and 110 percent recovery.

The system cannot be operated continuously or at a flow rate greater than 2 liters per minute due to benzene

evaporation. Three one-hour samples will be collected during each day of incineration. Sampling will begin after the incinerator has reached equilibrium while incinerating Herbicide Orange. Based on an absolute detection limit of 1 nanogram and an average TCDD concentration of 2 ppm, the sampling will detect any TCDD present in the effluent gas up to a destruction efficiency of 99.997 percent.

In preparation for sampling, the line, connectors, and impingers will be rinsed with benzene, the impingers will be wrapped with foil to protect the contents from UV light, all components connected, and the system leak tested. The line will be heated to 190 degree centigrade, the flow rate established at 2 liters per minute and sampling started.

Upon completion of the one-hour sampling period, contents of the impingers will be transferred to amber glass containers. The line and connectors will be rinsed with benzene and transferred to amber glass containers. All sample containers will be stored aboard ship until the test burn is completed. At Johnston Island samples will be concentrated and immediately transported by air to the Evironmental Health Lab, Kelly Air Force Base, for analyses by gas chromatography/ mass spectrometry.

The second portion of the paper will discuss the incinerator efficiency and stack volume flow rate monitoring using the appropriate formulae.

Due to the high temperature and corrosive nature of the exhaust gas and the steep angle of the sampling port, it is not possible to measure the stack volume flow rate using a pitot tube. It will be determined by measuring the oxygen content of the stack gas. Using this value and the theoretical stoichiometric stack flow rate for "Orange" incineration, the actual stack flow rate will be determined using the following formulae.

The sampling system for this portion of the stack monitoring consists of a quartz liner inside a stainless steel water-cooled probe, a 50-foot heated Teflon line, with temperature monitor, a scrubber system to remove chlorine and water from the gas and two continuous monitoring instruments, a Beckman Model 865 Carbon monoxide analyzer, a Beckman 715 oxygen analyzer, and a recorder.

The carbon monoxide instrument will be used to determine the efficiency of incineration. The continuous monitoring equipment will be on line whenever the herbicide monitoring system is not in use.

Appended to the paper are several attachments showing the analytical procedures and also the test results and some of our calculations.

That's all I have, sir.

MR. MOLLOY: Thank you.

Are there any questions by the Panel?

DR. ENOS: Yes.

Major, in the previous experience on board the Vulcanus we had some difficulty with equipment not operating at inopportune moments. Do you have any contingency plans for backup equipment in case this should happen while you are on the burn sites?

MR. GOKELMAN: Yes. We plan on bringing on two heated lines. We have water-cooled probes. We have two oxygen monitors. We have two CO monitors, and we will have a supply of benzene and glass impingers in the event, and we anticipate some breakage of the glass itself.

We will also have two pumps and two dry gas meters, so if any of these units at all break down we can replace them with the second unit.

DR. ENOS: And in the body of the text, when you discussed the efficiency for determining the ability to capture the TCDD from the stack effluents all the way to the impinger system, did you have an opportunity to evaluate the ability to concentrate benzene solutions containing TCDD to determine whether or not there is an efficient process? I didn't catch that.

MAJOR GOKELMAN: Our chemist did analyze the procedure. It's in the paper itself. It is actually contained in Attachment 1, and it's a codistillation study the people

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did, and we found that essentially the recovery ranged from 101.6 to 100.2 percent recovery after the evaporation.

Yes, we can recover the TCDD after it is evaporated.

DR. ENOS: Thank you, Major.

MR. MOLLOY: Are there any other questions?

(There was no response.)

MR. MOLLOY: Thank you.

The next speaker is Captain Stephen TerMaath of the Air Force Environmental Health Laboratory, Kelly Air Force Base, Texas.

CAPTAIN TERMAATH: I am Captain Stephen G. TerMaath. My current position is as consulting bioenvironmental engineer and sanitary engineer, United States Air Force Environmental Health Laboratory at Kelly Air Force Base in San Antonio, Texas.

I have a Master of Science Degree in Environmental Health Engineering from the University of Texas at Austin.

I am a member of the Texas and National Societies of Professional Engineers, and the Water Pollution Control Federation.

I was involved in conception and data analysis of the drum-rinsing experiments, at the Marquardt Company in

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September '74 experiments at Gulfport, Mississippi, which were discussed in the Air Force's Final Environmental Statement.

In addition, I was officer in charge of the drum-rinsing experiments conducted at the Naval Construction Battalion Center in Gulfport, Mississippi from 7 to 12 April of this year. The majority of the information which I will present this morning was collected during this last study.

The paper I am presenting this morning is entitled, Rinsing Procedures for Orange Herbicide Drums.

By way of introduction, the Federal Register Vol. 40, No 56, Monday 24 Mar 72 contains a "Receipt of Application and Tentative Determination" as regards the Air Force Application for an Ocean Dumping Permit of 9 Jan 75. The "Tentative Determination" includes the following condition:

"(4) The drums from which the Herbicide Orange is taken will be triple rinsed with solvent prior to disposal, or otherwise cleaned to an equal degree by jet rinsing, and the rinses will be added to the waste to be incinerated."

This is an extremely stringent condition and could be appropriate if the drums were to be reused. A triple rinse of a drained drum with clean solvent for each rinse ... will obviously result in a very clean drum. Reuse of drums as containers for any type of material or for any other conceivable use has never been considered by the Air

Force. Rather than a simple triple rinse requirement with no maximum permissible residual and in view of the Air Force plans for ultimate disposal, it would seem a much more realistic condition would be one that allows a certain minimum of Orange residual regardless of the method used to achieve it. An allowable herbicide residual would be specific to the Orange disposal project and not simply a condition wich could be applied universally. As has been shown in the Final Environmental Statement, the amount of solvent per rinse and the number of rinses has a tremendous bearing on the duration and complexity of the disposal project - which translates to increased cost to the taxpayer. Therefore, all efforts should be directed toward attaining an environmentally acceptable drum cleaning operation which applies specifically to the Orange disposal project.

The drums generated by the disposal of Orange herbicide will be recycled as "scrap" metal for the steel manufacturing industry. Disposal as scrap rather than disposal of unrinsed drums in a specially designated landfill is considered more favorable from the long term environmental standpoint because the Orange and its components would be rapidly destroyed in the steel making process. As the scrap drum metal is processed into new steel, it would be subjected to high temperatures (Approximately 2900 degrees Fahrenheit)

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for an extended period of time (Approximately 6 hours) which was discussed in Part 2 E of the Final Environmental Statement, and the other in April, 1975. This exposure is much more severe than that which would be received if non-combustible drums were subjected to incineration in a pesticide incinerator (2000 degrees Fahrenheit, 2 sec) as defined by EPA in 40 CFR 165.1. Recycling into steel conserves not only the drum metal but also raw materials for steel manufacture. The utilization of one ton of scrap steel in the steel making process conserves about 4 tons of iron ore, coal, and limestone. Therefore, the recycling of 45,000 - 50 pound drums as scrap will conserve approximately 4,500 tons of raw material. This method of ultimate disposal will also preclude the return of any Orange herbicide drums to manufacturers, formulators, or drum reconditioners for reuse.

The Air Force has never intended that the Orange herbicide drums be reconditioned for reuse. The negative public relations aspect of reuse, the solvent requirements to affect a triple rinse as recommended by the EPA prior to the reuse of containers (40 CFR 165), and the concomitant complication and expansion of the disposal project associated with such rinsing operations are not desirable. The solvent volume of 67,000 gallons necessary for a triple rinsing represents greater than one-fourth the volume of the total

Orange herbicide stock. The incineration phase of the project would be greatly expanded since the solvent rinse would require incineration along with the herbicide. The frequency of handling and the tremendous quantity of solvent involved would increase the possibilities of a fire hazard and spillage of the Orange-contaminated solvent. In addition, the use of a large quantity of a petroleum solvent during a period of emergy conservation and fuel shortages is not a prudent action if it can be avoided without risk to the environment.

Early in the evaluation of various disposal methods, the Air Force recognized the need for an environmentally acceptable method of drum disposal and considered the alternatives of disposal in a specially designated landfill, reuse of drums, subjecting drums to incineration in a pesticide incinerator, and recycle as scrap steel. The lastmethods was selected as the best procedure as regards the Orange herbicide disposal project. Realizing that the drums to be recycled into steel manufacture require storage and transportation, the drums should be rinsed to remove as much of the residual herbicide as is environmentally, economically and operationally feasible. The EPA recommended requirement in 40 CFR 165 does not clearly define the procedures to be followed to effect a triple rinse. The effectiveness of any rinse is dependent on many factors such

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as 1) how well the container is drained prior to a rinse, 2) the method of application or agitation of the rinsing material, 3) how long or how well the container is drained between rinses, 4) the acceptable residual of pesticide which is permitted to remain in the container after a triple rinse, and 5) the ratio of surface area to volume of rinse material because a wide range of container sizes may be encountered. To explore an adequate drum rinsing procedure, three studies of the efficacy of rinsing herbicide drums were conducted under Air Force auspices. One study was performed at the Marquardt Company, Van Nuys, California in December 1973 with the support of United States Air Force Environmental Health Laboratory (Kelly Air Force Base, Texas) personnel and the results were included in Appendix E of the Air Force's Final Environmental Statement. Two studies were conducted by United States Air Force Environmental Health Laboratory (Kelly) personnel at the Naval Construction Battalion Center, Gulfport, Mississippi -- one in September 197 , which was discussed in the Final Environmental Statement, and the other in April 1975. The conclusions of these studies as they relate to the methods of drum cleaning and disposal are set out in the paper which I am submitting for the record.

This paper submitted for the record will go in to slightly more detail and present some of our data

collected during the three experiments.

In summary, the drum rinse experiments have shown that only about 30 grams (0.07 lbs) will remain in a drum after a single two gallon pressure spray rinse. This is less than the 68 grams (0.15 lbs) predicted by the Air Force's Final Environmental Statement of December 1974. A residual of 30 grams is deemed environmentally acceptable in view of the subsequent destruction of the crushed drums and the residual herbicide in a steel making furnace. The residual is not considered a personnel safety hazard nor a potential environmental insult during the shipment and storage. This disposal procedure is specific for the Orange disposal project and represents, in our judgment, an entirely prudent course of action.

I will now briefly outline the rinsing procedures which we do intend to follow in our two de-drum facilities. There are about 16,000 drums which will be de-drummed and rinsed at the Naval Construction Battalion Center in Gulfport, Mississippi.

The de-drum/drum rinse sequence is conducted on a roller conveyor. There are four identical conveyor lines which are expected to handle a total of 1,000 drums per day. The first step is the deheading operation, after which the removed drum head is placed in a vat of diesel fuel to clean

off any remaining herbicide. Next, most of the Orange herbicide is pumped from the deheaded drum. The few gallons remaining are drained by inverting the drum. The drum is allowed to drain into a collection trough under the conveyor for at least five minutes. The drum is then pushed along the conveyor to a point over the spray nozzle for a 2 gallon spray-rinse of diesel fuel. After draining for two minutes, the rinsed drum is crushed.

On Johnston Island, where we have approximately 25,000 drums the following procedure will be used.

The full drums will be placed on either of two separate racks which hold the drums at a 45 degree angle. A notch will be placed at the lowest point of the lower head and a vent hole punched at the highest point in the upper head. The orange herbicide will be allowed to drain for at least five minutes. Either an additional notch will be placed in the upper portion of the previously notched head or the bung will be removed if it is also located on the upper portion of the head. The spray nozzle will be placed into the drum through the upper notch or bunghole, and a two gallon spray rinse administered. After a two minute drain, the drum will be placed in temporary storage before crushing.

Thank you.

MR. MOLLOY: I have a few questions.

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One is, what would you propose to do with the contaminated spray rinse material?

CAPTAIN TERMAATH: It will go along with the Orange herbicide and go aboard the ship for incineration. I believe that was pointed out in the Final Environmental Statement or paper.

MR. MOLLOY: Secondly, have you made arrangements or contacted any steel companies to take these drums?

CAPTAIN TERMAATH: There have been no formal procedures outlined or contracts as regards the disposal of the steel. One company was contacted, and they had no hesitation in accepting the material. It was done on an informal basis, our contact with them.

MR. MOLLOY: Have you made arrangements for transport, or considered the arrangements for transport of the crushed drums from Johnston Island?

CAPTAIN TERMAATH: There have been no formal arrangements as yet. There would obviously be sea shipment to -- designated by the disposal group, and that has not been formally established as yet.

We cannot make any formal contracts or make any formal bids, obviously, until we have a permit in hand.

MR. MOLLOY: I recognize that.

Have you made some informal contacts with

transportation companies or the Military Sea Transport Agency?

CAPTAIN TERMAATH: Possibly Mr. Merrill may want to comment on that. I believe there have been.

MR. MOLLOY: Sir, could you identify yourself and take a microphone?

MR. KARL MERRILL: I am Karl Merrill, Air Force, Assistant Deputy Chief of Staff, Distribution.

Air Force contacts have been made with the Military Sea Transport Agency as to Logistics of transporting the drums. They see no particular problems in that regard.

Informal contacts have also been made with the Defense Disposal Agency here in Honolulu and other places, and they see no particular problem with regard to the sale of the drums as scrap steel.

So though we have not made formal contacts, all informal contacts are positive.

MR. MOLLOY: Are there any other questions from the Panel?

DR. ENOS: Yes.

Have you calculated the amount of dioxin which theoretically could still be retained in the drums, the total amount?

CAPTAIN TERMAATH: In that 30 grams per drum,

for example?

DR. ENOS: Yes. If we assume a total destribution of two parts per million.

CAPTAIN TERMAATH: Right. I don't have that calculation with me right now, but we'll run that out quickly.

I will run those out and submit them. We will calculate it and submit that to you shortly.

DR. ENOS: All right.

Let's just consider the 30 grams that I think you indicated would be retained per drum, and we have got something on the order of what, 44,000 drums on Johnston Island now?

CAPTAIN TERMAATH: We have about 25,000 drums on Johnston Island.

DR. ENOS: Twenty-five thousand?

CAPTAIN TERMAATH: We look at about 30 thousand if you include drums that have gone bad during the storage period and have had to be redrummed, so we have about 30 to 32,000 drums on the Island.

DR. ENOS: The 30 grams, then, of material retained in the drums will then be subjected to some destruction in the process of reclaiming it?

CAPTAIN TERMAATH: It will be specified in the contract when the scrap steel is sold that it will used for

making new steel, so that it would required before these drums could go anywhere they are going to have to go into a steel-making furnace where they would be subjected, as I pointed out, to about 2900 degrees Fahrenheit for about six hours in that. In other words, the identity of the drum would be completely lost.

DR. ENOS: Thank you.

DR. MACKENZIE: First of all, I would like to give notice that in the audience today is Mr. Harry Trask from our Agency office for Solid Wastes Management, and I am really serving him on a very short warning. I recognize that I would like him to respond to a specific aspect of the Captain's paper, and that would be the one that would refer to the code of Federal Regulations that we have promulgated with regard to disposal of pesticide containers.

But before I come to that I have a specific question myself, and that is, in terms of the handling of these drums, that we have operations and the actions that follow on thereafter, what provisions are made for the protection of the people that will actually be carrying out this process in terms of protective equipment?

CAPTAIN TERMAATH: In handling the Orange, the main type of protective equipment which we are planning on using will be one that will protect from skin contact primarily.

The studies thus far with the Orange herbicide have shown that the vapor pressure is such that you cannot even reach the threshhold limit value on the 2,4,5-T, and to be more specific, I maybe had better ask Captain Jackson or Major Gokelman to comment on the Orange and the protective equipment specifically. But the protective equipment is not foreseen as needed a lot, and they can comment specifically on the industrial hygiene aspects of the Orange.

MAJOR GOKELMAN: On industrial hygiene for personal protection --

MR. MOLLOY: Could you identify yourself?

MAJOR GOKELMAN: I am Major Gokelman. I am also from the McClellan Air Force Base Environmental Health Lab. We have been given the job of providing both the industrial hygiene coverage of all the personnel working with the Orange Herbicide product during the de-drumming operation, and we have provided them -- we will provide them with masks, gloves, aprons, and if I am not mistaken, also boots -- coverlets or boots that will be impervious to Orange Herbicide.

So if that answers your question, they are being provided for the people who will be dealing with the herbicide itself.

We are also providing for some personnel monitoring of these people while they are handling it.

DR. MACKENZIE: Thank you very much.

Would it be appropriate at this time to ask Mr. Trask if he would like to make some comment?

MR. MOLLOY: We have some questions from the floor, so before we get to Mr. Trask, if I can get these questions out.

Whoever asked the question, do you feel that the questions have been answered?

(There was no response.)

MR. MOLLOY: I will read the questions, then.

"What kind of protection is provided in the drum draining at Gulfport?"

CAPTAIN TERMAATH: As Major Gokelman pointed out, there will be coveralls, butyl rubber aprons, rubber boots and face shields, and masks will be available if they so desire. The masks are not necessary, but there is an odor involved with Orange that is objectionable to many people, and that will be there for their optional use.

In addition, there will be industrial hygiene monitoring maintained on a daily basis, and we will be doing analyses on the spot, utilizing the laboratory in Gulfport, Mississippi, so personal protection we feel is well covered.

MR. MOLLOY: And the second question is, "What is the possibility of Herbicide Orange contamination in

the immediate area?"

I take it that means from a spill from the de-drum operations.

CAPTAIN TERMAATH: Since we will be handling them in the drums and inside a concrete facility, no major spill at the de-drum facility is anticipated. However, there, as pointed out in Dr. Welch's opening remarks, we do have absorbent material that will be on hand and available, and contingency plans to take care of that. We feel we have it covered.

MR. MOLLOY: Do you have plans to rinse down the area also when you have completed?

CAPTAIN TERMAATH: At the completion of the project the facility will be rinsed with diesel fuel, and any containers which have been used, such as tank cars for transporting it, will also be rinsed with diesel fuel, and this diesel fuel will be aboard along with the Orange for shipboard incineration.

MR. MOLLOY: The final question that I have here is, "What is the possible level in comparison with the one tenth of one percent residue from the burn?"

I take it that means in the case of a spill from the de-drumming operation, how would that relate to the burn efficiency? Would it result in severe contamination?

If you did get a spill in the area, would it result in severe contamination?

CAPTAIN TERMAATH: No, not in the area of the de-drumming on the naval facility, no. Obviously, it is going to be transported in tank cars to the ship, and we have sufficient absorbent material and plans to move in if we should have any type of spill.

MR. MOLLOY: Does that answer the questions, whoever asked them?

FROM THE FLOOR: Yes. I asked the questions.

MR. ROGERS: Mr. Chairman, I have a couple of questions.

MR. MOLLOY: Mr. Rogers.

MR. ROGERS: What would be the total liquid quantity the Air Force will be shipping from Gulfport, including the rinse, including the Herbicide Orange and the rinse?

CAPTAIN TERMAATH: 860,000 gallons.

MR. ROGERS: How does that relate to the ship's capacity?

CAPTAIN TERMAATH: 860,000 gallons.

MR. ROGERS: So the ship will be up to --

CAPTAIN TERMAATH: We will be shipping a full load from Gulfport.

MR. ROGERS: What happens if you have to use more rinse?

CAPTAIN TERMAATH: More than our two-gallon rinse capacity?

MR. ROGERS: Right.

CAPTAIN TERMAATH: Well, we are obviously going to have to re-evaluate the situation, and either consider shipping Herbicide Orange having more than one load. In other words, if there is a large amount of rinse water required, I think that you are talking about -- okay. If you talk about a triple rinse you are talking about roughly 16.5 gallons under the EPA procedures, 16.5 gallons per drum, and I think you are talking about an additional 30 percent.

MR. ROGERS: So you are saying you couldn't triple rinse and put the rinse in with the herbicide and get it all out of Gulfport?

CAPTAIN TERMAATH: Correct.

MR. ROGERS: But you think you could get it all out if you used your procedure?

CAPTAIN TERMAATH: All but the possibility of a very few drums, which we could ship.

MR. ROGERS: What have you been doing with the drums in the occasions you had to redrum up to now?

CAPTAIN TERMAATH: They have been sitting in

storage at Johnston Island. They have been in storage.

MR. ROGERS: What about the ones at Gulfport? Have they been re-drummed?

CAPTAIN TERMAATH: No, there has been no re-drumming effort at Gulfport. Johnston Island being as it is with the spray all the time has a very corrosive atmosphere there.

MR. ROGERS: Thank you.

MR. MOLLOY: Are there any further questions?

DR. ENOS: Yes, I have.

What is the total number of drums that you have at both locations?

CAPTAIN TERMAATH: About 45,000.

DR. ENOS: Forty-five thousand drums. Okay. Thank you.

MR. ROGERS: I do have one other question I forgot to ask. This relates to the possibility of reprocessing. If you do reprocess, decide to reprocess the herbicide, I assume you have to take the chemical out of the drums at some point, is that correct?

CAPTAIN TERMAATH: At some point. Since I am not familiar with the proposals made by the reformulator people, I presume that some of them may have said they would accept it in drums. Others may have said that they would

Mr. Trask

like bulk shipment, and I think if we go to reformulation we would have to develop something with regard to that.

MR. ROGERS: Maybe we should hold that question until we get into that area later.

MR. MOLLOY: Now, Mr. Trask, if you can comment on the Federal Code Regulations, and after Mr. Trask we will break for lunch.

Thank you, Captain.

MR. HARRY TRASK: I am Harry Trask. I am the representative of the Office of Solid Waste Management Programs of EPA in Washington. Our office did develop and publish 40 CFR 165, which relates to the storage and disposal of pesticides and pesticide containers.

Section 165.9, I believe, of that publication refers to methods of handling the containers, and it requires the triple rinse procedure which Captain TerMaath just described to you.

At other points in that particular code there are exceptions or possibilities for exceptions, and we have taken the position that a triple rinse or equivalent should be the proper wording for that particular regulation.

That is called officially a recommended procedure. However, it has been determined that it is a guideline, and therefore binding on all Federal Agencies.

Mr. Trask

I do have a question for Captain TerMaath, or perhaps for Carlton Williams, I'm not sure.

The Environmental Impact Statement in both the draft and the final contains some data which showed that approximately 1 to 1.2 pounds of Herbicide Orange would be volatilized from each drum as it sat in storage on Johnston Island.

My question is, what happens to the 30 grams or the one ounce as it sits in storage on Johnston Island? I assume that you would not be moving it immediately after the drum has been rinsed.

I also am concerned as to the de-drumming operation itself. If there is volatilization, are there any provisions being made to contain these vapors? Otherwise, it seems fairly clear to me that they are going to be released into the atmosphere down there.

Perhaps you would want to comment on that after lunch if you want to break for lunch, Mr. Molloy.

MR. MOLLOY: Is that all right with you, that you comment on that after lunch?

DR. WELCH: Yes. I would like to summarize just briefly before you break, however.

MR. MOLLOY: All right. Yes, Dr. Welch.

DR. WELCH: Mr. Chairman, my overview comments

Dr. Welch

which attested to the safety of incinerating Herbicide Orange at sea, have been further substantiated by the technical comments just presented.

I might say, if this material was not called Herbicide Orange or Agent Orange, as so many term it, it would have either been used or destroyed by this time. Herbicide Orange carries with it an emotional connotation of something bad or sinister. There are groups who do not want the material used at all -- who would prefer that it be destroyed -- and the sooner the better. Nothing is assured concerning Herbicide Orange, except perhaps controversy.

In this connection I want to comment briefly on the resolution on the TTPI Environmental Board, and call to their attention that Herbicide Orange is not, and I repeat not, a poison gas. It is a herbicide, specifically intended for controlling certain types of plant life. Products much like it are legal for use in the United States, including the Trust Territory. Where used, obviously, the exposure to humans is far greater than the exposure from burning it 1,200 miles away. In our opinion, there is absolutely no reason to believe that the products of combustion will even be detectable in the Marshall Islands, that there will be any threat to public health or that any Marshall Islanders would ever become sick from any potential exposure to the products

Dr. Welch

arising from combustion of Herbicide Orange on board the Vulcanus.

I believe we have laid out for consideration a very credible argument which should be sufficient to warrant the issuance of a research permit.

We do have a problem in storage of this material. It does cost money to maintain it. The material that is stored on Johnston Island is stored as it was received, in 55-gallon drums, but it is open storage. Johnston Island is roughly 600 to 650 acres in total area, with an average height of less than eight feet above sea level. So it is a fairly corrosive environment, and we have a major effort to maintain the integrity of the drums. During the past year (April to April) we spent about $140,000 to remove the herbicide from leaking and unsound drums and place it in sound containers. As the storage time increases, the integrity of the drums will continue to degrade. Salt spray and the age of the drums continue to be a problem.

In order to preclude continued redrumming, continued utilization of money for the redrumming efforts, it is our desire and our charter, we think, to dispose of the problem in one way or the other: either by reprocessing into products that can be used or by destroying the material in terms of incineration, either on the high seas or on Johnston

Dr. Welch

Island. Our position has been laid out in the Environmental Impact Statement. It is there for anyone to study, and we think that the solutions are fairly self-evident. We see the need to reach a conclusion on the option of reprocessing.

At the time the ocean incineration technique came to our attention, reprocessing alternatives seemed technically and legally infeasible. We have always recognized that alternatives that returned the material to legal and productive use, hopefully with a net return to the DOD, were preferable if the problems could be overcome. In recent weeks, there has been some progress in this area. Technical proposals received by the Defense Supply Agency, surplus property sales agent for the DOD, appear on paper to be potentially feasible, based on largely experimental data. The proposers have been requested to demonstrate their techniques on a pilot plant scale on an expedited basis.

There are many questions - technical, legal, economic and political - to be explored with respect to reprocessing. At the moment, we cannot say whether all or any of the material can be reprocessed. We recognize that, under the tentative decision, we have the burden of demonstrating to you that there are no technically feasible and environmentally sound land-based alternatives to ocean incineration. To allow sufficient time for this information

to become available, we are asking that the hearings be adjourned temporarily after the San Francisco session, to be convened in Washington, D. C., within ten days of a request by us. We will make this request as soon as there is sufficient data to demonstrate the feasibility, or lack of it, of reprocessing some or all of the herbicide. We do not expect this to be too long a period, hopefully no more than ninety days. Let me underline that the Air Force is most anxious to proceed with disposal of this material in an environmentally acceptable manner at the earliest possible date. We understand that the 180-day decision period will be suspended until the hearing is reconvened.

Once again, we thank you for your indulgence in having the opportunity to present to you the studies that we have carried out, and as the day goes on we will be pleased to try to answer any questions that might arise.

Thank you.

MR. MOLLOY: Thank you, Dr. Welch. There will be some questions after lunch, so if we can break for lunch now, it's one o'clock, and come back sometime before 2:15.

(The hearing was thereupon recessed, for luncheon, from 1:00 p.m. to 2:15 p.m.)

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(The hearing was reconvened at 2:17 p.m.)

MR. MOLLOY: We can reconvene the session now, please. It is now 2:15.

Before the break for lunch Dr. Welch finished his statement, and there had been some questions posed by Mr. Trask to the Air Force.

Mr. Trask, could you repeat the questions, perhaps, and then maybe they can respond to them.

MR. TRASK: The questions were, what would be the fate of the 30 grams of material which would be left in each drum according to the instant data that you have presented?

The earlier Environmental Impact Statement indicated that substantial volatilization would occur if the drums are left in the open with material in them, and I am wondering what if any material would volatilize from the rinsed drums and what provisions are being made to contain that?

MR. MOLLOY: Dr. Welch, could you answer that, or have someone from the Air Force answer?

DR. WELCH: Well, let me start it and see how we make out.

As to the fate of the 30 grams left in the drums, the drums would initially be crushed, and involved in crushing would at some subsequent time, as yet undefined, be moved to a smelter and recovered as scrap metal.

In the process of that recovery, fairly high temperatures -- the numbers escape me at the present time -- but 2,900 degrees Fahrenheit, I am told, and some six hours of exposure in the smelter would be utilized to smelt the drum down for reuse.

Now, as to the amount of the 30 grams that would be left in the drums, how much of that would be volatilized, quite frankly I don't have the foggiest idea right now.

MR. TRASK: The earlier data indicated about 90 per cent would volatize, and I am wondering if that's a fair assumption to make now?

DR. WELCH: I don't think that, you know, one could really comment upon that, because if the drums are crushed, the surface area that's available for volatilization would be considerably less, and the earlier data was on uncrushed drums. And the amount of material that we are talking about is something less than a total of about 2,000 pounds in the Johnston Island area, and substantially less than that at Gulfport.

MR. MOLLOY: Is that all the questions you have?

MR. TRASK: Yes.

MR. MOLLOY: Are there any other questions for the Air Force from the Panel?

(No response.)

MR. WASTLER: Mr. Molloy, I have a couple of questions from the floor.

MR. MOLLOY: Sure. Why don't you speak them.

MR. WASTLER: What safety precautions will be provided for personnel transporting the crushed drums and personnel at steel plants?

DR. WELCH: The safety precautions that would be provided would be those consistent with the type operation involved. In other words, if it's an American firm that's involved, they would be required, according to the contract, to comply with the applicable occupational safety and health standards.

Beyond that, one really doesn't see a requirement for strong safety measures beyond what would be required to the industry involved.

MR. WASTLER: Does the two-gallon rinse per drum plus the 860,000 gallons just happen to equal the total capacity of the VULCANUS, or was the two-gallon amount for rinse back-calculated from the ship's total capacity?

DR. WELCH: I am told that that's coincidental.

MR. WASTLER: Those are the only questions.

MR. MOLLOY: Thank you.

I am now going to call on Dr. Jake MacKenzie to present a statement of EPA policy, and the summarization of that policy concerning the disposition of pesticide and

herbicide waste.

Dr. MacKenzie is not the author of the document, but he has kindly consented to read it and summarize it for the members of the Panel and to the public today.

Dr. MacKenzie.

DR. MACKENZIE: Thank you, Mr. Chairman.

I would like to submit this statement into the record of this hearing.

I am today representing both Paul Duvall, Regional Administrator of Region 9, EPA, and Deputy Assistant Administrator Edwin Johnson of the Office of Pesticide Programs in Washington, DC.

The Environmental Protection Agency disposal policy for pesticides has been laid out in regulations promulgated under Section 19 of the Federal Insecticide, Fungicide and Rodenticide Act as amended.

This policy states, in brief, in considering disposal techniques the first preference should be given to procedures to recover some useful value from excess pesticides in containers. In light of current shortages of critical agricultural chemicals, including 2,4-D component of Herbicide Orange, and consistent with the need to conserve and reuse our natural resources this policy has been followed in respect to disposal of Herbicide Orange.

To date the following milestones should be noted.

The first series concern the consideration of the option of reformulation, and that would be reformulation of the existing Herbicide Orange with the present levels of dioxin contamination.

First of all, manufacturers were not willing to take the Herbicide Orange back.

Secondly, the Air Force would not dispose of Herbicide Orange by sale to reformulators because allowable levels of dioxin only permitted disposal of 30 per cent of the total stocks.

I should mention here that this allowable level represents 0.1 parts per million of the dioxin contaminant.

Secondly, reformulation of the remaining 70 per cent of the stock containing the higher levels of the dioxin would present unacceptable hazard to public health. Therefore, reformulation was not considered to be a feasible option.

Reprocessing represents the next alternative. The Office of Pesticides Programs was at the time of the decision to consider reprocessing in possession of general information which indicated that the potential for reprocessing did exist, which might destroy dioxin in the

process or concentrate it into readily disposable waste material.

Once reprocessing came under consideration, the Air Force, through DSA, placed an offer for bids to chemical processors for purchase and conversion of existing stocks of Herbicide Orange.

Now, with regard to what has happened since that time, actually three process descriptions in support of bids to reprocess have been submitted. They have been evaluated this month by the Evironmental Protection Agency and Army Evironmental Hyigene Agency technical experts.

One particular process, or one process appears particularly promising. One company proposes to destroy via a selective chemical technique the dioxin present as a manufacturing impurity in Herbicide Orange. The company plans firstly to hydrolize the end butyl esters of 2,4-D and 2,4,5-T with caustic to cause the production of 2,4-D and 2,4,5-T salts and end butynol.

Separation of the acids from end butynol will be accomplished by physical methods involving solvent extraction, distillation.

The 2,4-D and 2,4,5-T acids produced will contain less than 50 percent per billion dioxin, far superior in quality to presently available similar registered Herbicide formulations.

Spent organic solvents containing less than fifty parts per billion dioxin will be incinerated in an approved incinerator.

Aqueous waste streams containing less than 225 parts per trillion dioxin will be trickled through coconut charcoal before treated effluent containing no detectable dioxin (Less than ten parts per trillion) will be pumped to an existing brine disposal well.

Spent charcoal slurry will be combined with the spent organic solvent and incinerated.

In the opinion of the above-mentioned experts, the processors reviewed today appear promising, firstly, in aspects of the 2,4-D and 2,4,5-T recovery, and secondly, in terms of satisfactory destruction of the dioxin contaminant.

However, there were sufficient questions related to dioxin disposal and to in-process destruction aspects which warrant a mandate for pilot studies, and a pilot study would be considered to involve up to 150 gallons of the actual Herbicide Orange I presume via processing.

What would this mandate include? It would include an attempt to confirm process claims, to study the effect of scale up on process efficiencies, to closely evaluate dioxin destruction and disposal, and to obtain an accurate estimate of possible dioxin environmental contamination.

Now, with regards to the timing of this, which is of interest, it is assumed that six months would be ample to allow collection and evaluation of such data. All reprocessors have indicated that upon acceptance of a bid reprocessing could commence immediately.

What other considerations have to be reviewed?

Assurance of quality control over the dioxin content of the reprocessed commercial products;

Probable level of dioxin refuse in waste generated by the reprocessing;

Consideration of safe handling, transportation, storage and drum disposal associated with the transfer and processing of the Herbicide Orange.

Finally, assurance of proper registration of end use products.

In summary, recovery of useful value from pesticides in a disposal situation must be determined to be unfeasible before non-productive (Destructive) means can be considered. In the case of Herbicide Orange reprocessing to recover useful herbicidal value from the 2,4-D and 2,4,5-T components with concurrent destruction of the teratogenic dioxin contamination component appear promising. Pilot plant studies to accurately evaluate the chemical processes involved in reprocessing are required at this time. They probably can be completed in six months. EPA believes the

reprocessing aspect is worthy of additional serious consideration and if feasible it may well be preferred to ultimate disposal. It might well, in light of current estimates, return 2,4-D and 2,4,5-T to commercial channels with lower dioxin content than that currently manufactured.

That ends the summary policy statement, Mr. Chairman.

MR. MOLLOY: Thank you, Dr. MacKenzie.

Are there any questions?

(No response.)

(Following is the text of the report dated April 22, 1975, from Deputy Assistant Administrator, Office of Pesticide Programs.)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SUBJECT: Office of Pesticide Programs
Statement: Herbicide Orange Disposal Option, Reprocessing

FROM: Deputy Assistant Administrator
Office of Pesticide Programs (WH-566)

TO: Mr. Brian Molloy, Hearing Office
Herbicide Orange Hearings April 25/28, 1975

I. Background and Policy

In accord with Section 19-A of the amended FIFRA the Administrator of EPA is required to establish procedures and regulations for the disposal or storage of pesticides and excess amounts of such

pesticides. Initial regulations under Section 19 were published in the Federal Register on May 1, 1974 and additional rule-making is now under final deliberation within the Agency.

The disposal policy embodied in these rules states, "In considering disposal techniques the first preference should be given to procedures designed to recover some useful value from excess pesticides and containers." Under this policy at least 3 useful avenues of disposal can be identified. These are:

1. Use of the excess material for the purpose intended i.e., return of an Herbicide to normal marketing channels in end use Herbicide consumer products under legal EPA labels.
2. Return to manufacturer for potential reuse or processing.
3. Export of the material to countries where use is both legal and desirable.

Only if none of the preceding are applicable is ultimate disposal by non-productive methods considered.

In light of the current situation of shortages of critical agricultural chemicals including the

2,4-D component of Herbicide Orange and consistent with the need to conserve and reuse our natural resources this policy has been followed with respect to disposal of Herbicide Orange. To briefly summarize progress to date the following milestones should be noted:

1. The manufacturers have not shown a desire or willingness to accept the material for return to normal trade channels in their own end use products.
2. Although the Air Force had sufficient data to obtain a Technical Product Registration the material could not be disposed of by sale to reformulators because:
    a. Compliance with allowable level of dioxin (TCDD) in the Technical Product would allow only 30 percent of the Herbicide Orange to be disposable by this route.
    b. For Air Force to formulate end-use products (lowering dioxin content by dilution) would require end-use label registration. Obtaining the data required for such registration

and developing marketing channels for product disposal would be beyond Air Forces capability and would require, in all probability, several years before fruition.

c. Reformulation of Herbicide Orange containing high levels of dioxin would present an unacceptable hazard to the public health. Even were sufficient dilution practical it would be virtually impossible to monitor all reformulated products dispersed by numerous reformulators thus posing an unacceptable risk.

3. Reformulation was considered unfeasible. The decision was made to investigate the next alternative, reprocessing. OPP was in possession of general information at the time of this decision which indicated that a potential for reprocessing Herbicide Orange into commercial products which might destroy dioxin in the process or concentrate it into readily-disposable wastes did exist.

4. Air Force through DSA placed an offering

for bids to chemical processors for purchase and conversion of existing stocks of Herbicide Orange.

II. Reprocessing

Four manufacturers have evidenced interest and three also submitted process descriptions in support of bids to reprocess Herbicide Orange. The basic processes proposed all basically attempt to selectively separate the valuable components of Herbicide Orange (2,4-D;2,4,5-T) by classical chemical methods i.e. solvent extraction, distillation or adsorption with resultant concentration, and partial destruction of dioxin in waste streams (and/or on solid absorbents). The unreacted dioxin impurity would then be disposed of by incineration. The process descriptions have been evaluated by EPA and Army Environmental Hyigene Agency technical experts. In their advised opinion the processes, one in particular, appear promising in aspects of 2,4-D and 2,4,5-T recovery as well as satisfactory destruction of the dioxin contaminant. However, sufficient processing questions were raised, particularly as related

to dioxin disposal and in-process destruction aspects to warrant a mandate for pilot studies (Up to 150 gallon capacity) to be carried out to: (1) confirm process claims, (2) determine impact of scale up on process efficiencies, (3) closely evaluate dioxin destruction and disposal, (4) obtain an accurate estimation of possible dioxin environmental contamination probability in process.

III. Timing

Evaluations by the technical experts have been turned over to DSA with summaries of specific data required to be obtained in the pilot plant operations. It is assumed that six months should be ample to allow collection of such data and final evaluation of reprocessing as a feasible means of disposal to be made. All reprocessors indicate capability to initiate immediate disposal on acceptance of bid. Pilot samples of Herbicide Orange have already been transferred by A.F. to prospective reprocessors.

IV. Other Considerations

In addition to determination of process feasibility, efficiency and time-framing EPA

will also be concerned with, consider, and evaluate various aspects of:

1. Assurance of adequate quality control in the process so that careful monitoring of dioxin levels in commercial products manufactured from recovered materials insures maintenance below acceptable levels.

2. Probable level of dioxin refuse and other wastes generated by the reprocessing. Included in these considerations are possible aerial emissions from smokestacks, if incineration is proposed, contamination via liquid vs. solid refuse incineration resulting from the processes and possible sources of on stream process losses in carbon balance.

3. Consideration of safe handling, storage, and drum (or other container) disposal associated with transfer and processing of Herbicide Orange. Adequate safeguards must be apparent and eventual container disposal executed in such a manner as to obviate environmental risk.

4. Assurance of proper registration of end use products.

V. Summary

Recovery of useful value from pesticides in a disposal situation must be determined to be unfeasible before non-productive (Destructive) means can be considered. In the case of Herbicide Orange reprocessing to recover useful Herbicidal value from the 2,4-D and 2,4,5-T components with concurrent destruction of the teratogenic dioxin contaminating component appear promising. Pilot plant studies to accurately evaluate the chemical processes involved in reprocessing are required at this time. They probably can be completed in six months. EPA believes the reprocessing aspect is worthy of additional serious consideration and if feasible it may well be preferred to ultimate disposal. It might well, in light of current estimates, return 2,4-D and 2,4,5-T to commercial channels with lower dioxin content than that currently manufactured.

s/Edwin L. Johnson
Edwin L. Johnson

MR. MOLLOY: Our next speaker is Manfred Braun.

He is representing the Ocean Cumbustion Service, which is the owner of the vessel VULCANUS.

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MR. MANFRED BRAUN: My name is Manfred Braun. I am a citizen of West Germany, and I am employed by D.D.G. Hansa, a West German Steamship Company, in the capacity of an Owners' Representative for the United States and Canada and I have offices in New York. Ocean Combustion Service in Rotterdam, operators of the incineration vessel VULCANUS is a wholly owned subsidiary of D.D.G. Hansa.

It was my intention to talk about the construction, the capabilities and the performance record of the ship. However, I will not read all of what I have here because I feel that considerable part of it was adequately covered by Colonel Williams as well as Dr. Welch.

The vessel was put in service in September 1972 in Rotterdam as a tanker designed to incinerate chlorinated hydrocarbon waste products which are produced in considerable quantities by chemical industry, and which are extremely difficult to dispose of on land due to the fact that they contain chloride. By burning at sea the otherwise harmful fumes are deposited in the ocean in the form of hydrochloric acid, which the sea can neutralize in considerable quantities by its alkaline components without harm to marine life.

The vessel is constructed as a double hulled

tanker, classed by Germanischer Lloyd and complies with IMCO regulations on the carriage of dangerous chemicals in bulk at sea. Because of her size of 4,768 dwt. she can operate world-wide and is also capable of working in rough weather. I particularly want to mention that because the question was raised before that this ship is liable to sink, something of that nature, whereas in actual working experience she has worked in the North Sea at Wind Force 9, which translates itself into 15 to 20 feet waves, and she does not only keep afloat, she also keeps operating at that kind of weather. She does not shut down her incinerators, not at that Wind Force.

While the next paragraph is about the working procedure on the vessel, I will skip that because it was covered before.

(The paragraph omitted by Mr. Braun is as follows:

She has two incinerators mounted at the stern into which the wastes are fed from her 15 holding tanks. Regular marine gas or diesel oil is used to bring the combustion chambers up to the desired temperature. Only when this temperature is reached will the pumps allow the wastes to enter the chambers. The chambers will then be fed solely by the cargo, but in the event of the temperature falling below the required level, the flow of waste is thermostatically stopped. The average incineration temperature is 1400°C.

Each chamber is fitted with three burners ensuring an even distribution of combustion throughout the chambers. The incinerators are equipped with fans that can supply up to 90,000 cubic meters of air per incinerator to achieve near complete combustion. The vessel is equipped with a control device that photographically records in 15 minute intervals the location of the ship, time and date, temperature inside the incinerators as well as the switching on and shutting off of pumps and burners.)

MR. BRAUN: (Continuing) Since the vessel was put into service, she incinerated a total of 97,400 metric tons of chlorinated hydrocarbon waste in European coastal waters. These wastes originated from Dutch, British, Belgium and Scandanavian industrial plants. Before allowing such operations, the Dutch government conducted extensive monitoring of the vessel, the results of which showed a combustion efficiency in excess of 99.99 per cent. The monitoring report of the Dutch government has now become available and is in our possession. It gives details on the type of monitoring done, techiniques used, analysis made and their evaluation. I am submitting a copy of it for the record.

Actually, this monitoring report consists of two parts, and we have only been able to translate one into English for lack of sufficient time. The second portion of

it I have submitted in Dutch, and we are working on a translation. As soon as that is completed we will also submit that.

In addition, the French government has also conducted extensive monitoring on the vessel and her environment, independent from the Dutch government. The French Ministry of the Environment made these studies in order to formulate legislation on the disposal of such organic chloride compounds. Their findings confirmed the results of the monitoring by the Dutch government, i.e. a near complete combustion efficiency, and no adverse environmental impact. This French report, is also in our possession and I have submitted a copy for the record.

Actually, the translation of this was just finished a few days ago in Washington, and at that time a copy was already given to the Air Force.

The vessels operations in Europe are being carried out under permits of the governments of Holland, Great Britian and Belgium in coastal waters as close as 20 miles from the shoreline of populated coastal regions. This is considered safe in Europe in line with the results of the monitoring done.

In one instance, or in one particular incineration site, incineration is actually done within 15 miles of the coast of Belgium, and that is actually upwind

from the coast. I want to mention this particularly because that might answer a question that was asked before by one of the speakers who wanted to incinerate Herbicide Orange in Washington. I don't see him around anymore, but I think that will answer his question.

During this activity over two and a half years, not a single accident, spillage or complaint about the operation of the vessel or any environmental stress whatsoever has occurred.

The performance record of the vessel further includes the incineration of an additional 16,000 metric tons of organic chloride wastes in American waters for Shell Chemical Company, Deer Park, Texas in the Gulf of Mexico in 1974. This operation was carried out in a federally approved incineration site under the most extensive monitoring of the Environmental Protection Agency, and also Shell Oil Company. I do not have to go into the details of the results, because they have been well documented by EPA. It suffices to say that the results confirmed the findings in Europe with no detectable quantities of unburned residues in the ocean at the point of maximum fall out, a hydrogen chloride concentration at sea level of well below the 5 ppm standard set for workers exposure in onshore industrial plants, a harmless PH variation in the ocean water of well below 0.5, with no adverse impact on zooplankton or phytoplankton, and no adverse

effect of the plume on migrating birds in the area. In short, no environmental stress at all.

The product proposed for incineration near Johnston Island is similar to the wastes that have been sucessfully destroyed by the vessel, i.e. it consists of organic chloride compounds. We have determined that based on the characteristics of Herbicide Orange given to us by the Air Force we will be able to safely handle and incinerate this material. The VULCANUS satisfactorily completed an examination in Rotterdam by the United States Coast Guard after having undergone a nuber of changes to comply with the United States Coast Guard regulations. A letter of Compliance subsequently issued by the Coast Guard to the vessel specifically names Herbicide Orange as a product the vessel is equipped to safely handle in accordance with Coast Guard regulations.

The preliminary requirements for the incineration of Herbicide Orange as indicated by EPA in the Federal Register of March 24 can all be met, and are well within the performance record of the vessel. The National Wildlife Federation has generally supported the concept of ocean incineration of Herbicide Orange, as they had also done withthe incineration of the Shell Chemical waste in the Gulf of Mexico. They have,however, suggested that six conditions be imposed on the permit applicant, as published in the Federal Register of March 24. The first four of these

conditions, which are dealing with combustion temperature, dwell time, fuel to air ratio and excess air, cannot only be met but can be exceeded in accordance with past performance of the vessel. The other two conditions suggested by the National Wildlife Federation are to preheat Herbicide Orange to at least 90°F and to inject the waste into the combustion chambers with a radial slot type rather than a central poppet type nozzle.

As to the preheating, we see no need for it, since the vessel's pumps as well as its burners are designed to handle a viscosity in excess of Herbicide Orange at the ambient air temperature of 80°F prevailing at the proposed incineration site.

As to the type of nozzle suggested, the burners do not have any at all. Instead, the vessel uses a much more efficient rotary burner which atomizes the fuel by centrifugal force through a rotary cup spinning at 5,000 rpm with an excess air supply of 30,000 cbm per burner. This allows to atomize liquids without any hazard of clogging which is the case with nozzles. In our experience this burner is more efficient than any other for the purpose.

We welcome any type of monitoring that is desired to carry out this operation and that is physically possible. I am sure that EPA's experience in this regard is available to the Air Force, and I also have the assurance of

Shell Oil Company to cooperate with the Air Force in sharing their monitoring experience of the VULCANUS made last year in the Gulf of Mexico.

Concluding, I would say if ocean incineration of Herbicide Orange is the disposal method elected for this material by EPA, we believe that the VULCANUS is the proper tool.

Thank You.

MR. MOLLOY: Mr. Braun, I have a few questions.

You say you have never had an accident or a spill of any kind?

MR. BRAUN: That's right.

MR. MOLLOY: How far is the furthest distance off-shore you have gone in the North Sea with the material to be burned?

MR. BRAUN: A hundred miles.

MR. MOLLOY: And how far is it that you go out in the Gulf?

MR. BRAUN: In the Gulf of Mexico, you mean?

MR. MOLLOY: Yes.

MR. BRAUN: That was about two hundred miles. The closest I think was 190 miles.

MR. MOLLOY: How many screws do you have on the vessel for propulsion?

MR. BRAUN: How many screws?

Mr. Braun

MR. MOLLOY: Yes.

MR. BRAUN: One.

MR. MOLLOY: What safety features do you have on the vessel that would tend to assure us that a spill would not occur if you were say five hundred miles from shore?

MR. BRAUN: Well, number one, there are no pumps to -- the way the vessel is designed is that the material is pumped into the holding tanks like a regular tank operation, but there is no pump that can pump it back out unless it goes into the incinerators. There is a possibility to pump it out for safety reasons, but that is sealed or can be sealed if desired by the respective government agency in whichever country this is done.

So, in other words, if anything is pumped out, over board, it would be immediately known by the virtue of the fact that a seal was broken.

MR. MOLLOY: How far can you travel with a full load of cargo, fully fueled?

MR. BRAUN: You mean without refueling?

MR. MOLLOY: Yes.

MR. BRAUN: Maybe Captain Borchers can answer that.

CAPTAIN DIETER BORCHERS: One moment, please.

That's about twenty-eight days.

MR. MOLLOY: What does that translate into miles?

CAPTAIN BORCHERS: That's 250, about 250 miles a day.

MR. BRAUN: So that's about what, 16,000 miles?

CAPTAIN BORCHERS: Two hundred and fifty by -- about.

MR. MOLLOY: Then there is no apparent necessity to refuel on the way from Gulfport to Johnston Island?

MR. BRAUN: No, except that the ship would have to refuel in Johnston Island in order to get back.

MR. MOLLOY: I have no further questions.

If there's anyone else on the Panel?

Mr. Enos.

DR. ENOS: In the last two experiences with the Vulcanus, the question of whether or not the Vulcanus will be underway at the time of the burning to maintain the plume behind the vessel was discussed. Yet, it was my understanding from some of the testimony at that time that there were occasions when the vessel drifted back through the plume. Does this present a hazard? Do you take some overt measures to avoid this? Would you discuss that particular problem?

MR. BRAUN: Well, the vessel doesn't really drift. The vessel is a mobile unit, and has the capability of avoiding just that in proceeding against the wind, which depends on the speed.

I think the speed that we normally use is three to four miles an hour, which is perfectly adequate together with the wind not to get into the plume, and we haven't had any problem with that in the past in the North Sea where the weather is much, much worse than here.

DR. ENOS: So you are underway at all times when you are burning?

MR. BRAUN: We stay out of the plume, yes.

MR. ROGERS: I have some questions, Mr. Chairman.

MR. MOLLOY: Go ahead, Mr. Rogers.

MR. ROGERS: Mr. Braun, we had quite a bit of discussion during the Shell burn about the topic Dr. Enos just raised, and your last response was one of the responses we received during that burn. You said that you stay out of the plume. But are you underway at all times? Do you steam up and are you moving at all times? Because our man on board the Vulcanus testified that while he was on board the ship was not underway.

MR. BRAUN: We generally are, but whether we are in all cases, I think Captain Borchers would be in a better

position to answer.

CAPTAIN BORCHERS: That depends on the weather conditions, what kind of wind you have. Is the wind strong enough? Then it's not necessary to steam.

MR. MOLLOY: Sir, could you identify yourself, please?

CAPTAIN BORCHERS: Yes. My name is Dieter Borchers. I am one of the technical directors of Ocean Combustion Service in Rotterdam.

MR. MOLLOY: I see. You are for the firm owning the Vulcanus. All right. Thank you.

MR. BRAUN: This means, in other words, we are keeping out of the plume. If weather conditions permit to do so by not moving, then this can be done. But if otherwise the ship does move in order to keep out of the plume.

MR. ROGERS: What does Wind Force 9 relate to in layman's terms?

MR. BRAUN: Well, that's the measure in Beaufort of the force of wind, and there is a scale from one to twelve. The twelve is Hurricane, which is the highest, and nine translates itself in the North Sea into 15 to 20 foot waves, the height of the waves.

MR. ROGERS: Has the Vulcanus ever gone to Port during a storm?

MR. BRAUN: Not in that kind of weather. Not at all.

CAPTAIN BORCHERS: Not up to now. Up to now, no.

MR. BRAUN: Not at all.

MR. ROGERS: So you would think it very unlikely that in a Pacific storm you would have to seek shelter or, as implied in some of the other questions, you would have to jettison some cargo?

MR. BRAUN: Unless it's a full-scale Hurricane that presents a real danger, but normal bad weather it is no problem for the ship.

MR. ROGERS: Would you be in more danger with a ship fully loaded than a ship half full in a full-scale hurricane?

CAPTAIN BORCHERS: No. No, it's no different.

MR. ROGERS: So you would not need to jettison cargo in a full storm?

CAPTAIN BORCHERS: That depends on the storm. If the storm is too strong, it's better the ship's going back to the harbor. "Storm" means really, Beaufort 12 and more.

MR. ROGERS: But are you saying you would not foresee any occasion when you would have to jettison cargo, during a Force 11, Force 12 storm?

MR. BRAUN: That is really a problem that would arise if the vessel would be so far removed from any shelter that she would be in any real danger, but all incineration sites that we have been working in, we are so close to shelter, and in addition to that, this type of bad weather, especially a hurricane, is predictable, so that the ship would not move out in order to incinerate in the first place if such a weather condition is predicted or anticipated.

MR. ROGERS: Now, I take it you will steam from Gulfport through the Panama Canal?

MR. BRAUN: Yes.

MR. ROGERS: And into the disposal area. Would you refuel then at Johnston Island?

MR. BRAUN: The ship would have to refuel at Johnston Island, that's right. Yes.

Oh, you mean before the first burn?

MR. ROGERS: Yes.

MR. BRAUN: Yes, also.

CAPTAIN BORCHERS: Yes.

MR. ROGERS: Do you need any special clearance to go through the Panama Canal?

MR. BRAUN: Not any special clearance that we don't have as far as the ship is concerned. I don't believe so at this time. I don't know what we really need because we

haven't gone through the Panama Canal with the vessel, and I couldn't really answer that question what we need in addition to what we have.

MR. ROGERS: You mentioned that you had made changes to meet Coast Guard Regulations?

MR. BRAUN: Yes.

MR. ROGERS: Could you quickly tell us what those are?

MR. BRAUN: It was a number of changes that we had to make. One was the piping system had to be changed, and one thing in particular, which also relates to some of these questions that were asked in terms of safety during loading and escape of vapor into the air -- the vessel had a restricted gauging system, which is not allowed in this country by the Coast Guard. What the Coast Guard wanted was a closed gauging system which permits no release of air into the atmosphere of gasses, and we had to install that. So instead of opening, an outlet at the pipe, we had to install a windowglass type gauging system through which one can see the scale in the tank and read the outage of the tank without opening anything. That was one of the particular requirements of the Coast Guard which was installed in Rotterdam before we got the letter of compliance.

MR. ROGERS: I am unfamiliar with what the

Mr. Braun

Coast Guard jurisdiction is in this area. Do they issue a general certificate of seaworthiness to a tanker such as yours?

MR. BRAUN: They don't issue a certificate of seaworthiness. That's issued by the classification society of the vessel.

What the Coast Guard is concerned with is safety of loading in the United States port and safety of carriage of cargo in United States waters, and their concern in this case was to make sure the ship can safely load this material at a United States port without any possibility of spillage or mishandling or bad handling, and also safely carry it. And those were the conditions that we had to fulfill.

MR. ROGERS: Now, the classification society or group that issues, I would assume the classification, did you receive such a classification, and what is it?

MR. BRAUN: Oh, yes. That's issued by Germanischer Lloyd in Germany as to the seaworthiness of the vessel, and that she -- the classification societies have certain stylets to be complied with and they have certain grades of certificates that they issue, and we have the highest that Germanischer Lloyd issues at all for any type of ship in terms of seaworthiness.

MR. ROGERS: Thank you.

Mr. Braun

One final question, just out of curiosity. What's your freeboard between your fully laden lowest point of gunnel and your fully laden ship to the water? How much --

MR. BRAUN: The freeboard when she is down?

CAPTAIN BORCHERS: One meter and ten centimeters.

MR. ROGERS: That's what, about six feet?

MR. BRAUN: No, it's about three feet. A little more, three and a half feet.

MR. ROGERS: Three feet from the lowest point of the deck to the --

MR. BRAUN: To the waterline.

CAPTAIN BORCHERS: To the waterline.

MR. ROGERS: Thank you. I have no further questions.

MR. MOLLOY: I have one more. I apologize.

Is this a new vessel? You stated it went into service in 1972. Is that when the vessel was built?

MR. BRAUN: No. She used to be a dry cargo ship. We bought the ship and then converted her in a dry dock in Rotterdam. We ripped everything out and put the tanks in and the incineration plant.

MR. MOLLOY: And since it has been under your control, has it ever been disabled in the sea? Whether or not fully loaded or whether or not in a storm?

Mr. Braun

MR. BRAUN: No, it has not.

MR. MOLLOY: Thank you. I have no further questions.

Mr. Biglane?

MR. BIGLANE: Yes.

There was mention expressed in the following line. You mentioned several countries for which you have burned chemical wastes.

MR. BRAUN: Yes.

MR. BIGLANE: Now, what kind of monitoring requirements did these countries assess on the Vulcanus for such burns?

MR. BRAUN: None at all. The monitoring was done initially be the Dutch government, and also by the French government. And when we received the permissions of the other countries, they based themselves on the monitoring experiences particularly of the Dutch government and accepted those. So there is no monitoring done currently, after that.

MR. BIGLANE: Were there any biological surveys or other type of marine-type surveys conducted by the other countries?

MR. BRAUN: By France, yes, and that's part of that report that I submitted today.

MR. BIGLANE: And did they note any damages

Mr. Braun

from the incineration of wastes that you burned in those areas?

MR. BRAUN: None at all. They concluded that there was no environmental stress, and there was only one qualification, and that is, as I recall, that they did not recommend the incineration of wastes with heavy metals.

MR. BIGLANE: Do you recall whether or not any of these countries had similar type criteria in areas of the ocean where one ought to burn or incinerate wastes, that is, areas of low productivity?

MR. BRAUN: I don't think that was a particular criteria, for the simply reason that in Europe we don't have that much space available to move anyplace, and it had to be a site that is practical.

Also, from a weather point of view in the North Sea there is more bad weather as here, and if we would move a thousand miles away, which wouldn't be feasible in the first place, so there were certain priorities that couldn't be rearranged, for which reason it had to be done near densely-populated areas. Not only that, but also very near shipping lanes, which has produced no negative results during the last two and a half years.

MR. BIGLANE: I think the burn that took place in the Gulf of Mexico was about one hundred thirty miles off-

shore. Is that not right, Mr. Wastler?

MR. WASTLER: It's one hundred forty nautical miles, which my instant calculation shows to be about 170 statute miles.

MR. BIGLANE: What's the shortest distance offshore that you have ever incinerated wastes?

MR. BRAUN: Is that a question for me?

MR. BIGLANE: What is the shortest distance offshore?

MR. BRAUN: In Europe?

MR. BIGLANE: In Europe.

MR. BRAUN: Fifteen miles.

CAPTAIN BORCHERS: It's eighteen miles. Correction.

MR. BRAUN: Correction, eighteen miles.

MR. BIGLANE: And was this done with consideration of winds blowing toward the mainland or toward the coast, or was that taken into consideration?

MR. BRAUN: Yes, it was taken into consideration, because that entire coast of Western Europe is in the western wind zone, so usually there is west winds which blow toward the land.

MR. BIGLANE: Was there any atmospheric fallout noted from such a short distance offshore?

Mr. Braun

MR. BRAUN: None to our knowledge, and we would certainly know if there were.

MR. MOLLOY: Are there any other questions?

Mr. Wastler?

MR. WASTLER: I have one point that I seem to be a little unclear about.

I assume there is some mechanism for jettisoning cargo aboard the Vulcanus, isn't there, as a safety measure?

MR. BRAUN: Yes.

MR. WASTLER: Could you tell us what that is?

MR. BRAUN: I would prefer it if Captain Borchers does that, because he is a master marine and he has been running the ship himself. He would be more qualified to specify that.

MR. MOLLOY: Could you come forward, sir, and use the microphone.

(Discussion off the record between Captain Borchers and Mr. Braun.)

MR. BRAUN: It's an emergency regulant marine-type ballast pump that can pump the material from the holding tanks overboard, which is usually sealed if required.

MR. WASTLER: This is connected to all fifteen tanks?

Mr. Braun

MR. BRAUN: Yes, connected to all fifteen tanks by a manifold system.

MR. WASTLER: Is it normally sealed or is there a means for putting a seal on it of some type?

MR. BRAUN: Yes. It is normally sealed.

MR. WASTLER: Okay. Thank you.

MR. MOLLOY: I don't think there are any further questions.

MR. ROGERS: I just have one question I forgot to ask, Mr. Chairman.

Have you ever had an engine failure?

CAPTAIN BORCHERS: No.

MR. BRAUN: No.

MR. ROGERS: Is it a boiler system that you have on the ship?

MR. BRAUN: Diesel engines.

MR. ROGERS: Diesel engines. Thank you.

MR. MOLLOY: I guess that's all.

The next speaker is Mr. James L. Boyland, Deputy General Manager, Marquardt Corporation.

MR. JAMES L. BOYLAND: It looks like I am the last one today.

Gentlemen, I am the Deputy General Manager of the Environmental Systems Division of The Marquardt Company,

Mr. Boyland

and I am here to present a prepared statement by the President of Marquardt. I have submitted copies to the appropriate people. I have an extra one if anybody particular wants one.

I think what I will do is summarize the report, since a lot of it has been incorporated into the Environmental Impact Statement as our comments, and can be referred in the appropriate appendex. I don't remember which one it is offhand.

My name is James L. Boyland, as I said. The statement is prepared in the name of Mr. George Hanauer. He is our President.

What I think I will do is just to summarize some of the key points of the statement, and then read portions of it in the interest of brevity, since a lot of it is going to be rehash as to what's already been discussed.

Primarily, we notice today that there has been a lot of conjectore, but still, as far as I am concerned, have not reviewed data that does specifically establish a combustion efficiency for the VULCANUS. It has been stated that such reports exist, so I will not challenge or concur.

We think that there should be tests conducted on the ship to determine its efficiency.

Our unit was tested at Marquardt under Air Force's supervision. A very thorough test was conducted and

Mr. Boyland

consisted of eight separate runs. We used a total of 1,540 gallons to conduct this test, and it was more than adequate to obtain the data required.

We do concur with the ocean incineration principle, under systems with proven efficiency, and we do not object to research permit being granted to the VULCANUS under restrictions.

We do disagree as to quantity. I do not see a need to burn a complete shipload to obtain data, and there by run two incinerators.

We have, as I will mention when read the report, looked at available literature which is slightly off from the numbers that were given today, but apparently there's fifteen tanks on the ship. We feel that any one of these tanks, whether the smallest or the largest, could be filled with the herbicide, one incinerator used and sufficient data obtained to evaluate how efficient the system is and how well it destroys it without taken the risk of a whole 4,200 tons, I believe it is.

So with that in mind, I think I will proceed through the statements, paraphrasing.

This statement addresses itself to the United States Air Force application for a special permit to incinerate at sea the remaining stores of the compound known

Mr. Boyland

as Herbicide Orange and the Environmental Protection Agency's tentative determination as published in the Federal Register, Volume 40 Number 57.

The Marquardt Company has successfully incinerated Orange Herbicide for the United States Air Force under two separate contracts using the patented Sudden Expansion -- SUE for Sudden Expansion -- burner.

The major objective of the second contract was a joint investigation by the United States Air Force, Marquardt to "Determine the capability of an incineration system to destruct the 'Orange Herbicide' over a range of selected incineration conditions."

Test data demonstrated that the Orange Herbicide was effectively and safely destroyed by incineration. Four of our test runs were done with the slot-type nozzle, which is a different type of injection. The other four were done with the poppet nozzle, which injects a different manner. The four slot nozzles were the most effective, and generated efficiency data of 99.998 percent.

The contract objectives, Summary and Selected Sections of the final report we are including as Appendix A. The full report is included in the Environmental Impact Study.

The United States Air Force stated in both the

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final report for the U. S. Air Force-Marquardt pilot incineration program and the Final Environmental Statement that the purpose of the joint contract was a pilot program to obtain incinerator operational parameters that may be appropriate to a commercial incinerator system.

I think the point -- I will digress a minute. I think the point has been belabored, but I will make it one more time, and that is that two points should be clarified in order to assess that statement.

The first is, the SUE burner used in the subject pilot program is a unique type burner that operates on a entirely different principle than the normal commercial incinerator, the VULCANUS as just described, and that statement is still factual.

The second point is, the SUE burner is a commercial incinerator system in use in industry today. So our system does meet the requirements of the contract as it was stated.

All totally successful incineration runs in the United States Air Force-Marquardt pilot program were made with slot nozzles. Only a SUE burner can properly utilize slot nozzles which inject the fuel at the point of expansion and stabilizes the flame. Therefore, the reported 99.998 percent efficiency is only applicable to a commercial incinerator

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system using a SUE burner, and that's in the strictest technical sense. We are not saying other incineraters can or cannot meet that requirement. All we are saying is, they should be tested.

The remainder of this section of the report is basically our comments as submitted in the Impact Statement, and I will bypass them.

I will reiterate what I stated in my opening remarks. I will read our section of the report.

Available literature on the VULCANUS indicates that the ship has fifteen (15) separate storage tanks that feed two (2) separate incinerators at a rate of 12 metric tons per hour each. Tank capacity varies from 110 cubic meters to 600 cubic meters. I believe the exact number is slightly less than six hundred.

If you translate this in burn hours of Herbicide Orange, you would have 12 hours for the 110 cubic meters and 66 hours with the 600 cubic meters, respectively, using one incinerator. This arrangement lends itself to testing of one of the two incinerators for a reasonable time.

It is our professional opinon that a 12-hour run of one incinerator is adequate to complete the required tests, and that 66 hours is the maximum that can be justified.

In addition to the proposed conditions and the

Mr. Boyland

contingencies stated in the Tentative Determination, we recommend, one, that the quantity be reduced to one tank and one incinerator for testing. We also request that the additional conditions be imposed as follows:

Demonstrate adequate preheat of the incinerator chamber, smooth transition to the Orange Herbicide, and a second smooth transition to a clean fuel for the purge cycle. In other words, demonstrating the preheat that it has been stated the ship is equipped with, demonstrate that it will complete its burn and then demonstrate the shutdown. We were required to do that in our test program.

The second condition is to demonstrate emergency shutdown procedures to simulate a plugged waste fuel line. In this event, a rapid transition to the clean fuel should be made and the purge initiated. This procedure is required to prevent release of raw or partially burned Orange Herbicide to the atmosphere. This condition would occur if the incinerator, in layman's terms, flamed out and the pumps continued to pump herbicide in at a rate of -- I think it's six and two-thirds pounds per second, if I remember the number. No mention has been made so far today as to whether the VULCANUS has ever experienced plugged fuel lines. We have no data on this. This is an interesting point. If the line plugs, the flame goes out and then the plug comes out

Mr. Boyland

and continues to pump, you would release herbicide unless the flame was reinitiated. Therefore, you should change to another fuel to keep the flame going.

The Marquardt Company has no objections to the incineration of Orange Herbicide at sea when an incineration system with documented efficiency is utilized. However, the company does strongly object to data obtained from their SUE burner being applied to an entirely different type of incineration system.

The Marquardt Company does concur with the Environmental Protection Agency's published Tentative Determination with respect to the application to the U. S. Air Force for issuance of a modified, as we defined, research permit pursuant to 40 CFR 220.3 (e) for conducting a test burn of no more than 600 cubic meters -- that is 718 metric tons -- of Orange Herbicide on board the MV VULCANUS at an approved location.

The Marquardt Company is prepared to design, install, check out, and operate a land based incineration system using the SUE burner on Johnston Island. A scrubber system can be incorporated with our land based system, and this would comply with the stated requirements of the Governor of Hawaii.

We appreciate this opportunity to comment on

Mr. Boyland

the Tentative Determination.

It's signed by George H. Hanuer, President of Marquardt.

MR. MOLLOY: Are there any questions from the Panel?

DR. ENOS: Yes.

In determining the efficiency of the incinerator, would you consider that it would be acceptable to use a range of materials, or would you require that the particular chemical under consideration would have to be evaluated each and every time that particular incinerator was to be used?

MR. BOYLAND: I think in the case of something in the category of Herbicide Orange, it should be tested specifically. I think if you established a general pattern, such as has been done with Shell, for a typical waste of a refinery that generates basically the same type wastes over and over again, once it's been tested it should be adequate.

DR. ENOS: Would you consider that the Shell waste would be more difficult to burn, for example, than the Agent Orange?

MR. BOYLAND: We have never handled the Shell waste.

DR. ENOS: On the basis of thermodegradation consideration, would you not consider that something containing

Mr. Boyland

66 percent chlorine would be more difficult to incinerate at 1,400 degrees than some materials which contain considerably lower percentages of chlorine?

MR. BOYLAND: I don't think I could make a determination on that raw data without knowing more specifics of the compositions.

DR. ENOS: Even on a theoretical basis you couldn't make that?

MR. BOYLAND: We could make such a determination if we had the analysis of material. We could run a computer program as to what the by-products of combustion would be. All I know, it's a chlorinated hydro carbon with a heat content somewhere in the neighborhood of 6,900 BTU's per pound.

DR. ENOS: Right.

MR. BOYLAND: That apparently burns. That's been established. Other than that, there is nothing that I could say on that without having a constituent analysis.

DR. ENOS: Thank you.

MR. MOLLOY: Are there any questions on this side?

MR. BIGLANE: I would like to ask a question.

How long would it take you to incinerate the volume of Orange Herbicide that we are talking about here?

Mr. Boyland

Say you had a system going. How long would it take you to incinerate it?

MR. BOYLAND: The part I left out of the statement indicates that the basic unit tested was a 12-inch diameter can. This is a full-scale incinerator. We obtain additional flow rate by adding additional cans rather than building a larger unit. We don't try to scale.

I submitted a letter to Dr. Welch on September 23, 1974, which had a table, and if you assumed that the maximum burn rate, using a 20-can unit, which is 20 12-inch burners operating on two shifts, ten hours a day six days a week, we estimated four months. We gave them a matrix. You can take any type of --

MR. BIGLANE: Maybe I missed something there. Did you say operating on ships?

MR. BOYLAND: On shifts.

MR. BIGLANE: Shifts. Excuse me.

MR. BOYLAND: First and second shift of ten hours each, which is a twenty-hour burn day on six days per week system, which you call a 2-10-6.

MR. BIGLANE: It would take four months to burn?

MR. BOYLAND: The complete stockpile.

MR. BIGLANE: The stock we are talking about,

Mr. Boyland

how long will it take?

MR. BOYLAND: I'm sorry, that's 2,300,000 gallons is the quantity we quoted on them, which is basically a little bit less than the total, I think.

I didn't get your last question, sir.

MR. BIGLANE: Well, I should have asked this question first. How long would it take you to construct a unit?

MR. BOYLAND: Our lead time is out of date at this point. It really right now would depend upon the availability of stainless steel. That would be the limiting factor. I would not be able to answer the question without checking the current mill runs. I don't think we could give an estimate at this point. It's been too long since we checked the job out.

I can tell you what we estimated the job to be a year ago. I'm trying to find the right page.

We would be able to have a complete installed system checked out and institute a -- have completed a training program for the operating crew in nine months. That's from design of the system to installation at Johnston Island, checking it out and training a crew to operate it if the government wished to operate it. That was nine months.

MR. BIGLANE: And then four months to burn?

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MR. BOYLAND: That's correct.

MR. BIGLANE: Then what would you do with the unit after you finished the burn?

MR. BOYLAND: You would then clean it up and break it down for shipment back to the states for whatever disposition was required.

MR. BIGLANE: Thank you.

MR MOLLOY: Mr. Rogers?

MR. ROGERS: Yes. I have a couple of questions, Mr. Chairman.

How much would you charge the Air Force for your services, or is that something that is not public information?

MR. BOYLAND: Well, I haven't heard any -- I prefer not to divulge that in public at this point since it would probably become a competitive procurement, and that would be sort of giving the store away right now.

MR. ROGERS: Very candidly, you are in a position of a competitor to the VULCANUS?

MR. BOYLAND: That is correct. We make no bones about it.

MR. ROGERS: Your objections, it seems to me, are that you feel there are too many things unknown about the VULCANUS's operation vis-a-vis Herbicide Orange, is that

Mr. Boyland

correct?

MR. BOYLAND: That is correct. We concur with a research program to define it similar to the one we did. Our point is, we don't think it takes a whole shipload of material to do a research program.

MR. ROGERS: Where would you burn your one tank load? Where would you suggest the EPA allow it to be burned?

MR. BOYLAND: That is not really in our expertise, and I would prefer not to comment on that. We find nothing wrong with what has been said today as far as the burn sites. We are not qualified to make a judgement on that.

MR. ROGERS: You mentioned that you would propose using a scrubber. Has there been any thought of what you would do with the scrubber wastes that would be generated? And what would those wastes be?

MR. BOYLAND: Well, what you would have is, if you use a caustic scrubbing system, you would then retain the scrubber material, test it as we did at our plant, neutralize once you have run a test to determine there is no material left in the scrubber solution. You could then neutralize it to a neutral pH, and I assume it would be acceptable if you can meet all the requirements to discharge it

Mr. Boyland

into the ocean. If not, it would have to be removed.

We have been able to successfully neutralize any of the scrubber solutions that we have had as indicated in the Environmental Impact Statement, and it was put in our main holding reservoir, which eventually is discharged into the Los Angeles sewer system, and this is very strictly monitored before this is done.

We collected all the scrubber reservoir in special holding tanks and did not release them from the holding tanks until complete analysis was done of the solution and it was neutralized.

MR. ROGERS: Would there be any dioxin in the --

MR. BOYLAND: There was no detectable dioxin in the scrubber solution in our test.

MR. MOLLOY: Mr. Wastler, do you have a question?

MR. WASTLER: Yes, I do.

Am I to gather from your comments that you are not questioning the data already collected on the efficiency on the VULCANUS with regard to other types of wastes?

MR. BOYLAND: We have not reviewed it, sir. We don't have any means of questioning.

MR. WASTLER: Have you, with your incineration

Mr. Boyland

system, tested it on other types of wastes besides Herbicide Orange?

MR. BOYLAND: That is correct, we have. We have burned DDT in a solution of 5 percent and 20 percent kerosene. We have burned hydrozene, toxic hydrozene propellants. We have done other programs for different -- they were not wastes, but we have burned nitrous oxide, for example, as part of another program for the Navy.

MR. WASTLER: And do you get essentially the same type of efficiency, or does it change with the waste?

MR. BOYLAND: We have had the same type of efficiency. The Orange program that we conducted for the Air Force was the most thorough one that we have ever done. There was mass balance done on the flows. It was an extremely thorough approach to the system.

MR. WASTLER: Well, I find myself a little bit at a lost, then. If you feel that your system will operate consistently on different kinds of wastes, why do you feel that the VULCANUS system will operate all right for other kinds of wastes and won't operate satisfactorily for the Herbicide Orange?

MR. BOYLAND: That's not quite what I meant to say. Maybe I did say it.

You asked us whether we had tested other types of

Mr. Boyland

wastes, and I answered, yes, we had and, yes, we had received similar data. We have no reason to believe that the VULCANUS will or will not operate as efficiently. What we are asking for is a test to prove it as we would test any new material before we went to a full-scale program.

MR. WASTLER: You said, I believe, that you would estimate on a land based incinerator on operating at two shifts?

MR. BOYLAND: That's correct.

MR. WASTLER: That is sixteen hours out of twenty-four?

MR. BOYLAND: No, that's twenty hours out of twenty-four.

MR. WASTLER: And then you let your incinerator cool down after that?

MR. BOYLAND: We had assumed a working shift for the purposes of putting together a matrix, of two ten-hour shifts with a four-hour cycle for maintenance if it's required, normal servicing of any of the equipment. You have blowers, pumps and other equipment that has to be serviced. There is no reason to assume you couldn't go on a full twenty-four-hour a day three-shift operation. We just prepared a matrix for the point of planning, and that was the assumptions that we made.

Mr. Boyland

MR. WASTLER: But you would let your incinerator cool back down over that period?

MR. BOYLAND: That's correct.

MR. WASTLER: You would have to purge at each shift, then, wouldn't you?

MR. BOYLAND: No. It would be continuous operation for twenty hours. You would not shut it down at the midpoint, but you would shut it down at the end of four hours. In other words, it's completely automatic system. Your operators are nothing more than on standby and monitoring. So you could change shifts without shutting down the unit. The only continuous operation would be the de-drumming and filling the feed tank to the unit. That is not part of our effort.

MR. WASTLER: But the point that worries me is, if you are operating the incinerator for twenty hours, and it's down for four hours, it must be cooling off during that period of time?

MR. BOYLAND: Well, you mean by that, how long does it take to come to operating temperature? Is that your question?

MR. WASTLER: Well, what I am worried about is, you were talking about unburned Herbicide Orange going out through the system.

Mr. Boyland

MR. BOYLAND: Let me explain how the system operates, then. Our unit is a completely metal system. It comes up to operating temperatures within five minutes on a pilot fuel. You then do a transition from the pilot fuel to the material.

At the end of the cycle, when you initiate the stop sequence, the logic would then introduce the pilot fuel again, cut off the herbicide flow or whatever material you are burning, burn for some predetermined period of time to purge the unit and flush it, and then shut off the pilot fuel. The unit is metal. It would cool down rapidly and can come back on stream in about five minutes.

MR. WASTLER: I see. Well, the VULCANUS, as I remember, it takes about twelve hours to get up to operating temperature, and then it can't be shut down -- well, not rapidly, so I don't quite see why the question of it suddenly cooling off and releasing unburned herbicide is a matter of concern in that type of operation.

MR. BOYLAND: We mentioned that is a fact because it had not been discussed in the meeting so far. If you shut off the feed supply to any unit and there is nothing else being introduced to burn you have a flameout condition, and then you start to cool. If the material is reintroduced then and without an ignition sequence you could release

quantities of the material that you are burning before it flamed up, especially in a system like the VULCANUS. It is a firebrick system thats a long time to heat. You would have a cold wall perhaps when the thing started up again. If you had a plug situation where the nozzle -- or the feed pipe pulgged and then the plug came out and it was reintroduced at some period of time later, I did not hear any discussion as to how the system handled that condition.

MR. WASTLER: Okay. Thank you.

MR. MOLLOY: I have one further question.

In your system are you continuously de-drumming the Herbicide Orange or do you have a very large storage tank?

MR. BOYLAND: We can operate off of a feed tank, and you could run a continuous de-drumming operation and therefore illiminate the requirement for a very large storage tank.

MR. MOLLOY: What system do you have -- do you propose? Do you propose continuously de-drumming or do you propose a very large tank?

MR. BOYLAND: Our discussions with the Air Force at that period of time revolved around a relatively small feed tank on a continuous de-drumming. It would be their decision on how they wanted to proceed. It would not be ours.

Mr. Boyland

MR. MOLLOY: Thank you. I have no further questions.

Are there any more questions from the Panel?

(There was no response.)

MR. MOLLOY: Thank you.

MR. BOYLAND: Gentlemen, thank you.

MR. WASTLER: Mr. Molloy, I don't know whether you consider it appropriate or not, but I would be very interested to hear what Mr. Braun might have to say about this flameout possibility, which I had not heard raised before.

MR. MOLLOY: Yes. Would one of the representatives from the VULCANUS care to comment on the flameout probability?

MR. BRAUN: I really think that this point, though I thought it was covered in previous testimony this morning when the operating procedure of the ship was described, which is what we do in this vessel. We preheat the incinerators with regular fuel that is used for the propulsion of the vessel to the required temperature, which in this case is 1,400 degrees Centigrade, and only then, when that level is reached, is the fuel oil shut off and the waste -- Orange in this case -- is injected into the incinerators.

Now, if anything happens, like clogging of a waste line, of a fuel line, and no fuel is introduced in the

incinerators, then there is an automatic shutoff of all three burners into that incinerator. If the waste is then to be reinjected into the incinerators, this is not done when the line is cleared. In that case, of course, the temperature has gone down in the incinerators. Fuel would be reinjected again, without any waste being injected until that required temperature of 1,400 degrees, whatever the minimum for the particular product is, is reached, and that may take up to twelve hours, depending on how long the incinerator was out of operation. And only then will the waste be reintroduced into the incinerators.

MR. MOLLOY: So then you are saying that there is an automatic shutdown in the event of a plugged herbicide line, and that it cannot start up again then until the temperature has been reached in the combustion chamber?

MR. BRAUN: That is correct, and that affects all three burners in that same incinerator.

MR. MOLLOY: Is that adequate to you, Mr. Wastler?

MR. WASTLER: I just have one additional question.

Am I to understand that this is an automatic control, that when the temperature drops below a certain level the feed cuts off?

MR. BRAUN: That is correct.

MR. WASTLER: Or if the feed cuts off, then the burner shuts down?

MR. BRAUN: That's thermostatically controlled. If the temperature goes down it cuts off automatically.

MR. WASTLER: Have you any idea how long it would take the incinerators to cool, let's say, from an operating temperature of say 1,450 down to about 1,200?

MR. BRAUN: From 1,400 to 1,200?

CAPTAIN BORCHERS: Two hours.

MR. BRAUN: Two hours.

MR. WASTLER: Okay. Thank you.

MR. MOLLOY: Are there any other questions?

(There was no response.)

MR. MOLLOY: Thank you, Mr. Braun.

Our last speaker today, the last one that has indicated that they would like to speak, is Elaine W. Schwartz of Honolulu.

MS. ELAINE W. SCHWARTZ: My name is Elaine W. Schwartz.

I cannot list any academic qualifications, since I have not taken even a junior high school course of physics or chemistry. However, I am a member of the public, and a citizen who has not been gulled into believing that I lack the competency to make a judgement or the right to speak on issues of public importance.

Ms. Schwartz

You are a formidable group, and this has been an instructive day. We have sat here today, technicians and taxpayers, who have produced, used and paid for an abomination against nature and other human beings. It is to our shame that Agent Orange exists.

Will we now compound that by acting hastily to rid ourselves of these chemicals purposely made toxic?

The ocean is a fragile and crucial environment. The peoples of the Trust Territories are human beings to be treasured. We do not really know our ecosystem's recovery abilities. It is our one and only world, and our knowledge is very limited.

Worse, perhaps, we don't even know if we are capable of learning from this deadly lesson before us today whether we will stop doing what we have been doing.

This hearing has been calm, scientific, rational. I would like to speak for outrage and caution.

MR. MOLLOY: Thank you.

Is there anybody else who would like to speak?

MRS. MARGARET SCHMITT-HABEIN: Yes.

MR. MOLLOY: Go right ahead. If you could go to the lecturn and introduce yourself it would help.

MRS. SCHMITT-HABEIN: I introduce myself as a grandmother of deep concern. I have been in the peace

movement fifty years. I was in college in World War 1.

I will never forget the dear friends that I lost in the war in college.

I had an uncle, a Ph.D from Cragburg, who demonstrated against World War 1. I have a cousin who went to the moon.

I am not on this earth this afternoon.

I am awfully proud of the Air Force in taking the lead in this issue and letting me hear this symposium. I am delighted with what I have heard and what I have learned.

I just want to call your attention to a wonderful book. I could name about four hundred in my bibliography, but this one is a recent book. I have had it only about four or five years. I have had five copies. This is the only one left. I had lunch with the author, Seymour Hersh. I think he is a correspondent now for the New York Times; a brilliant man.

I'm not so worried about Herbicide Orange as I am about the V-8 and some of the other things. I am frantic in my worry about the ozone and plutonium.

Eighteen or so years ago, with the American Friends Service Committee under the Quakers -- I'm not a Quaker. You know, George Bernard Shaw gives even hell to the Quakers in his last book called Geneva. That isn't why I am not a Quaker. I haven't time to be a Quaker in my

busy life, and now I have forgotten what I was going to tell you.

But this book is a book I want you all to own and read. And my worry about plutonium is what I wanted to talk about. Eighteen or so years ago when I was filing for the AFSC we demonstrated against the AEC. I have a holy hate for the AEC. They dropped their name of the AEC, but they have just finished a fourth this year underground test in Nevada.

I don't want my potatoes, and wonderful Idaho potatoes, poisoned with plutonium. I love a good baked potato.

MR. MOLLOY: Ma'am, I think you are going to have to stick closer to the point, and we are concerned today with the Herbicide Orange situation. Although we appreciate you concerns about the Atomic Energy Commission, we really have to stick to the point.

MRS. SCHMITT-HABEIN: Well, just work against the AEC, too.

MR. MOLLOY: Thank you.

Are there any other people here today that would like to speak?

MR. WASTLER: Mr. Chairman, there is one question from the floor for the Air Force.

MR. MOLLOY: Would you read it, Mr. Wastler?

MR. WASTLER: "What will it cost the U. S.

Government to burn versus reformulate all the Orange?"

MR. MOLLOY: Dr. Welch, do you have a ready answer for that?

DR. WELCH: No, I don't have a ready answer.

Let me just say relative to the cost of burning it versus the potential impact of reprocessing, we really do not at this point in time have a clear firm answer on that. There are a lot of factors that would become involved. For example, how long it might take for a reprocessor to get ready to carry out the reprocessing, how long it would take him to reprocess it, how much longer we might have to restore it, how much additional transportation cost might be incurred. There are a whole series of things that would go into arriving at the bottom line. We are not far enough along on that particular thing to say what the number would be.

MR. MOLLOY: Do you have any idea of the cost of ocean incineration?

DR. WELCH: Well, I would suspect it's going to be on the order of two to three million dollars when everything is added up, by the time you look not only at the cost of incineration per se, but the cost of de-drumming facilities, transporting material from the storage site to the dock, monitoring. You know, the whole thing, by the time it's all in.

MR. MOLLOY: Thank you.

Mr. Wastler, anything else?

MR. WASTLER: That was the only question.

MR. MOLLOY: If there are no additional comments from the floor --

DR. WELCH: Could I say something before you adjourn, very briefly?

MR. MOLLOY: Go right ahead.

DR. WELCH: We would like to express our appreciation to the Environmental Protection Agency and their Panel for the gracious way they held this hearing, and would like to second the comments that you made this morning to the gentleman from the State of Hawaii relative to the accommodations. I think they are outstanding.

MR. MOLLOY: Thank you. With no further comments, then this hearing is recessed until Monday in San Francisco.

(The hearing was thereupon adjourned, at 3:40 p.m., to be resummed at San Francisco on Monday, April 28, 1975.)

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Reported by:

Reginald D. Knipes, C.S.R.