Mediterranean Environments
Ischia working group 1-3
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BORGESE: The first part of the meeting, on the part of the Minister of Truism, Dr. Matteo Mateotti, whose greetings he was bringing, wishes us full success with our meeting and hopes that we will come to a practical resolution of the problems besetting us. The problem of polution is extremely grave for this country, it has to defend a coastline of 8000 miles and urgent action is indicated. The Minister of Truism is very much interested in what we are doing, they will also come to Malta. The Ministry will do all it can to aid our initiative also finincially and Dr. Mennini concluded again with welcome and best wishes for the success of our work.

BONADUCE: I want to welcome here, at this [words] which is new department to study Ecology. General ecology is a different field and so particularly related with the work and search ~~of~~ from pollution. The posi[illegible]tion of this laboratory which is department of the Zoological Station of Naples is particular because it is between the coast where the pollution is very high and the open Meditterranean. So the sky in the south

side is completely not polluted, to the shore we have pollution especially the Bay of Naples. So, the particular area of the[ ]gives the possiblity to study the comparison between polluted waters and not polluted waters. The work which will be done here and is done partly now is to study all the living organisms in relation with environment. So, particularly in relation with chemical and physical data of the sea waters. We have here the possibility to study the[ ]in the laboratory because we have system of control of temperatures, control of the light, control of the open of the near shore sea waters. We have a thermo-salineograph, we have a special system to collect material and so on. We hope that this laboratory which started about one year ago to work will be helpful also for parties as yourselves. Thank you.

BORGESE: Before turning over the meeting to Lord Ritchie-Calder I would like also to express my thanks to all of you for having come here. It is very gratifying indeed to see such a distinguished gathering in preparation for our

Malta Convocation. The aim of our whole Malta project, as you all are aware, is to be very prudent in what concerns scientific data and basis and very bold as far as proposals for action are concerned. I think we have been, by and large keeping three years ahead of the official schedule as far as ideas are concerned, and I hope we will keep to this idea. I think what we propose action wise, should be looking ahead farther than official governments are in a position to do today.

RITCHIE_CALDER: Well, welcome everybody from me, my exercise this morning is very simple. As Elizabeth has indicated, what we are trying to do is, to prepare material of substance for the Malta convocation in June and to make it as responsible as we possibly can. What I am proposing to do is to, I hope that most of you have seen the paper I have prepared and I will deal with that paper. Not because it has any particular merit, and that's not modesty, but merely because it gives you the sort of picture, the patch and the framework within which we hopre we can produce constructive ideas at Malta

It is the framework, the basis of the kind of thing we would like to present, with some further detail , backing as it were, for the Malta conference. ~~The~~ As has been pointed out in the paper, we set out to; first of all we were in Malta and we were very deeply concerned about the Meditterranean and the whole problem but also we thought it extremely useful to use the Medit. as a model for these things which we keep talking about in large in relation to the ocean. And therefore, it serves these two purposes, serves a very I wouldn't say parochial purpose or local purpose in terms of the interest we are canvassing ~~in~~ at Malta, but it also, I think helps us to focus in finer detail the kind of problems we talk about in general. I was asked by the steering committee to produce this monograph, even elevated by that term in order to do just what I said, and I have had the help of many people here. But, at the smae time, this is not a paper which is in any sense scholarly in determining the end results or the specific aspect, but merely the basis whichI hope will be substantiated.

I started off by trying to get a picture of the Mediterranean which to me as an outsider, as not one who is a hydrographer or an oceanographer , will in fact answer some of the questions or present some of the questions which we would like to focus on. And the first part, where I had at least the benefit of guidance from Mr. Miller, is simply subject to anything you want to do or say about it ; the general picture of the physiographic or oceanagraphical or hydrographical aspects of the Mediterranean. But I hope that it does show up, and I am encouraged by Mr. Millers reaction to it at Wood's Hole I some appects of the matter that certainly wouldn't have occurred to people working on either detailed aspects or those who are dealing with it in the general as well. that is to say that it does , subject to what people here have to say , show that the Mediterranean with its peculiar characteristics presents, to me in writing it, a fascinating picture of oceanic behavior. And particularly in so far as it does enable us in looking at its structure, at its history, and that is very important, because

here we had a admirable opportunity of looking at the sea which had a historical control. The civilization which is now creating the grass problem has been growing up around the Mediterranean for 5000 years. Civilized man or man in process of civilizing has in fact been contributing over these centuries , millenia, to the kind of problems that were looking at now. I would like to get guidance on the structure of the paper and then we'll come down to the parts of the aper.

MILLER: I would like to say something because what the whole tempert of this is, is using the Mediterranean as a model, is it not, and I'd like to inject a ~~note~~ new thought in this I would like to suggest that you include the Red Sea as the Mediterranean. My reasons for this in regard to pollution is that the Red Sea would serve as a blank, as a chemistry blank. After all , for all the argumenta that are put in here , you take the Red Sea and they're not present there. The only possibility of pollution there, at present would be ship traffic through the canal which has been closed

for five years, four years. With respect to the Mediterranean as a model, I have used the line in the past, that what occurs in the larger ocean occurs in the microform which is here in the Mediterranean. IN fact my own interest has begun from the Antarctic and the question of the formation of bottom water in the Antarctic and in association with Paul Chinia of FRance, we found that very similar phenomena were occurring right here in the Mediterranean, and where in the Antartic watching the formation of bottom water was not particularly condusive in terms of climate, Mediterranean permitted you to observe it and in the Winter of 1969 an international group we observed this and it has now become a classical experiment. We saw this bottom water formed off the coast of France and extending from the surface down to the bottom a phenomenon that is peculiar to this water here. There are other areas where this it would be [approached] of me to say that this kind of phenomenon exists until it is actually

but, for instance in Lord Ritchie-Calder's paper here, he mentions the lung system. The southern Aegean Sea in my own opinion, is a very crucial part of the circulation of the Mediterranean, and certainly the Adriatic. The seasonal character of the Adriatic is most important in determining the quality and the kind of water that actually occurs here. Now, one rather important point might be helpful to start off with. One has to subscribe to someting whenever you think about the Mediterranean circulation. I notice that many people think of the water as a product of the run-off of the rivers and rain fall and with this Medit. Sea, this is a rather dangerous thought. I think it is very necessary that you recognize that the Medit. Sea is merely a piece of the Atlantic Ocean. It is a place where Atlantic water goes through a change, and in that change it is then returned to the Atlantic. Actually the loss of water that make the Mediterranean salty is about one meter per year. And in this phenomenon, I propose these latter remarks upon , off the

southern coast of France in the winter. We found that the evaporation there was a gram a day, one centimeter if you will, during the course of this very spectacular sinking of bottom water. On a daily basis that is a very significant amount. So it is important, I believe, to consider the Mediterranean as an entity belonging to the Atlantic circulation, as a bell weather if you will.

RITCHIE: What is the gram a day per ?

MILLER: One centimeter per day.

RITCHIE: Have you any quarrel with the general arguments here? Has there been any violation of scientific fact, as I go along, and also to get as we've got now new ideas to fill it in. The lung system I found extremely interesting because this does seem to lend itself to a very important aspect of pollution, if in fact your lungs are becoming affected in any (to any degree) then this is really important. The other thing, as Miller has pointed out, the question of the river, I found extremely interesting, because one always assumes that great rivers are a very great factor in th

the Mediterranean, that it looke, at the moment, as presented here, as though it weren't. I wonder if anyone has any contributions on that, on the river contribution.

KENNET: One general point, it is not on the scientific content of the paper at all, but is there any plan yet about what would be the overall shape of the package of papers given to people at Malta. This is a description of the Mediterranean and how it works. Will there be a paper corresponding length and importance about the control systems in the different countries, there is a little appendix there on the law, but there is nothing on how the law is administered, nothing on the actual levels of different pollutants in different places round the coast. Will this be the first of a package of papers?

RITCHIE: Now I anticipate just one point and that is that Professor Dupuy has produced the paper, mine was simply and indicative thing and we hope that by the time we get to Malta we'll have a fairly shrewd idea of what the law is and how inopperative it is, in the sense that what exists is not administered. So that will be part of the discussion

at Malta. In fact I put it in here to remind everybody that that is.

ARANGIO: May I simply inject another idea to complete what you said about legislation, problem of national legislation, I think there should be a small paper at least three or four pages, about international law , not only considering national legislation singly in their application and in their effective impact, because one thing is written pieces of legislation and another is how they are applied, more often than not , they're there but when you get to the aplication, especially in the field of pollution, they are very hard to apply.

BORGESE: I would even suggest that more than a description or analysis of existing national and international legislation we should try to come up with some model for international action. I would like to see a kind of model treaty emerge from this and propose it to Malta. I think that on the basis of what we have and what we can commission here and between

now and Malta, we can and should and must produce that. The idea is to keep several years ahead of official action in order to stimulate it.

~~This is the first part of the~~ This is of course, one of five projects that are being run in preparation for Malta. Two of them have direct bearing on what we are doing here and their being developed along parallel lines. One is directed by Professor Dejavenal and it is a forecast of the economic potential for the next ten years and we have an official commission from the United Nations to do that as a private organization. And the other one, which also has a bearing on this particular project is the study that we have undertaken for a proposal for an ocean development tax. Study on that is under way in a number of countries, Professor Dupuy is working on it, Centre national pour Lextro des Ocean there working on it in Yugoslavia, in Brazil and in a number of other countires. All this material might be quite pertinent to what we are doing here as well because maybe in

the end what we can propose is that one measure by which we might effectively fight pollution here is to collect an ocean development tax so we get money to pay for the stuff on an international basis, among all the nations around the Mediterranean. So these two projects certainly will influence the discussion of this project when we get to Malta.

RITCHIE: I apologize that the paper did not get into people's hands in time for them to come with objections or suggestions. Are we on the right track? Does anyone have any observations on the biological part of the paper. I'm looking for guidance for any revisions of the paper that may be necessary.

STIRN: I read the apaper and I would like to say that the major biological problems are very nicely pointed out. I think what is important are the main, the most drastic problems which appear in the Mediterranean, are pointed out a very good guideline for discussion.

RITCHIE: That is what I was aiming to get, reaction didn't

have to be friedly, but also to try and get from this meeting supporting papers of scientific substance. The other question is that of pollution itself. I don't know whether anyone here has got observations to make on the analysis of the content of pollution in the Mediterr anean, what are the contributing factors and the degree that this is involved.

ROS: About the River R.. two hundred pounds of industrial ... which killed about one hundred tons of fish, this date is unsure. Thirteen. Two hundred pounds of industrial... which killed about one hundred tons of fish. In the river maybe is exactly I would like to say in our experience in Lac olonia, we have one spill of five tons of "Biodrine" and it didn't kill more than 50 killograms of fish in the sea. In the river there is big difference in two hundred pounds of ... is not more toxic than biodrine is not more toxic than "andorsofan". Two hundred thousand one river kill one hundred tons of fish. And in Lacolonia we lost five tons of biodrine and kill only twenty or 50 killograms of fish, no more.

All the fish escape and don't die. Three months ago this accident occurred, the Sudanese ship broke in the Lacolonia Bay and lost five tons of biodrine and one ton of Mercury(?) and we have not killed the fish.

HENNET: On the same token, let me say that the German inquiry into the Rhine accident hasn't been able to determine what was the cause, not only what was the chemical but where it came from, whether it was the ship or from the shore. Whether one was so sure that it was androsophine athat one could ignore the findings of that inquiry and be in a position to judge.

FEATHERSTONE: As I am supposed to be here representing the oil industry, perhaps you would like a paper about the operation of the load on top... system which we have. As you know the oil industry has brought this system into operation whereby the tankers which used to discharge their sludge into the sea, now in fact, hold it on board, and this theoretically has stopped indiscriminate discharge of oil into the sea as to about 98 percent. So that at the moment, theorectically, if you didn't have this system, something like 3½ tons of oil, black sludge, would be going into

the sea every year. In fact, something like85 percent of the ships in the sea operate on this system or should operate this system. And therefore the amount of oil going into the sea from this source is reduced, as you say on page 24, to something like a million tons a years, between 800,000 and a million. Now in theory that is what should be going into the sea. We also calculate that so far as the Mediterranean is concerned in 1953, something like eight hundred thousand tons of sludge was deliberately put into the Eastern Mediterranean AIt was a result of the fact of the Suez Canal authority would not allow oil tankers to go south-bound through the Canal with the tankwashings still on board. They regarded that as a loaded ship and charged duties. And therefore, the ships used to discharge this enormous amount of sludge into the eastern Mediterrnaean before going south bound clean through the Suex Canal. And this amounted to about 8 hundred thousand tons , we are resonably certain, a year. With the load on top system we are now down to something of under a hundred thousand tons discharged in the Mediterranean as tank washing and of that hundred thousand

only 4000 can be acounted to ship practicing the load on top system, so if all ships practiced the system there would be less that 5000 tons a year discharged into the Mediterranean. But what I'm getting at is that the effectiveness of the load on top system depends on its supervision and ~~importance~~ enforcement and this is something that the oil industry can not achieve on its own, its got to have government support, although it can do alot. And if you would like a paper from us with some of those facts I'll be glad to see that it is supplied.

RITCHIE: Thank you very much indeed.

MILLER: During the Malta conference wouldn't it be well worth the point of bringing out this remark in terms of when the Suez Canal opens again? That perhaps some provision in charging ship traffic be allowed for.

FEATHERSTONE: This in fact sir, is done, because before the Suez Canal closed for the last time an aggreement had been reached with the Canal authorities to allow us to retain the tank washings on board and also operate the system provided the tank washings

don't exceed, I think it's 1.15 percent of the ships capacity But there is an agreement with the Suez Canal in existence.

RITCHIE: That's excellent. The Is there any sense of outrage about any part of this

BUONOMO: I am part of the Italian ... which is part of the an Association which takes care of the defense of the historic and also natural environment. So we are particularly interested in the part of the relation speaks about danger of oil in the Mediterranean. Giving already as something known by everybody about the danger that is in the Mediterranean, it has been said that maybe within twenty years it will be a dead sea, I would suggest that we should talk also about what is the trend regarding oil transportation in the Mediterranean toward always bigger and bigger tankers. For instance, there is there is a plan for the Bay of Naples, the construction of an oil ... which will give the possibility of mooring to tankers of two hundred tons up to five hundred tons. Two hundred thousand, I'm sorry. Now the danger is obvious that if an accident occurs as lately

tape 2, side 1 two days ago we had news in the papers of Oklahoma, that broke up in two off the shore of North Carolina. There is always the possibility of such an accident in the Mediterranean. Here it would be more dangerous even in the Bay of Naples, so I think the suggestion of Mrs. Borgese that we should be two or three years ahead of what the official governments are doing . I think this would be interesting, something would come up. in preparation for the Malta conference to suggest, for instance, the Italian government to reconsider the construction of the oil terminal in the Bay of Naples, particularly the Bay of Naples.

RITCHIE: I'll make a note of that and I'll ... Is there any way that we could in fact, get a picture of , not just the prediction of what the handling of oil in the Mediterranean is going to be, but what actually what is now being committed. I'm thinking of the main terminals like the Algerian oil field, the Chinettian oil field, and so forth. In addition to the oil terminals, the reception terminals, is there any way we could get a paper on that.

FEATHERSTONE: We could try to answer a specific request, but it is something that would have to be done through the industry as a whole and probably try and go through the oil companies international marine forum that I'm representing here.

RITCHIE: We could get a picture of, as I point out here, a and I think I'm right, largely thanks to the help of public relations, I think I'm right in saying that the traffic, the actual movement of oil in the Mediterranean is as great now as it was when the Canal closed. What I called ferrying as distinct from through traffic is as, at least as great as it was.

DOHRN: I have the date of this in my record which I do not recall exactly now, but I can find it for you. It was when the big showdown occurred between the oil producing countries and the consuming ... Mediterrnaean was on the newspaper gave it and it is around eight hundred million pumps being transported across the Mediterranean every year in 1970. Now this may be 80 million, I can give you the exact figure from

from my records which I have in Naples. This is from earlier this year the broadcast on the proper quantity oil rising from the south where the oil is produced to the north, where it is received, refined and used.

FEATHERSTONE: Well, I can't give you actual figures. In 1963 through the Mediterranean there went 244.6 million tons of oil. In 1966 before Suez shut the figure was 352.4 million tons of oil. Of that 352.4, 154.1 million came through the Suez Canal. In 1970, there is of course no oil through the Seuz Canal, but the total is 332.7 tons of oil, of which 229 came from North Africa, 83.7 came from the Eastern Mediterranean, that's the tap line terminal, 20 million came from the Black Sea. Making a total of 332.7 million.

BORGESE: To come back to the suggestion about reconsidering the thing in Naples, would it not be better if there were international agreement, a model agreement among Mediterranean nations. It would limit the size of tankers.

BLAKE: There is a certain amount of oil to be transported. Is it better to transport it in a too large tanker or a

large number of small ones. If there are a large number of samll ones, you are more likely to have accidents. I don't think anybody can answer the question today, as to which is more hazardous, the few large, or many small. On the question of hazard other than just pollution, I would also point out that a good deal of transportation is increasingly in typified natural gas, as well as crude oil, especially in the Mediterranean, that is extremely dangerous cargo, not pollution, but dangerous. There United Coast Guard has done some experiments combining at least small quantities LNG which is very cold dropped on water or exposed to high orders. Can be very dangerous.

KENNET: I wonder if we could on this question of ...sides and terminals would this be an opportunity to ask the oil industry if they possibly could do some thinking or bring out some figures about what seems to me the crucial point on this now. Its clear that if you've got a large number of small tankers you have more conditions, that if you'd had a smaller number of larger ones; it's clear that when you have a collision involving a large tanker, provided its got large tanks you

get more pollution than when you have a collision involving small tankers. What I would like to see some figures about, and never have, is the amount of pollution one could expect indeed, one has had, from accidents of different types which involve the large tankers with tanks of different sizes. INCO, the International Maritime Consultative Organization, has just come to an agreement subject to ratification that tank size in large tankers shall be controlled. That is the tanks shall not be above a certain size. It will take some years I think for that to work throught into national law which will effect ship yards but in the meantime it would be interesting to know what is the, what facts are available on this question of variable, constant large tanker, variable tank size and pollution.

BLAKE: This of course, has economic factors and what you have to do is trade off with the insurance cost. is what it boils down to.

KENNET: It doesn't boil down to that at all.

BLAKE: I mean in a very broad sense, I'm including the social cost, I don't mean just ordinary Lloyd's type of insurance .

KENNET: The first thing I want to note are the facts; what happens in an accident. Then when you've got that you may come into the fourth dimension which is the insurance company.

RITCHIE: You are talking about the tanks within the tankers.

KENNET: Yes, compartment size.

ARANGIO: I just want to make one small point, as a layman in all of this. With full respect for oil companies, I would not want the Malta Convocation of this meeting to rely too much on interested parties. I mean there are interested parties, they have very respectable interests they have very respectable interests because they are supplying us with essential stuffs. So we all have our cars to drive occasionally, But I think that ship building experts, for instance and technicians or experts in transportation should be consulted too, and should give us some reply. For instance what intrigues me is why tankers break up in two so easily

Why do we have this, It doesn't happen to other ships, It happens to tankers more often, and it happens particularly to the large tankers. Now there must be some reasona and obviously their reason, the reason is that they don't want to spend enough money to make the tankers safer.For the sailors who sail them, and operate them/and for the general public in so far as the population, and pollution is concerned. Could perhaps we find some sort of information on that particular aspect on all these questions; size of tankers, size of tanks, safety of tankers.

DOHRN: LEt me go with pipe lines along the Mediterranean and it will be cheaper and much less hazardous as far as I know.

FEATHE RSTONE : Well I'd just like to say that although I'm here representing the oil industry, the oil industry is not striking a defensive attitude here or anywhrere else on the question of pollution. What the oil industry wants to do is to help, and on this question of the tank sizes, an awful lot of work is being done on this in the oil industry and the ship building industry and the clas-

-sification societies, and of course in INCO. But I do think it would be a little unfair to say, not unfair, but I think inaccurate to say that big tankers break in two very easily because if you take the Sell tankers, begging their leave, the "Macra", they had these two explosions in 200,000 ton ships. One of them sank, but it sank because the engine room filled with water. It didn't break in two. The other sustained the most massive,damage, it was gutted, and yet remained a float, and is being repaired and so did the other ship that blew up, The Kon Harkon, the Norwegian ship. That also sustained massive internal damage, nevertheless remained in tact. And all this is being taken into account.

RITCHIE: As a matter of immediate interest, what was the explanation of the two explosions?

FeaTHERSTONE: Nobody knows, sir. The likeliest is static electricity due to the effects of the jets of the tank washing machines. You know when you wash these tanks you lower a machine in which revolves with very strong jets of water, high pressure jets. And they do generate static electricity. But nobody

as yet proved that they do generate spark with enough energy to flash a hydro-carbon mixture.

MILLER: ... from this static generation, drops of, particularly with respect to cloud formation.

ROS: The incocomity of safety and is speaking about the construction of ships and the roads for the ships, the big tankers. Why not the more important things for the safety of the tankers is the double bottom. It is very expensive, but, the I think the tanks with two bottoms, now the accidents, with the rocks, the little rocks break the bottom and the oil escapes. It would take 10 years for a specific committee of the INCO for the safety of the oil tankers.

RITCHIE: I want to come back to Dr. Dohrn's point about the pipeline. This seems to me to be a very interesting question, but I'm not myself entirely satisfied with the safety of a pipeline. I'm talking comparatively now. What would happen if you had a pipeline as was once intended, from IRAN around to Marseilles, no, its not from Iran, what would be the comparative risk between a pipe= line and a tanker. This is not for the record.

DOHRN: Pipelines have an automatic system locking them up as soon as they leak, I was told and this is where they get out of function, if there is any leak, and they must be repaired of course then there is an interuption. But, finally there spill is ultimately down to very little, and this seems to be also the system by which they make themselves pay in the places where they are already working, not so much under the sea, I think the latest experience is running a pipe across the Nigit from Alot)?) They are operating already, aren't they? And when I think of the Italian Penninsula being completely supplied with a major auto route from the southern tip of Calabria to Milan and Turino, This auto route is being considered, as a wonderful occasion to make a pipeline underneath the same part which the road makes under bridges. Would be very economic, in terms of supplying Continents, from Africa to the North. This of course does not consider any appropriate elaboration of the crude oil, but the idea of saving all the trouble tankers are giving, and yet they are indispensable, we must find a way to clean them. They cannot supply oil in a dirty condition. There's a lot of it behind

which is adding to our propblematics. I-f we think the cost of pipeline across whatever distance, big or small, might solve, I think this is worth going into.

RITCHIE:I wonder if I could ask here, whould you think a short paper, Elizabeth, on the comparative risks, the big and the small tanker, the question of the tanker capacity within the tanker, and the pipeline question. Because I feel if we are going to be critical, implicitly critical, we ought to be constructive as well and therefore we're saying that we must make suggestions where we can learn to live with ~~xxxxx~~ the oil.

STIRN: The difficulty with any such paper I think would be hypothetical because nobody has ever built a pipeline of the type of affinity which exists in the Mediterranean. Nobody knows how to repair pipelines under such conditions, nobody knows how to build them in the kind of depths that exist in the Mediterranean, nobody knows how to put thsse automatic shutoff valves in so that they will be reliable without servicing. I think great depths for many years. Any paper which will be produced on this subject would be highly speculative.

RITCHIE: Well I think it important just to say that, what you've just said. We don't have this kind of knowledge.

STIRN: This type knowledge just doesn't exist.

KENNET: It would be important that whoever wrote it bore in mind the~~s~~ fact ~~this~~, I don't think any government of any nation-state is every going to agree to have 100 percent or even 80 percent of its oil come through one pipeline. Just on simple political grounds, its too easy to shut off.

MILLER: I propose that this pipeline, I believe there has been some consideration of a pipeline across the Mediterranean with some new technique, rather than having it on the bottom, having it suspended from substance and this with respect to some of the phenomena that occurr in the Mediterranean would really be hazardous. It certainly requires a lot of engineering bearing disaster possiblity in mind.

RITCHIE: It is clear that a paper is needed. I think what I'm really saying is that we should...

BORGESE: We have been asked to speak one at a time and announce ourselves.

BUONOMO: Excuse me if I come back to Italian problems for a moment, but leaving apart for a moment the risk of a pipeline underneath the water, I know there is a pipeline from "Anversé" to Genoa. Now what I think would be very easily done, would be to continue to have this pipeline continue through all Italy and arriving in Tarant or Sicily. Now there would be no risk and we would avoid the risk of tankers coming to the port. Now I understand the interest of the owners of the oil tankers, naturally but now a days, fortunately, the idea is growing that we cannot talk any more just in function and profit.

RITCHIE: One of the things that interest me on this whole question of pipelines, which is not just a factuous remark and that is: who carries the major hazard. If you're going to have an oil terminal at Trieste, for example as you have, one also at Tras, as you have. Oil can turn the other way. It seems to me that what you're doing and that what Italy has very substantially done is taken undue burden of the risks of oil. I mean if you've got that amount of traffic feeding in, to a point, now is this a fact of safety. I don't know. It is an interesting one, you might

very usefully do a comparative study of risk. Are you going to concentrate on a major port, with all kinds of safeguards, like Europort, or Antwerp or whatever, or are you going to, as has been said have a delivery point in the gulf of Naples. Quite an interesting picture here.

ARANGIO: Actually, the question at one point is not only technical, I mean the choice whether to use the Este (?) as a head point of the middle European... or Genoa... for a middle European pipeline has to do also with interests of the cities concerned. So the people who had to write the paper would also have to take into account such factor, which would be political, economic and social. Trieste is a city which needs, from the National government, help. One of the helps which have been given is precisely maybe choosing Trieste as a head point. The idea of placing a pipeline as the Italian ... was suggesting which is an idea I would favor, through the Peninsula or along the Peninsula, down to the South, sounds healthy to me from the point of view of preserving the sea, but it creates another problem. So the person who deals with this must take into account these factors, which are not minor factors,

they are extremely important, I mean there would probably be a revolution in Triesete the day you say to them the pipeline is not going to stop in Trieset, the pipeline is going down to Tarranto.

KENNET: There will be no unrest in Trieste, if Trieste had never been told it was going to have a pipeline. We have to watch our words about this and when we get to Malta. Here we're private at Malta, we shan't be. One further point to this paper which I think is going to fall to the oil industry, our friends in the oil industry to produce, I hope it can go very fully into single buoy moorings. These are the very large buoy which you fix a couple of mile off shore in deep water . I don't think you'll even need a port and with your quarter million ton tankers you don't even need shelter, unless you happen to be on the ~~coast~~ north of Norway. The ship just comes and picks up the buoy and discharges its cargo into a submarine pipeline, only a mile or two long, and then comes to the ... installation, whatever it is. The advantage of this is that it takes the ship out of the crowded port thereby reduces the risk of collision, it also stops the crew going ashore and getting drunk. And altogether it seems to me that

if one is seeking to reduce marine pollution by oil in a practicable way, because I do think the Continental pipelines are pipe dreams, if one is seeking to do it in a practical and immediate way, one would olike to go further into the single buoy mooring question and learn whether it may not have great advantages.

RITCHIE: THANk you. Thxx. I find all the points that have been raised strictly relevant to what we are talking about and can we work out somewhere where we can get at least two, I think three papers are what we need, very short papers (I assure you) for this purpose. To bring out the point about, as Wayland has been saying, what are the comparative advantage of big ships against small ships, the comparative risks I mean, and what are the nature of the tanker problem, what is the nature of the pipeline problem and let us see what in fact we can determine from it. Even if we don't make reccommendations, merely to cite the thing would be sufficient.

ARANGIO: Wouldn't it be, Mr. Chairman, a good policy, to determine more or less here, the object of these papers, two or three. I assume there will have to be three, and asking each of the

if I may speak that way, which may be more than two, to present their views, with the help, obviously of their own experts, on the problem. For instance, oil companies would have to come into the picture on all these issues. Such people as Italian Ostra, for whom I have the greatest respect, would have to do the same thing. But not just present vague claims, and vague ideas but stick to facts and also use experts in order to give the Malta Convocation a very fair idea of all the aspects of the problem. Not merely suggest, for instance, that the pipeline reach Sicily, but also explain what would happen with Trieste and so on. Then ship builders, that would come into the picture in one way or another. Each one could deal with the whole spectrum of the issues from their own point of view. Thank you.

STIRN: Also this is not my field, oil pollution, only I would like to ~~express~~ stress, to give a small warning. All the ... was mostly concerned, I understood about protective ... matters, against the oil pollution in the future. Although the oil pollution is very disturbing now I think the discussion of oil pollution should go in two directions, perhaps. One, this future, better methods,

and one in the sense , to deal with the present. My personal opinion, I hope I will have a chance to show you some slides to from that and discuss what we've seen. Incidentally, I was ~~saving~~ sailing the Eastern Mediterranean in 1966 by a small vessel, and in 1966 by a large vessel almost the same route. Although you mentioned the situation might be better now because the Suez is closed etc, I found the situation was much worse in two years, the same that I've seen in ten years in the Adriatic. The oil pollution with no regard, how it is born, by tankers, by pipelines, by harbors,by cleaning... commercials vessels, my personal opinion is that the Mediterranean is always covered with a tiny film, of hydrocarbon matter. There exists also scientific evidence that this is the case. On the other hand there exists the evidence that the crop of the blue fish which used to have eggs just in the tiny surface is almost decreasing in the Mediterranean. So, these are small arguments to give this warning that we should talk also about the situation now which is disturbing. Not only what we will do in the future to prevent. Thank you.

RITCHIE:Thank you very much, that's a very good idea. We'll be coming back to Professor Stirn's points for discussion. Just two points be fore I forget them myself. First of all I think we should, before we finish, decide that we should have at least three papers, short papers, I mean four page papers. We shall simply give the essential arguements of these aspects. The second thing is to know if there is anyone here, a point which struck me very powerfully when I was looking at some of this material was this, and I don't know if there are any chemists here who can tell me;this combination of DDT and oil, hadn't struck me before, and that is there is evidence from the Tyrenean that the molecules of oil and DDT make a much stronger film, much more consistent film than oil or DDT itself, which is a very interesting factor. I don't know whether that is true, but if it is (I have cited it actually), it would be very well worthwhile later on in our discussions to see whether any other combination of this kind are in fact producing different factors than we thought existed. Is it possible, again with the help of our friends from the oil industry or anyone else, to get any kind of picture, not where you're

going to strike oil, but where the amount of oil is going to be struck in the Mediterranean. I think this is one of the things we are short of at the moment, is in fact, any insight into what is the potential of the oil drilling in the Mediterranean. We have the camper thing, but theis there, I'm not asking any industrial secrets, (I wouldn't get them anyway) but if you had some idea of the hydrocarbon potential in the Mediterranean, I think it would be very useful. It was one of the things I fell short of in this paper. Anyone know anything about this? Potential hydrocarbon offshore drilling in the Mediterranean?

ROS: In Spain we found two months ago the hydrocarbon petroleum but the Shell company has not said what exactly the situation is and I asked them, but they didn't know the extent of the time. But I think there are other points, like the North Africa that can make their potential geologically regionsfor ...

RITCHIE: I think so, I actually give the figures from the Shell company.

DOHRN: Didn't the glomer challenger ... people say that the whole of the Mediterranean by and large had oil underneath, it was just a question of going

deeper.

RITCHIE: Yes, but I still want to get that substantiated from Glomer Challenger, we did have that discussion.

BLAKE: If we are going to stick to the facts, we ought to stick to the economic as well as the technical.

RITCHIE: But the point was, the thing that I'm really trying to say, is that we're not trying to spell out a picture of the oil in the Mediterranean, but we're trying to find out whether there is a new factor developing from very large off-shore drillings in the Mediterranean.

HENNET: I can't see that it really matters how much oil there is under the Mediterranean. What then shall we do if we know that fact. It seems to me that what we ought to be thinking about is how you can obtain oil, or rather, how governments can take powers, or what sort of powers they ought to take and what sort of communications they should have, one with another in order to insure that oil is obtained and carried about the world without polluting the seas

RITCHIE: Well, there's another point, Wayland, I think that was

in the back of my mind and that was subject to what our friends from the oil industry say, I really do feel that there is a very strong case to be made for pointing out strategic reserves of oil. Because tat the moment, I think a great deal of this oil should be reserved. One should know its there. The classic case, of course was the channel in Santa Barbara, where you had... they knew it was there, why should they exploit it? you know what I mean, I'm talking now about the national-international aspects of the thing.

KENNET: Well this brings us to a theological division, but I should say why shouldn't they exploit it, that the ... is on the conservation list of resources to say why the y shouldn't be exploited.

RITCHIE: Yes, I take your point, but is there any way we can get these figures,Mr. Featherstone?

FEATHERSTONE: No, I don't think so sir I like to eat three times a day and one way of stopping would be to march up and ask BP where it thinks its going to strike oil.

BORGESE: I understand that in the Black Sea they have made an

find, much bigger than in Norway and Romania.

RITCHIE: No, what I'm saying Wayland, I'm not trying to stop anything but what I do think is that it's rather important in trying to take the measurements of a problem to know what the size of the problem potentially is.

BORGESE: Is it not also that it will interfere with tourism, we see that certainly in Santa Barbara

KENNET: The beaches are interfered with by pollution , not by exploitation.

BORGESE: Well even by exploitation, you get these things in front of you. Certainly the coast of Santa Barbara from the point of view of tourism now that oil is there, it is not what it used to be, there's no question about that.

RITCHIE: And also this big terminal on the Gulf of Naples, that's an amenities question, not just one of pollution.

ROS: We cannot deny the oil companies for the tourism?(?)

RITCHIE: This is a cost-benefit study, I think our friend would have something to say about.

DOHRN: I just thought to ask for the very solid figures, what

is the revenue from the tourist activities in the Mediterranean as compared with the oil transport and refining. I think that the balance will be heavy on the side of the tourist.

RITCHIE: I think this is a provocative issue, worth examining.

BORGESE: I think this is worth another paper, some figures quite apart from the emotional, human problem. From tourism as a main source of income to oil as a main source of income has enormous social and political significance. And I think to make a study of that would be highly useful.

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STIRN(Arangio). I would like to add two considerations. Let's not forget that whoever writes the paper should consider the very high interest which is at stake from the point of view of national state, and their defense, because its very nice to talk in terms of tourism being more profitable than oil, but at one point if you need oil for your defense for instance, or for other purposes, what about it. And a state is very likely, unfortunately, in our times, to pre prefer oil, if oil is essential for defense and other vital national problems, to tourism in spite of the fact that tourism may bring more revenue. First.

The second consideration, the whole problem should be considered in the perspective of the development and production of electricity of power by atomic energy. I have the impression in this there has been, but maybe I'm a layman about it and that's why I'd suggest that something be done with this problem in some paper, I have the impression that many developed countries are installing a few nuclear power stations, as you've done in Italy, for instance, have sort of thought that power stations, nuclear power stations may not be developed so intensively any more, that they better wait and go on with the relying on oil. Now obviously if you substituted oil for another source of energy, then you would be able to make the arguement in favor of tourism, provided you've got the energy from somewhere else. So it is all tied up with national planning on a very large scale.

KENNET: I don't want this to become some sort of theme song from this corner of the table, but as I see it, our Malta meeting is to be about the pollution of the sea. And I think that if we get a lot of papers and ask people to read them on philosophical questions, on oil versus tourism, this might

distract our attention from the real concrete job which needs to be done, which is the framing and devising of regulations and the enforcement of these regulation and economics of enforcing regulations on the people who are ~~using~~ polluting the Mediterranean at the moment. Particularly, it seems to me that the question of the visual impact of off-shore drilling on the beaches and on tourism would really be outside from what we want to do at the Malta meeting. This falls into preservation of the countryside preservation of ancient towns, and also the preservation of the view from the beach. But, I hope we can confine our papers and our work to what pollutes the water and how to stop it polluting the water. Because you know, when it comes to tourism versus oil, tourists use petrol, oil men go on holiday, there is no conflict between tourism and oil, we need both and we're going to continue to have both.

BORGESE: Well, I think there is a conflict, but I think that maybe rather than falling under this project it falls under the economics of the oceans in general. I know that Professor Dejuvenal is teaming with the economics of the amenities, I mean

with the economic value of the amenities, and so I think we might leave it to the other project and concentrate on this project.

RITCHIE. Can I come to another point which I feel that we should give preliminary thought to before we get down to details, and that is the other sources of pollution. The conventional sources of pollution, historically conventional, which in fact is human waste and so forth. This shows us (I should have thought) for our purposes, certainly for mine, in knowing what I am short of, in this paper, more insight into what in fact are inland regulations. You have transnational rivers and so forth and common areas of pollution and the thing that always strikes me is that every country blames the other for the pollution that is being created and I just want to know if there is anything in this paper and again I would ask Professor Dupuy; How far does your paper, which unfortunately I haven't seen, deal with inland regulation of pollution?

DUPUI: My paper is only a tentative paper and I only dealt with four countries. I received information from Israel two days before

I left for Ischia, and I hope to give some additional remarks about other countries before the Malta Convocation.

RITCHIE: Well, thank you very much. We'll come back, we're going to discuss your paper and your suggestions in far more detail at a later time, but I just wanted to know whether in the body of the paper, the nature of pollution part of this, whether we've dealt adequately with the question of the interest of the inland industrial development or domestic sewage and so forth. Was this adequate on domestic pollution. To me, it was a very horrifying piece to write, I must say that. Seems to me there is an enormous, deplorable lack of control in any kind of sewage disposal. Am I right in saying that there is only one sewage plant on the whole coast, one treatment plant. I haven't said it here but only Remeny has a treatment plant. This is frightening when you think of the concentration of population apart from the concentration of industry, quite frightening. I will before the end of the meeting, try to get people here to suggest, not necessarily new papers, I would like to devote attention to existing papers on the local problems which would illustrate what we're saying.

Kennet
XXXXX: There was a very good paper on sewage situation in Italy at the Rome conference in 1968. It would be interesting to see that updated.

RITCHIE: Yes, I worked very largely from that sort of material, I would like to get it updated.

Dolhn
KENNET: I know that Dr. Marchese is supposed to report on Saturday when he is back from Paris... the meeting on nutrification, both his own research work in the sea around Italy for its present state of pollution done for the research council in Rome, and of course the work done in Paris at the Nutrification meeting which will come straight to your attention.

RITCHIE: Well, I'd be very grateful for that and any other indicative material. I feel that what this paper lacks is detail, although I worked from detail, the trouble was I had to enlarge the picture so that I lost the detail, and I think that in the presentation of the annex of this paper for Malta, we ought to have at least two or three reports, detailed, which illustrated and substantiate what I'm saying; updated.

BORGESE:What about the cost of sewage tré-atment plants, are

there facts available, costs of building , cost of running them and how many of them would be ideally needed.

ROS: I prepared one paper about the ... of pollution on the ... coast of Spain, industrial and sea waste with the treatment plants and projects and so I don't know, if it is for here or for Malta Convocation, it is in Spanish, maybe you could translate to English.

RITCHIE: We will ~~ids~~ discuss it in the next three days.

BORGESE: Yes, I think you should summarize it for us.

RITCHIE: And Wayland you ought to know about the cost of treatment.

KENNET: Yes, too much. Whoever is preparing anything for us on cost of sewage treatment, that is domestic sewage treatment, not industrial, I hope you will be able to find someone who is fully conversant with the different biological treatment that is modulation and who experiences the ... which in very many places which is ... tolerable effects, mascerated sewage and two miles out to sea ...

RITCHIE: The other thing is, again, I'm coming to the critism

of the weakness of the paper, and that is the nature of industrial pollution, and that is is this in tact? An adequate picture of the nature of pollution and pollutants?

ARRANGIO: I'm sorry, I had one point of the general content concerning the Malta Convocation on this point. It just occurred to me, Mr. Chairman, that it is difficult getting information on national legislation and what happens within each nation with regard to pollution. I was wondering to what extent it would not be useful to involve directly, in part at least, of the Malta Convocation which would be devoted to the pollution problem, involving directly, or more or less directly the national authorities of the Mediterranean countries, I mean representatives significant representatives of the national offices, authorities which are concerned with the control and enforcement of anti-pollution measures. Whether regarding internal waters or coastal waters. Internal waters, in a physical sense, because this would be the best way of having these people exposed to the necessity for them to vey effective, because I think most of all this, a large part of the problem comes from the fact that

legislation may provide, there may be gaps in legislation I have no doubt about it, that legislation provides; but then when it comes to the important enforcement, they complain, for instance, I know that Italian offices concerned with this matter may complain that they are unable to cope with the necessary controls simply out of lack of stuff. Because there has been this problem of fishes dying in considerable numbers in innumerable rivers and rivulets of Lombardy and Piedmont and Rivento, and they say when we know something when you go there and find out and apply ~~scientific~~ sanctions to the industries which are responsible for what happens, but otherwise we are unable to check on everything, so that they have problems. I think that the best thing might be both to collect information from them and impress them with the necessity of acting and acting effectively and impressing the governments with the fact that one is checking on what one's dependents, their subordinates are doing and or not doing, it might be useful.

RITCHIE: How do we sit about doing that? It seems to me that this is , next to finding out where the oil is, this is one of the

most difficult problems, and that is, how far have we got any access to people who... well, first of all we might have a paper showing how the law is not being applied and this would be an illustration because if you look at the list of laws, as I gave at the back, my summary, it looks rather impressive. You feel that the ground was actually covered. But I'd like to know, for instance, here we've got I think a very impressive basis of law in Spain, how far is it applied?

ROS: NO, no. They're not applied.

BUONOMO: I believe the applications of laws are the main problem in Italy is apparent concerns the same thing happens. There are laws which are not applied. Now there is a ... the government says we have laws which are not efficient which are very old, so we are expected to make new laws which will permit us to fight pollution. I believe this is not true because the old laws we have could fight pollution. So, if it is just waiting for new laws, even if the new laws as in Spain, happens it would be just a piece of paper and not being applied.

ROS: In Spain there are many laws, too many and too many organisms

there is no one place for responsibility, and no one general law for water, like the French law.

RITCHIE: Wayland, speaking from a wealth and depth of experience,

HENNET: But not in Mediterranean countries.

RITCHIE: NO, no...I mean in trying to administer laws that really exist.

HENNET: IN a Nordic context, it is exactly the same, we have perfect laws, I mean if you can identify the gaps in the British laws with a microscope, it has been done and they will be plugged. But the problem is not even to get them enforced, because the tradition in Northern Europe, one is more used to law enforcement the problem is how to determine how to enforce them, how much economic burden to lay on what classes of the community. It is a political problem, what affect on prices, who shall pay, and all these matters come in. Now if we could return to the question you asked, Mr. Chairman, this is an international meeting we're going to have in Malta. I don't know if an international meeting is going to do much to persuade the governments of single countries to apply their own laws. Perhaps a little, if we hit the press saying the

Italian government is not applying its own law from Malta, it may have some affect, but not a very great one. I think that what Elizabeth has said in the beginning of the morning that wehave to do, is to keep three years ahead and to suggest a framework of international co-operation, of a regional treaty if you like which the governments can look at and say this won't do because of this, or this will do, and will work towards it, to remember that we're an international meeting, because I think public opinion within each single country would be far more powerful in obtaining enforcement than anything we can do in an international meeting. That's only my opinion.

BORGESE: I wonder whether national enforcement would become more effectiv if there were international penalties provided. The interest of the government in enforcing its own laws would be far stronger if by failing so, it would incur an international penalty.

HENNET: A point of clarification, do you mean if I live next to a rivulet in the Po Valley which is polluted, I have to go to the head court before I can get righted. Because this would be bad. I want to go the mayor in the town hall.

ARRANGIO: I'm sorry Mr. Chairman, I hope that my colleage will

agree with me. Let's not jump too far into utopia now, we must take care of course of the future and also we must provide blueprints of, I won't say treaty, because it is very easy to draft a treaty we should indicate what the aims of a treaty would be. And I wonder if we can do that if we devote ourselves exclusively to the Mediterranean. It's such a general problem that we might sound rather odd, so far as the legal problem is concerned to treat it at the regional level. In any case, before going into the international arena, we have a problem, ~~de~~ present day problem of pollution and we have national authorities. Lets see what national authorities do and how could they be brought to do more and more effectively, because ~~even~~ that's most essential, even if you have an international convention it is very unlikely that you have such enforcement means of procedure accepted in an international convention, (even in a small place like the Mediterranean, or the more so in a place such a as the Mediterranean) with all the different countries and ideologies and so on, accepted. It is very unlikely that real enforcement on an international level, or penalties as Elizabeth puts it, or even incentives. At an international level ; you would have rules such

as those we have already in some conventions. But the convention will have to rely on the effective enforcement of the rules which on the basis of the convention have been adopted on an international level in order to execute at international convention. So, the key problem is the effectiveness of internal legislation and the effectiveness of international authority for control and enforcement.

RITCHIE: Might I make a suggestion:We have jumped the gun a bit, Let's have a real discussion this afternoon, this is very important and we will discuss the legal aspect, this afternoon.And I think we could do something quite perceptive, not just in outlining what an international convention ought to do. And I think there is something to be said for illustration of problems, and if we could have some way in which we could produce for,example the effect of the Rhone Valley, transnational river, or on the Mediterranean at large. Seems to me in writing this there is a very good case to make for saying what are the regulations up that river which allows this sort of thing to happen. What Wayland is saying is that here is a very big problem. The social

cost is not just the effect of what is happening now, it's the things we haven't done in the past. That is to say that industry for perfectly good reasons,by default have got themselves into a posi-tion where to impose dnow regulations, punitive regulations would in fact,cost them out of the market in terms of the profit. How do you make clear this transfer of social cost. Let's make it lclear they're are being responsible for twhat they've been doing, for the pollution. What are the kinds of things in the future which would prevent this happening. This is not Utopian, but the point is, if you can get industries to foresee what pollution they're creating and as I have tried to do here, not very effective, If you take for example this business, where I think you could make a very good case and (I hope this is going to be done in the economic one) of demonstrating the actual economic cost to the industry of not doing the job properly. The amount of things they're wasting, in terms of quantity is very large seems to me to be a very powerful argument to industry to do something about it.I'm not being very provocative if I say that I hate this word "recycling" because it should have been precycling. They should have known

in advance what the discard of an industry was going to be. So that you wouldn't have to think of recycling. You would have taken advantage of the wealth you were throwing away. And there is a very strong case to be made for bringing out this question of what in fact are people throwing away.

I wonder what I can say constructively now for the rest of the morning. Does anyone have any questions to raise on the paper itself, how it could be altered, improved or re-enforced? BORGESE! I think we got a very good over view this morning and I think it would be useful if we would spend the rest of this morning ahead of us in planning out these next five sessions more profitably. Breaking up the paper into sections and see who has to say what on which topic. I know that perhaps we should reserve Saturday morning to hear some reports of people who are coming from various sessions and discuss what they're bringing to us which leaves us with four sessions, Saturday afternoon will be winding up and drawing conclusions, which leaves us with three sessions. So I think we should plan very carefully what do do during these three sessions. Evidently we have to deal with biological aspects

industrial aspects, hydrographical aspects in all these sections in the paper and maybe we can hassle them out. I would take the legal aspects rather last than first.

PRESIDENT(RITCHIE): Can we reserve the legal aspects till the last because I feel that the legal aspects really derive from the other discussion.

Could I just ask Mr. Miller again to tell me how this first part the whole oceanagraphic, hydrographic part of it could be supported by papers. My references which are not here, and deliberatel not here because I didn't want to extract from people in and/in or out of context and so on without consulting them. Whenever I couldn't rely on my own judgement I would refer to Arthur H. Miller, and

MILLER: Yes I think we should have some kind of bibliography attached to this report, in all aspects. It could be as a supplemental thing so you wouldn't have to carry so much around with you and in fact, it would seem well worth while as future commitment to set up some kind of referential base. Would that not be true? You recall that I spoke to you about an article in the New York Times which started from a completely wrong premise, at

least in my opinion and a lot of others, and so if you have referential material at hand, you are backed up, not just opinion. Appropriate to this though, I threw out an idea earlier this morning about including what might be considered a non-polluted sea in this framework, in other words the Red Sea. One reason for including this is that the Red Sea, a phenomena hydrographically in many respects are ~~phenomen~~ the same as the Mediterranean. In other words, there's a sill at the straits of 'Batomenden' in which water from the Indian Ocean comes in ~~and goes~~ through the Red S ea and goes through this transformation which occurs in the Mediterranean and then it returns to the Indian Ocean. One particular aspects that differs there is that the source of this water as opposed to the source of the water of the Mediterranean while it is surface water it is now water that has been recently up- ... so it is very rich in nutrient material and thus, the Red Sea is a very productive sea. I don't know what fisheries exist there but at least the materials, Dr. Oren can make a comment on this, but it would seem to me that with the draft of pollution, with no appreciable river run off or industrial concern into the Red Sea, that this serves as

a blank; a standard to be used in comparison with respect to the Mediterranean.

OREN: I think that what Dr. Miller says is correct, although the productivity of the Red Sea is limited to its southern part, the northern part is poor in organic production. But if going from the Mediterranean to the Red Sea as a smaller model, there may be a basis for studies, or a baseline for study, there is even a smaller part which is very similar to the Red Sea, and this is the gulf of Akaba which is again connected with the main Red Sea, body of the Red Sea with the silt, narrow and shallow silt water coming in from the Red Sea flowing out into the Red Sea and which is probably as a model even more feasible because it is much smaller. But in principle, also in other organizations which have been talking about the Mediterranean we do include the Red Sea as a part and as a baseline for studies.

RITCHIE: I think that is a very good idea, could we have a discussion later on, I think it is an excellent idea. What about new factors in the Red Sea with the discovery of minerals.

OREN: Well that is a separate item, but there is one factor and that is with respect to the Suez Canal and these larger tankers. I think it is reasonable to suppose that when traffic does begin to flow that it will be deepened and enlarged and that will affect the Mediterranean and in fact you might say that that is the only passage for biological animals to go from the Pacific to the Atlantic otherwise they have to go by a cold water route, which they can't possibly survive.

RITCHIE: One of my most frustrating experiences in my having written this is talking with Mr. Miller about the biological traffic in the Mediterranean and the Red Sea. I didn't have enough courage or information to write about it., Dr. Lloyd

DR. LOYD: This problem of the passage from the Indian Ocean to the Red Sea, to the Medit. is rather well covered lately. There is a big program sponsored by the Smithsonian Institution and two groups, one in India and one in the United States, are very active in this. There have been a large number of papers published lately, I may refer to one paper which I published lately; water and technology on the problem of passage in the Suez Canal. But I think that if

this, this should be included because this is in some aspects, biological pollution of the Mediterranean, by indo-Pacific elements and vice versa.

RITCHIE: You were saying, Rocky that the character before it was even closed that this had happened.

OREN(LLOYD): Historically there exists for a long time a passage but we now find that this passage is much more active than it was in the past because of the silt barriers in the Suez Canal which does not exist anymore and which was a rather solid barrier in the past with the first years of the opening. But there is a lot of material to talk about, the differences of marine biology we could contribute to this talk, and I might also add that we are preparing a symposium during the next international zoological society congress in Monaco in 72, then we will have about a day or two to discuss this problem.

MILLER: This salt barrier when the Canal was opened was very high in salinity and its progressively diminished as salt from the bitter lakes has been leashed out. In 1965 I took ... in the bitter lakes and the salt was no longer there, it was only gypsum

and so the barrier no longer exists. That was a very effective barrier for keeping these species from coming through.

RITCHIE: Is there any difference in level between ? ... There is

OREN: Yes, between the Mediterranean is half a meter higher than the level of the Red Sea and the currents are mainly from the Mediterranean into the Red Sea.Excuse me, it is opposite, it was higher during the Nigh floods but usually the current was from the south to the north.

RITCHIE: Now has anyone here got any insight at all as to what is going to take place now. I did deal with the beaches. Well we'll come back to that again.

ARANGIO: Now there is no doubt that the geographies are important and there is no doubt that any paper that is presented at the Malta convocation should be documented in the sense there should be references and so on, but I would suggest that it is not so much a problem of documentation for the people at Malta, in Malta we will have to read... condensation and then rely on... they can always go home and check on what they read in the papers. The basic thing is the elaboration of the data on the part of the

writers. Don't you have this impression.

RITCHIE: What I'm really trying to do is to make an honest man out of myself and in this sense I want this documentation.

BORGESE: I would like to come back to my proposition and try to organize the next three sessions. I wonder are we going to have treatment of the physical aspects.

OREN: I would like to bring up a point which has been mentioned here and this is pollution from solid materials of the sea and not only discuss the negative effects of pollution but also the positive effects of pollution refering to this one sentence that you have put into your paper about using discarded automobiles and tires to create artificial schools. Which I think is an aspect which should be considered because I think it is one of the few positive aspects of the control and planed pollution. It solves the question of land pollution, especially of approaches to towns because the area covered by old automobile tires is increasing. And a third point which is I would like to stress is also of some social aspects that you can create palces for recreation for sport fishing and

maybe also affect or produce some more spaces for devoting people who have long weekends to spend their time in such kinds of activities rather than in demonstrating or gathering on streets. So I think that three aspects of this one point could be used and stressed and we can discuss this.

BORGESE: The next thing that is important is the present situation of pollution of fish and fish farming. We have several experts here that we want to hear from.Don't you think so?

RITCHIE: Can we deal with this subject now which is the marine-biological side in relation to the effects of pollution on either present or perspective marine biological, economic marine biological development?

KENNET: When you said deal with it now, you mean consider whether or not we should devote one of our two remaining sessions to it.

RITCHIE: Well the point is we're really taking the effects on marine biology in large. We're trying to see what in fact we can put forward constructively either in terms of sea farming, oyster bedding, all that kind of thing which is a matterof concern. Fish farming and what is the effects on marine biology in the

Mediterranean in large and then come down to the specifics.

OREN
HERMETROPOULOS: These are the effects on two things. One is the effect on the natural conditions because farming this is already artificial condition. Because for farming, pollution is positive because what you do is fertilize your ponds or lagoons or whatever you use.

HERMETROPOULOS: I was just going to say that it depends on the kind of pollution you are talking about. In Cyprus we do have adverse effects from pollution. Dr. Oren is quite aware I think of our problem in ... Bay/ We have about 20 percent of the whole fishing grounds of Cyprus polluted by industrial material. Iron oxides, mainly and our production from this area is about 20 percent of what it should be. On the other hand there are positive effects but it depends what you are talking about.

OREN: This pollution is caused by elements or compounds which increase production which cause ultrification and which the other chemical which is pollution from mines which is larger, which are not organic materials ?) but which are suspended materials of solids.

Because what is happening in Malta is polluted from mines, not polluted from the Suez or from some organic matter, in order to increase production. And then I think we should also try to see first, how ultrification of pollution starts and where natural fertilization begins also where it ends. Because we are in the sea, very much concerned with areas of upgrowing(?) which also brings alot of nutrients in to the opossive zone. And this is very possitive in our point of view, but when this same material from the land then we are very concerned about it. We should particularly in the Mediterranean find andefinition(?) where the department should consider pollution and where it should consider fertilization. Because the Mediterranean is a very poor sea(?) Whatever more you introduce into it, in belts of fish, it is possible so I think that I point out a new aspect.

DOHRN: I just thought to remark at this stage of discussion in this field we are behind FAO. They have been dealing with problems of plant cure at the largest possible advantages for sea farming in the East Asian area in November and in our own conference at Rome which I understand reached you only now . There are some

exceedingly interesting papers on this subject of (?) which I think we should insert. Getting the information from the opus of these papers into the discussion or at least their spokesman as (?) may see fit. This is no doubt (?) by them, for us there is a number of articles on the problem.

RITCHIE: I still think that we should have a discussion this afternoon on the marine biological aspects, and I hope that Dr. Ohren will give us the picture that he has been giving us. Because it seems to me that one of our objectives at Malta, should be in addition to throwing up the problem we should also throw up the opportunities. And we can be constructive about this. It will be an informal discussion and then we might get an indication as to where we might get the appropriate material.

BORGESE: Another thing that we haven't touched upon at all, I have two more things: One, would be how to tie in the abatement of pollution with the satellite pollution spotting possiblities.

RITCHIE: I don't know how far we want to enlarge on this in terms of Malta but ~~again~~ again I appeal to Wayland:

is there anything that technologically in this kind of determination we should deal with?

KENNET: I think it is a bit of a gimmick. All one needs is an economic, legal and political system to enforce pollution control. I don't believe there is very much difficulty in finding out where the pollution is coming from or what it is, this is known with comparative ease for 99 percent of it, I should have thought.

RITCHIE: There is one point and this again we might look at, and that is the distribution of pollution, meteorlogical pollution, how far that in fact could be determined, both by aerial surveys the kind of thing that John Wood does, or by satellite. What do you have to say about that, Arthur?

MILLER: Well, the one clear thing about pollution with respect to meteorology is, I think its well accepted now, that the Mediterranean is an air-sea phenomemnon, phenomenon of exchange betweeen the air and the sea. And, in doing so it's what happens at the skin of the sea surface that is so important. For instance, if evaporation were to stop here, perhaps your tourism might change a bit, in fact the whole of Europe might change and of course this is one aspect

that we haven't dealt with here, the chain reaction of natural phenomena, and certainly hydrocarbons affect the exchange between the air and the sea. If you look out there you'll see white caps and the foam and every bubble when it bursts throws something into the air, but what about the tension on that in that might be affected by some change within the skin. I think that in that light the satellite program is not completely a gimmick, it's something that needs to be developed because it can observe the radiation from the sea surface.

KENNET: That would be developed for the purposes of scientific inquiry, not for the purposes of pollution control.

MILLER: Wouldn't it be wise if within our adgenda we do concern ourselves with the weather.

RITCHIE: I do, I think the point here is the important one, that we are dealing with the weather as a system of transport and also the modification of the weather by the interference with ...

BORGESE: I have several suggestions here which seem to me all excellent, one which I have still on my own list, was developing nations and impact of pollution on them and their readiness or

lack thereof to cooperate

lack thereof to cooperate in this thing. Relations with developing nations, it seems to me are always problem number one, and this respect too, the Mediterranean is a kind of a model since we are dealing with highly industrialized and highly industrialized nations here. Another aspect that we ought to go into is nuclear waste, from installations and nuclear ships, whether military or civil. The overall organization of the next three sessions that has been suggested and I think it has been a very good one is that this afternoon we should clean up the physiography and the biology: deal with all of these aspects. Tomorrow morning we should deal with the economics of regional pollution control, actually what is the cost and what would be the possiblity of revenue, because this, it seems to me might be the news of our approach, that we should provide for an economic or financial source to deal with these matters and create an incentive, because I do think that incentives are very much more efficient than enforcement mechanisms or penalties. And that Friday afternoon we would deal with the politics and the law of regional pollution control. Saturday morning then we

would have a few reports from people who are arriving from other meetings and Saturday afternoon we would wind up and draw our conclusions. Quite presicely assign papers that still have to be written and see where we proceed from here. Do you have any comments on this order?

RITCHIE: Have you any other ideas. What I'd like, hopefully, is by the time we finish on Saturday, the fact will be very clear in our mind as to what the character of the discussion at Malta is going to be. This is merely mind clearing, so that we ought to get some quite specific proposals. I don't know whether it involves resolutions or not, but the thing is, we've got to be clear as to what we are presenting in the way of arguements and scope and scale of our discussions in Malta.

DOHRN: But I thought it would be very desirable to come out from the Malta convention an extremely needed and useful round about the whole Mediterranean in more of the developed than perhaps the so-called developing part of it, would be a tiny handbook of the essentials, would be delivered to all administrators to have them guided by an large, how to handle their own practical

problems, before it is too late. This would be in my opinion an enormous help; it would take small effort to get this out of all the Malta Convention into a quickly printed paperback in various languages which I would like to have at hand for distribution in many palces where I have been, it was surprising these very fine people who often were not enough in contact with the events of the day and discussions. But it is a five, ten dollars expense to install their purification(?) for each citizen in their area, and this is a credit which is in reach for them while often they panic because they think," hell, what will it cost." Then of course, there's many other aspects where geography comes in, a few remarks on pertinent papers should be added to it. This could be achieved in Malta, we would definitely be ahead of all the governments around and many many internaional organizations and so on. Whether this then need further additions every year and perfection steps I wouldn't now discuss.

STIRN: In order to avoid some problems I would suggest to you to follow also Dr. Oren's suggestion, at least for this afternoon,

to discuss various large types of pollution, particularly separtely, because it is impossible to discuss scientific as it is impossible to discuss industrial and organic pollution in the same way. And also I would suggest that we discuss , that we don't talk about physical effects on one side and one hour later geological affects, because they are only one effect and this is environment and ecosystem modification or how you would call this. I would rather suggest that you include all scientific aspects of certain kinds of pollution, so classify organic polluion is something completely different from industrial toxic pollution is different from air pollution and is different from radio ~~pollution.~~ contamination and is different from ter.. pollution, so I think this should be classified and discussion would be much easier. But then to discuss organic pollution, lets say or industrial, from all scientific aspects, physical, chemical, and biological because this is complex and it is impossible to do lightly. This is the first remark I had, the second one, I think we are missing the most important chapter

which should be brought out in the Mediterranean or elsewhere in the world. This is a question of regional economical planning ... because the actual problem of pollution is that we are always doing ameliorations instead of planning which part of the coast, which river can absorb certain kinds of pollution, I feel this is the most critical point because the economy is growing in capitalistic countries as well as in socialistic countries without a plan; regional plan. The economy does not know, what nature is giving, what possiblities we have and this I feel is a very large problem and I think it should be started from elementary school, in education from childhood up to the minister; because they are not educated and because of that we have such problems, they are positely low in legislation in all our countries which are never respected. There are not respected in capitalistic countries because the system profit industry would like to get more and more profit out of a certain plant. On the other hand, the same as in socialistic countries because the certain factory will do all possible not to unrest for amelioration because perhaps this factory is on the limit on the directability. I think that the major trouble

is sociological economic one and I think this should be pointed out and I feel the only hope would be, for control of pollution, is regional economical planning done by educated people. We should know what this means. In this case we will not face such discussion...we didn't do this ... of econmical aspects of a certain part of the coast, what this means, not only tourismos if a certain part of the ... is polluted. As you pointed out as one of eastern Mediterranean which is very damaged, this can mean much more that a profit of tourism. It is a question of existance of future generations. Therefore, I'm suggesting that to put in the adgenda a discussion of real possiblities for a large anti-pollution campaign with all possible instruments which we can use. If not, we are just putting some results to show the way

RITCHIE: I very much agree with you, I think that our experience, any of us who are working on this, is the fact that you get people so overwhelmed by the size of the problem that they become disqualified from even thinking about it. We've got to break this down and make it real in terms of not just the interdisciplinary attack on it but this complete sense that you can only ask the environment

to carry so much at natures' cost and I think this is very important. And it is not just the old hackneyed conservationist point of view that you musn't do anything about anything, and we ought to spell it out and I think we could do a very good jog of it. I hadn't thought of this actually.

BORGESE: I think that the importance of planning it is very useful (that you stressed) that I think that planning is the key to the solution of this whole problem. As Ritchie has put it before : precycling rather than recycling. This is a very good slogan. I would like to make one more organizational suggestion, if ~~the~~ these big topics, as we now blocked them out, and distributed them over the remaining sessions is agreeable I think it would be useful although of course the discussion will be free ranging and every topic interlinked with every other, we realize that, nevertheless I think it would be perhaps useful for each session we have two people who would want to speak to a particular aspect of the problem so also, they can give it a little thought in advance, and it might help us to structure our discussion.

RITCHIE: When have reserved Professor Stirn's suggestion? For Friday morning? Well ywould you, Rocky and Dr. Oren, like to shoot off on this, well, what Lord Kennet has now suggested is that we don't try to separate the physiographic and the biological,no, it was Professor Stirn, treat the whole thing this afternoon as a combination of the physiographic and the biological. But this wouldn't involve anyone, it's simply to get the discussion going this afternoon.So, if you two would like to take on this task? I think very much just reminding us of what you've been saying already but then we'll be able to see in in a conjunction of physiographic and biologicalso that we're not getting into compartments.

BUONOMO: Just one thing about planning, I"m a pessimist about it because I think the problem is, to see that is brought to reality what has been planned. Because, for instance, in Italy we ~~are~~ have a plan which is called the 1980 plan as far as the idea of Naples and Solermo was concerned, this plan says that no oil traffic should get into these two areas. Nevertheless, this is something that was just written, and now they are planning the oil

they are building the termin

It is not a poor plan, but after the planning, when the moment arrives for the politicians to bring the plan into reality, then they are the prisoners of economic pressures.

KENNETT: We should discuss this in the political session but it does seem to me that a plan which says that none of the biggest single product imported into a country should come into the principle port of one half of that country is an economic plan of doubtful possiblity.

ARANGIO: I understand very well that it all comes to regional planning; I mean I heard regional planning mentioned, and I agree in theory that this is correct. We should international regional economic planning but, Mr. Chairman, we are still in difficuty to rely both in socialist and not only in capitalist countries to put plans into effect is difficult, once it has been adopted. We have had one example and I think you will find easily some examples in socialist countries. Now, Mr. Chairman we are stepping one step higher than that, and we want regional international economic planning among countries of different economic systems, of widely different economic development, around the Mediterranean. Now I think, Mr. Chairman that I would

watch, just as the last speaker in one of his previous interventions in this discussion, he insisted that we stick to pollution as much as we can, that we do not widen the thing because otherwise we will blow up the whole. We will make it so ambitious that we will not achieve precisely the complete results which were indicated by Dr. Dixon and by our distinguished friend who spoke on this wider context. I tend to agree with him, well actually there is no point ~~we didn't agree~~ for me agreeing on anything, because he mentioned very close relation between the physical and the biological. On this I have nothing to say. But if we reach the state where we must connect the prevention of pollution and the fighting of pollution, ~~then it is~~ and the remedies to pollution ~~then it is~~ with regional international planning, then it is, I have the impression that we have just gone too far, and we will not achieve what we really want to achieve.

RITCHIE: COULD you tell me whether it would be useful to talk about trans-national problems. What I'm trying to get at, is that if you have a situation in which the concerns of two or three different countries in a common basin or something like that, isn't

it possible to discuss that?

ARANGIO: You see Mr. Chairman, look at Italy and France, Italy and France are the two Mediterranean countries, if I'm not incorrect who belong to the European economic community. I mean if there is any planning that they may do about economic policies for the next ten or fifteen years, they are bound to make that planning with the community. At this point then, the Mediterranean problem will become the North Sea problem because there are the Dutch and the Germans involved, and the north of France which is also involved with its Atlantic concerns. So,inevitably the whole thing becomes universal and this is why, do we want to pursue the more limited, the less ambitious aim of doing something as early as possible within the realm of the Mediterranean with regard to pollution, that's one point; the other point is, do we want to achieve the ideals, then Mr. Chairman, I would reply to this, in so far that you have regional economic planning for the Mediterranean, as practically such an integration among the countries which are ... states of the Medterranean sea as to make one

bound up into a community, as closely bound up as the European economic communtiy, which is incredible, which is absolutely in the realm of dreams. I fully respect this, I mean I'm one of those who contend in so far that we will achieve anything about the seas, then we'll have a supernational authority, and I would be ready to sign a treaty as an individual submitting myself and my country to a supernational authority with the whole of the regime of the seas. On the other had I do feel that this is...

BUONOMO: What about recording the laws and the penalties against pollution especially considering that pollution can be caused in a country or in the waters of a country and pollute waters of another country. If each country all along the Mediterranean would bring forthlaws against pollution and the damage of pollution this would work, something that could do.

RITCHIE: Well, this is my point when I was referring to transnational as distinct from international, and this is a very fine point which exists only in my own mind but the point of what I'm getting at is where the inherent laws, the internal laws of the country are not applied. I quoted here where you could have in the Po

Valley the farmers complaining about industrial waste(?) getting into the Po Canal and the same time they're debouching DDT and fertilizer and so on into the Adriatic. Now, it's this kind of thing I had in mind and I think this would be very fertile and very useful to simply ask ourselves, as an exercise, how far can you spell out in very concrete terms, the effect of the internal law on the external. That is to say, where does the duty lie? As a matter of fact, you take a very simple case, I'd like to illustrate, from the application, for example of the nuclear regualtions in the United STates. You can in fact, you can have your four different authorities, each of which is capable of liscencing a nuclear plant, I think I'm right about this. They do it, and then accumulatively, the sum comes out wrong. That is to say, if you've got a river and the atomic energy authority is doing so and so, and your state authority is doing so and so and your county authority is doing so and so, and then each are well within the defined limits on paper, but the some of the pollutants finally come out higher than they should. This is what I'm getting at, unless you get this sense of co-ordination as has been

said, anyone can stop it if they know its happening and this is where you've got to have the exercise, first of all, know what is happening, where do we stand in terms of local regualtions, and so forth, and then see how far that adds up in total effect, say in the Adriatic or in the Provencal Basin. Because if the sum isn't coming out, its what I mean, if wevery-body is doing things on their own without addequate supervision in the total sense of the word. I think it might be a useful exercise to ask ourselves that. That is different from an international convention.

ARANGIO: Yes, I agree with you, but I wasn't speaking of a convention I was speaking of international economic planning at the regional level, this I would consider Utopia. It's not a matter of wording whether you call it international, transnational, I agree entirely with you that one should consider the situation as itsresults from a pluralismor a multiplicity of jurisdictions of national jurisdictions and national legislation, I agree entirely with you and that one should indicate what the dangers whould be. and where one should stop. And one should indicate the necessity

of coordination on a specific point, on a specific issue, on the use of a specific river or for the basin. I agree entirely with you. But what I was concerned with is not be too demanding on governments and in particular not be so demanding as to ask them something which is very unlikely to happen in the course of the next thirty or forty years, namely regional economic co-ordination among a number of countries such as those which are bordering the Mediterranean. This is all I would like to suggest.

DOHRN: I must add to this that I feel very strongly that we do not have the time to wait until the governments are prepared to go and act, whether they want to act or not, we should increase the dosage of pressure by all the speed we can enforce and go and get them to do. They are finally the ones, who can, not we; they must be told and this is our job.

STIRN: Well, once again I think that I have to defend the idea, I have to repeat to state this very clearly. I was talking on the problem of regional economical planning connected with education problems. In this I would like to say that each industrial plant being on the river or on the sea should have a part of this study of

the project before construction and before being approved by governments or ministry, should have a part which is discussed the environmental influences of a certain plant being this municipal discharge of sewage or anything. And what I personally am convinced, that without education from the youngest generation up, this generation will be later on administrating a lot of things, and I feel here is the trouble. My personal opinion is that most of the pollution problem with which we are faced now are not necessary. They wouldn't arise if they would be planned. This case of the Venice If the study would be done before, previously, I think no unreasonable men would establish 75 industrial plants discharging ~~which~~ industrial ... in the lagoon of ~~France~~ Venice, if they would know that one day they are supposed to close the Lagoon of Venice if they don't want Venice submerged, which is now the case. You see what I'm talking about? Probably the influence which will cause a complete disaster in the North Adriatic wouldn't do this in another part of Italy . I think that all possible pressure and all instruments have to be used because our generation will be desolat(?) in the methobolisms(?)of the sea. I disagree with history which

born by journalists on the base of H.. and Cousteau, statements etc. I am not with them I don't think this is necessary but what is true and we have scientific evidence there is for instance, the most dangerous problem of oxygen atmosphere. We have scientific evidence here in the Mediterranean that the ... is decreasing. I will show you in the paper. We are, it is not a question should we blow up the recent construction of economical planning or not planning, or we should blow up the next generation. I mean our historically possiblity of mankind is very large, I mean this should be put in this agenda. My suggestion is the relationship and possible co-ordination between education, because education is the basis of reginal planning in the future.

ROS: I think that all this in all the congress in the last five years, there are maybe ten or fifteen conference about pollution. In all these, we speak about the same thing; the education is necessary, all people agree with this, but this is not practical in effect now. Maybe then in 50 years people with a different education and will be conscience of the danger but I think we are obliged to do something for the next five years, not for the next

twenty-fvie years, for the years following we cannot expect, maybe we can try something abut this but not to expect something practical about regional economic regulation and planning international planning and so it is very difficult for the next. And bit more, the International, For the province for the Mediterranean Sea in Monaco the next month has a reunion of the bureau of the councie for the pollution of the Mediterranean because the councie has the mandate of the FAO and the Unesco to plan the investigation about pollution in the Mediterranean. All the Mediterranean countries are members of the Council of Monaco and I think we must have some co-ordination with our Malta conference and the Council of Monaco.

DEUETROPOULOS: YEs, I was also going to say something about education I believe, of course that it's a long term project and I doubt if we can see the results from education at the moment, it will come in time, but maybe too late. I think it is also another type of education that is missing. It is a sort of, there seems to be a gap between the scientists and their administrators or the governments, its a question of, I think its lack of communication

of stressing the right points to the administrator, in his language, not in the scientists language. I'm talking as a civil servant now and I have to deal with it sometimes, and it usually comes down to weighing things out . Quite often there's a lot of very scientific things, quantitative extrapolations are not sufficient for decision making and maybe this could be discussed.

RITCHIE: It certainly can, because it is one of my main preoccupations is not going back to the primary school and teaching the next generation, we have a tremendous job, even at this moment in teaching the decision makers. It's at various levels, not just at the political level,its in fact at the isolated expertise levels. One of the things that struck me in considering this when I was working on it, what ~~do you~~ the effect of say barrages on the road, you can have. Now this is, you can call it an economic imperative, or anything else you like, but when you put up barrages on the road or any river, you've changed the character of that river and you've changed the whole character of the pollution problem. And therefore ~~the~~ the thing we desparately need to know is an interdisciplinary

approach to this to make sure that the experts know what the impingement of their expertise on other experts. And we are very far short of that. ~~The~~ In Britain, Wayland, we probably get nearere to it than most, in the sense that you do have your public inquiries and so forth. But the thing is its a very difficult problem when you find that your experts have got absolutely completely defensible reasons why such and such should be done and they can make an overwhelming case for it and hyet are ignoring all the other elements in the case. We have one just cited in the case of the deep water ports, they are proposing are rather like this Naples problem, putting a deep water port, likely to, on the Clyde. Now there are tremendously powerful conservation reasons why you shouldn't put that there and yet the whole nature of the economics of the lowlands of Scotland in this case, is going to be determined by this or the lack of it. Now, at this point you cease to be a conservationist, I mean you're not just standing forsquare and saying you must; but, to bring the experts together to see that what is inescapable in terms of economics must be abosolutely in tact with respect to pollution.

Now this seems to me to be one of our biggest problems. At that level it is an emergency, it is the pressure to either do this or do that without regard, without comparative study, your case of Naples. And I don't want to be a sentimentalist about Naples this kind of thing requires a great more study, insight, what not than problably has gone into it. What about that Wayland, is that a good case?

KENNET: It seems to me that everything you've said Mr. Chairman is absolutely true, I keep remembering though, that we are a small meeting who are here really to help you and Mrs. Borgese arrange a big meeting and to chose papers to be written for it and so on, and I very much assented to what Mr. Borgese said right in the beginning about being three years ahead of the governments, and if we are not three years ahead, and this ties up exactly with your example, if we are not three years ahead of the governments, there is no point in meeting, there is no point in spending the money. But in order to be three years ahead, one must know where the governments are. I was very interested to hear from our Spanish

colleague something I didn't know that FAo and WHO had mandated an intergovernmental group in Monaco to do something about the pollution of the Mediterranean. I wonder if there is anybody here who could give us, during this meeting, before we go away, some details about that council; what are its terms of reference, how long will it exist, how far it has gotten with its work. Then we shall know how to place ourselves in order to be three years ahead of it.

OREN: I was asked yesterday by telephone to represent FAO here and I did not get any briefing what I should say, except that FAO is very much interested in being involved in the work of this group and of the conference which will be held in Malta. And they would like very much to have an official invitation to participate. And also this document which was prepared by the World Conference on Pollution is now being updated, and you will have the updated copy sometime in May which will include much more information from all the countries because questionaires have been sent away and many have been received. So in regards to coordination I think that participation of FAO would be useful because most

of the information is in the hands of the people at FAO.

DEUETROPOULOS: I was going to say that... Council of the Mediterranean is also got a working party on pollution in the Mediterranean Sea.GFCM, The General Fisheries Council of the Mediterranean. It's an FAO sort of agency and its undertaking a collection of statistical data on the state of pollution of the Mediterranean Sea at the moment. I think it has circulated questionaires to all Mediterranean countries asking for data and I think probably Dr. Oren is on , maybe the contact of his... country, I don't know.

KENNET: ... OF COURSE ASKING FOR DATA IS THE Sort of thing which must be done, but I hope we shall be way ahead of that.

RITCHIE: Can I produce my axiom? That research can sometimes be a substitute for thinking. That is to say that you are liable to get if you are asking for research all the time where as we I think here, might be doing a bit of thinking ahead of the research, or beyond the research.

~~KENNET~~: Mr. Chairman, if research can sometimes be a substitute

for thinking, thinking can sometimes be a substitute for action.

DOHRN: I wanted to add a little bit of information to the question of Lord Kennet about the Mediterranean Commission of Scientific Research which has agreed to act on behalf of several international agencies for the Mediterranean pollution. It is for the Mediterranean research co-ordination what they have been asked, and it is a year from now, and they have practically started talking about how to co-ordinate possible action by various joint projects and scientists. I don't think they will make much headway if they keep discussing possible plans among them. It is largely a question of national financing behind them which is not under the influence of these representatives of various governments of the Mediterranean in this commission. It was just to sort of ban from here the feeling that we might be brought very far by ...

KENNET: Could I just seek a clarification on that? Is this commission solely concerned with research or is it concerned with the reduction of pollution? These are quite different topics.

OREN: I would like to give some information on the Mediterranean that might be useful, on the organizations. In the Mediterranean we have three international organizations dealing with the sea. The oldest one is the Council for the Scientific Exploration of the Mediterranean which is based in Monaco ; it's chairman is Prince Ranier and its general secretary is Cousteau. This organization has existed since 1919 and it had its 21st assembly in Rome last summer. It consists of about 8 or 9 committees dealing with fish, dealing with chemistry, physics, geology, pollution, bacteriology, islands, maybe some more. It is non-governmental organization and it tries to hear reports on research that is carried out and somehow to co-ordinate. The other organization which exists is the General Fisheries Council of the Mediterranean which is inter-governmental organization attached to FAO. Their meetings also held like this in Monaco every two years where people presented papers and the results of their studies which were discussed. In the last few meetings of GFCM the tactic was changed and more discussion is

done than presenting of papers. This third organization which exists is the Mediterranean Organization for tOceanology and Biology and its Secretary is Dorhn so he can give more details about this.Two organizations, the ICSM and the GFCM, ICSM is the International Council for the Scientific Exploration of the Mediterranean Sea, have, under the influence of the IOC which is the International Oceanagraphic Commission of UNESCO, organized another body which is Co-Ordinated InVestigations of the Mediterranean which was supposed to start last year, co-ordinated and directed studies of the Mediterranean in addition to National studies of the Mediterranean which are carried out. The international Co-Ordinated is Dr. Joseph, director of the Monaco radioactivity laboratory belonging to the international agency for atomic energy. And this CHIM works through two committees. One is technical and one is scientific committee, trying to co-ordinate ship time scientists and so on. Among other things I think also that this matter of pollution has been introduced as a subject of joint study. Since I was not involved in last year's activities, perhaps Dr. Ros can add regarding this committee which he mentioned about pollution.

KENNET: Well, this is extremely interesting to me, was quite unfamiliar to me, but then that's natural because I come from the other end of Europe, and I would like to ask if you can tell us what these committees or their joint bodies, if anything, are doing about pollution control. Now, I base my question on this , the North Sea has for many years been studied by a number of international governmental and non-governmental scientific committees and these bodies, and committees, and councils reports always came to the same conclusion that the North Sea was polluted and was increasingly polluted and the governments ought to prevent the pollution. In course of time, the government did take th first step and there is now a convention which divides the North Sea into national zones within which a specific government is responsible for reporting and dealing with oil pollution on the surface of the sea. That is the first step and it grew out of years of international co-ordinated scientific research. Now, these committees which exists with respect to the Mediterranean, are they yet approaching that step? Do they concede it yet to be among their duties to reccommend action to governments.

OREN: Maybe yes, but they infact have no power whatsoever. There is a duplication of efforts. For instance GFCM deals also with pollution and ICSM deals with pollution, therefore they decided that maybe in future years these two organizations will be united, although in all the international bodies you have to have one which is intergovernmental and you have to have one which is between academies of sciences, to be more independent of governmental policy. I don't think they have the power to implement or to regulate.

KENNET: NO, of course not, nor do the corresponding bodies in the NOrth Sea, but they have reccommended that governments set up an intergovernmental body with power to regulate and this has been done in the North Sea.

ROS: I think that the FAO is theintergovernmental body the next month in our reunion in Monaco the (the Monaco and FAO bodies, international bodies) and I think the opposite of the meeting next month is to do in the Mediterranean exactly the same as ICS has done in the Baltic and the North Sea. International Council for the ~~Preservation~~ Exploration (X) ofthe Sea. This is

the study group of the NOrth Sea is the ICS , the International Council forthe Exploration of the Sea is in Copenhagen, is an inter governmental body , it is the co-ordinator of the study of the North sea. And I think that next month the same kind of body shall be a joint group FAO Monaco, the reunion is next month.

ARANGIO: I make the suggestion that we have on just a piece of paper...

PRESIDENT: That's right. We are getting so lost in alphabeti-sylabic words that I do think that Dr. Oren and Peter would let us have a list of the bodies and also the people we ought to invite to Malta. This is the important thing that we do get representation.

ARANGIO: I can tell you that at this moment there is a meeting in Milan on pollution, I don't know by whom, one in Paris by Richie- ... as I told you which is being attended in place of this one by Dr. Marquetti who will be here Saturday and one in Genoa which is the ... of Genoa in preparation of a meeting which will be next month in the place of Dr. Dupui in Nice. And then next month again there is a meeting in Genoa as I understand. So we arein a high tide

panic-ridden people in administrative, scientific and governmental orders. It would be rather difficult to track down who is doing what, largely it is a great danger that effort is pulverized in this respect. I agree that we should be very critical about the single organizations, their terms of reference, and then between the theory and the practive what have they been doing so far.

RITCHIE: Well I think this is important, I agree with you, we've now produced a new breed which I call polluticians, and we're all of what's liable to become that. It is the in word.

You tell them what pollution is, Wayland.

KENNET: Substances or energy patterns at large in quantities which do or may harm man himself.

RITCHIE: I should have thought that pollution in a simpler term is man-made residues in the wrong place at the wrong time.

If were talking about utrification that is certainly true, I was always taught a lesson by an academic colleague of mine who always used to say, What do we worry about erosion for, everything was created by erosion.

kENNET: Residue...

BORGESE: I think just to conclude this if we see this great number of conferences taking place and the enormous amount of work being done in this area, I think we should keep asking ourselves what is it that distinguishes what we are doing from all that and I come back with what I started out with, that Lord Kennet has stressed several times; we have to stay ahead and that what should make our effort different is that we should provide a model for fighting pollution in the Mediterranean. This, the other institutes certainly will not produce and I think we can.

DUPUI: What about a leagal measure adopted by this interim report many countries ... and I would be very grateful for all the members of this meeting for criticizing it and for giving me some additional information.

FEATHERSTONE: Have we chosen our opening speakers for the three.

RITCHIE: Yes, Mr. Millerand Dr. Oren, so we do getto the physiographic and the biological.

BORGESE: And tomorrow morning we have not selected our speakers yet on the economics of regional pollution control. Who is it that volunteers? I think Dr. Stirn might have something to say and perhaps one of our oil people will have something to say about

that. Mr.[ ] you have been awfully quiet, would you have something to say about the economics of regional pollution control tomorrow? Mr. Featherstone, would you be willing to talk tomorrow morning?

FEATHERSTONE: I will certainly do the best that I'm able to do Mrs. Borgese, but I haven;t come briefed in any detail about the economic...

BORGESE: So we will take Mr. Stirn and Mr. Featherstone tomorrow morning and then we will see where it goes.

And tomorrow afternoon I 'm sure we will want to hear from ... about the politics and law of regional pollution control. And Professor Dupuy would come under that too.That would be tomorrow afternoon we shall discuss his paper, too.

STIRN: May I ask participants to perhaps read quikly through my papers so that we may discuss, and talk once again. If I may have permission to show some slides.

BORGESE: We should start with Lord Ritchie-Calder's paper, and I think we might just as well use this occasion, not all of it, the Herculean work that he has done. We then have divided the field for the sake of our agenda to what basically is the scientific aspect , economic aspect and political aspect. The scientific aspect which we call the physiography and biology of the Mediterranean we want to deal with this afternoon., but seeing that Sidney Holt is arriving later this afternoon and will be available tomorrow, we suggest that we switch and discuss the economics today.

Under the heading of physiography and biology I took one note which I think we could take care of, not only tomorrow but between now and Malta, and that is the point made by Professor Miller that we consider the Red Sea in conjunction, and comparison with the Mediterranean. I wonder whether we need an extra paper on that or whether Professor Miller can give to you the indications as to how to integrate.

RITCHIE: I think it is a separate paper. Quite short, a supplement.

BORGESE: Well, that is the only point I noted down in this context. I f we step over this afternoon to a discussion of the economics

of regional pollution control, I note that this morning we raised the general problem of planning, regional-transnational planning for pollution ocontrol, and here I'd just like to include a few words of my own.

Pollution it seems to me, in a way that is very ... to the arms race. Its' a symptom, an integral part of a system which we cannot lop off by itself, evidently one has to come to grips with the roots of the problem and has to attack the system. This is true for disarmament and arms control as it is for pollution and pollution control. Therefore I think that a certain degree regional-transnational planning, whether it be realistic today or realistic two or twenty years from now, is absolutely essential in coming to grips with the problem. I would not be so pessimistic as some of my colleagues here are about the consequences of this fact, planning, it seems to me, in any case, at the national or international level, must be based on benefits; benefits for those who participate, much rather than on enforcability. You cannot enforce a plan, either on the national or international level, if its not good, or beneficial for those who participate.

There's not much difference between the internaional and the national planners. The argument that since we have not been very succes-sful in enforcing plans at the national level, and therefore at the international level it would be even more utopian or difficult is not a convincing one because the plan, it seems to me, has to be "cogrent" with the area planned for. If the area we are planning for does not make any sense in ecological terms, we cannot plan for it. And therefore planning at the regional level may be even easier at the regional level, or more realistic than planning for a unit for an area that has no longer any ecological reality or justification. So, so much for planning. I think it will turn out to be an essential part of what we have to do, what we have to provide for here.

Within the economics of regional pollution control we dis-cussed this morning, the problem of risks involved a large number of small tankers versus a small number of large tankers, or the problem of many tanks in one tanker, or then the economics of tankers versus the economics of pipelines, and we decided that we might need a paper on this whole complex of problems. Shall

we establish now who will provide us with this paper; Mr. Featherstone or Mr. ..., our oil people.

RITCHIE: How do you see this? The point is I think we want really, we can have one paper which is infact three which would give us the arguments in each case, and then the comparative paper, if you like, the question (I don't know whether its a real question, but I think its one we ought to look at) as between pipelines and tankers. What we want there is factual not just speculative; we ought to have illustrated facts, rather than arguments. What do you think Wayland?

KENNET: Well quite honestly, I say forget about pipelines, there are no facts about pipelines which would illustrate anything.

RITCHIE: Well, I think that's worth saying. We now have got a pipeline mentality, which is you can take oil or natural gas over any distance including the Artic and I think its awfully worthwhile pointing out, interms of what we know about the sea, we don't know enough to allow pipelines, or to consider pipelines.

ARANGIO: Don't you think it would be better to have something more imaginative that just using the facts, wouldn't it be

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better to have the arguments from the point of view, based on data, of course, one would not suggest that any one of the paper writers start pleading for their own cause, without any relation to the facts. I would much more prefer to have the oil companies tell us how they feel all the way through and the before,... of the environment, to give us their view. The readers make up their minds.

RITCHIE: Yes, that's what I had, I don't say you can illustrate the arguments on examples, the sort of thing we had right here this morning, but it seems to me, that implicit or explicit, there ought to be the choice. And whether its a contemporary choice or not a choice, like we don't know enough about pipelines, then this seems to me to be worth saying.

FEATHERSTONE: Well, Mr. Chairman, I certainly said that I'd take it back to the oil companies' international marine forum to look at, but it would be difficult for the oil company as such, to write a paper about this; I'll certainly find out what is written and published and see if there is anything, but one of the basic factors

from the oil companies point of view about pipelines, I think it was touched on this morning, is that if you've got a ship, you can take X tons of oil anywhere in the world in the ship. If you've got a pipeline and its cut off, for one reason or another, no oil. And the oil industry would never abandon its shipping in favor of pipelines because it looses its flexibility and of course, lays itself at the mercy of all the political upheavals which go on anywhere. That is the simple answer to this. But I certainly don't think that the organization that I represent would want to go into print saying this, I'm sure they wouldn't; but, if anybody has done, I will certainly dig the paper out and send it to you immediately.

BORGESE: But I find it quite fascinating why the oil companies should be in agreement with pipelines across nations which after all face the same problems of flexibility, I mean they might prefer trucks or trains, trucks especially, but they don't, they go for pipelins. But then when it comes to place them under the seas, this arguments arises. Politically speaking, the situation is not different.

RITCHIE: What is the difference between a pipeline from Arwitz(?) to Marseilles than between Iraq and Tripoli? I mean you've got the same political thing.

FEATHERSTONE: Actually, sir, I agree, but you would never sacrifice shipping in favor of such pipelines.

RITCHIE: No, I think we're jumping one, we're not abolishing shipping. That wasn't the point; because there has been a lot of very interesting discussion about trans-Mediterranean pipelines because I was in this from the days of the first oil strikes in Algeria when they were really seriously talking like that. I'd like to see it specified, I'd like to see it taken account of I don't know whethere there is any relative cost, of shipping or pipes or, and I should think that the relative cost would include usage; ships you can switch, ships you can put on another route and so on. And are you tied up with a pipeline to the point where the usability of the pipeline is an economic factor.

FEATHERSTONE: So far as I'm aware, the latest economics, I mean economic estimates have been made on every pipeline, every conceivable range of pipeline, but the latest economic estimates have

been done on the Sumed line, the line from Suez to the Mediterranean, which is now being backed by the British government and a lot of major oil companies who are going in for it, as I understand it, economically, this is a very viable thing. Which means you get your pipeline and you keep your shipping. I works both ways.

PRESIDENT: Does this apply, Dr. Oren, to the N... pipeline as well?

OREN: Yes.

BUONOMO: It is not a question of convincing the oil companies to give up oil tankers, just that for the Mediterranean, it could be necessary to ban the tankers.

RITCHIE:And the point which was raised by Lor| Kennet and that is your bouy, what I think of as your oil stand pipe in the deep sea, that should be brought in too. In fact we're looking at the future traffic in oil.

DOHRN: We need to take up the new oil findings and intermedia which seem very important and consistant for Japan because Japan otherwise has a far distant mileage to cover with its tankers and there

is a possiblity even of the China Sea supplying oil to Japan in pipes. And the other fact I want to mention, this is not to be forgotten, is the big powers like Russia are trading its oil and gas against pipes from Manisman? In Germany roughly, there is a big supply from Germany going into the Russian economic system, which I think is token demonstration that there must be an economic advantage in laying pipes. This is in addition to the aspect of biology in the Mediterranean which presses us to find a way round the problem of cleaning the tankers inside the Mediterranean. We will not get the Mediterranean back to its normal biological health unless the tankers are replaced somehow. If we have tankers we must clean them. If they must be cleaned its only the Mediterranean which receives their dirt and therefore even the climatic consequences mentioned by Professor Miller are a threat which is again an economic figure. Now this is all very tentative, what I am trying to outline, but it gives you a background.

RITCHIE: Peter, did I understand you to say that the Indonesians have a pipeline?

DOHRN: No, they found a lot of oil there. There are three thousand islands so it is the idea that one island is the bridge for the pipeline to the next one, to the next one to the next one... shortening the tankers and replacing the tankers which have a difficult navigation and of course it is the Japanese interested mainly in this.

BORGESE: Well, as far as the washing of the tankers is concerned as Dr. Featherstone told us this morning this might conceivably be avoided, eliminated, reduced to practically nothing with an additional cost. But, at any rate I do think we need a piece on what you call the oil traffic in the Mediterranean and I wonder who would provide it.

RITCHIE: Is there anyone we know who has done this kind of thing.

KENNET: I wonder if we really do need more than what Mr. Featherstone has offered, mainly to, having heard this discussion and knowing what is in people's minds and what we need, to look up the printed material and put it together.

RITCHIE: Be useful to have it. I take your point that the oil companies wouldn't like to go on record as having taken a flat

out position, but we might find a way round this.

BORGESE: Another peice that we decided we ought to have or at least more information was on the cost of sewage treatment.

RITCHIE: You've got material on sewage treatment.(Speaking to Ros) Wayland, have we got any standard material on cost?

KENNET: Oh yes, we've got a hundred years of literature on this matter. I wonder though whether these people who come to this meeting will want to know the cost of sewage treatment. It's a very standard, very widespread technology, very widely diffused throughout the world. Could it not be taken as read?

RITCHIE: I'm afraid not, not in the context of our approach at the manner, and that is having the man of affairs as well as the scientist. I think it could be quite useful to point out as somebody suggested, I think it was Peter was saying that if you would indicate what at local level, at such and such a level, the extent of the sewage committment would be. I agree you don't want a vast documentation on it; the question is that if somebody decides to have a treatment plant, what it would cost.

OREN: I think that we could provide such a, not estimate, but actual cost of a sewage treatment, because Israel has municipalities treating all the water, for many years already, although the water is not reused, nobody wants to buy it except for some agricultural purposes. But there is three years of experience.

RITCHIE: I know, I wasn't looking towards you but I was thinking about Israel. This is a very compact.

KENNET: Do we have any money for promotional work? Well I can get hold of some young person in the library of the relevant professional institution in London and get them to do it in their spare time, to make up short papers.

RITCHIE: Bearing in mind what Professor Oren has already said, that in Israel there is a very compact system right through the word I try to avoid; recycling.There's a budget which almost accounts for every molecule of H20,

OREN: ..... municipality has its own plant and treats all the water of the town which is about 200,000 inhabitants and industry. Complete treatment of sewage water.

KENNET: So does every major city in the world.

DOHRN: Professor Media who is due here on Saturday is one of those making estimates for various administrations in Italy of their sewage "depolation" plants and he gave me over the telephone and address of a firm in Germany who has a representative in Milan making such offers, and an address of another firm in Italy which could provide offers for a town, for a major or smaller installation. So, ther must be also a fair amount of knowledge industry right now who could, actually by the use of "depulation" plants made in recent months in the last year or two , probably quite some evidence. I think there is more in a practical light in a very polluted area like the German-French Rhineland and so on than we may think of right here. Shouldn't be too difficult.

STIRN: I would hear a biological remark on this matter because I think that that what we are discussing now is just a typical example of what we are missing, this is the knowledge about the processes and consequences even after treatment. This is a question about the cost of treatment is immense. In a certain area perhaps it would be better not to have treatment plants, it would be better to have

high molecular stage of organic matter to be consumed, not by ... but by higher organisms. I will give you an example; the Fjords of Oslo: they did mechanical treatment, they did biological treatment. After the biological treatment, the water which is treated completely , you can drink it. But there is still an enormous resovoir of nutrients of all kinds causing enormous ..trification and "oxic" conditions again and again. I will show tomorrow a typical example in the Lake of Tunis, there is a treatment plant, the water is running in the Lagoon causing each year mortality of fish , etc. Even the best most recent technology which we can use, the recent technology of secondary treatment in many cases is not sufficient. In other cases its not necessary. I mean this is so large, very wide question and knowing these problems I would say that our knowledge, scientific knowledge about the consequences, consequences of water coming out of treatment plants is too poor; we don't know, science doesn't know it, something is sure, that the miko elements nutrients, and unfortunately organic components of biological activity are passing secondary treatments, that are not enough.

Now in Oslo, they activated the third step of treatment which is called the relation of nutrients, the classical nutrients for photoplasm, these are phosphates and things like this that are relatively easy, but again there are ... probably ... again. So even the purest water which you can drink can cause enormous ultrification because its a concentrate of all possible nutrients. This is why I'm saying that our studies need much more scientific support and unfortunately this field, at least not for marine environment, not very popular one and there are not many people working here.

KENNET : Well, my reaction to this is that if we want to go into the economics of different grades of sewage treatment at this conference, then we ought to do it properly and get a commission to some one to write a round up about the present cost of plants of different sorts, bearing in mind that if there is a city which has no sewage treatment plant and is a seaside city the first thing you would have to do is lay a beach sewer to collect the thousands of separate sewers which will be discharging and then you may have to pump that uphill, that's

before the treatment begins. Then it will have to decide whether to give the primary settlement treatment, the secondary biological treatment , tertiary settlement and biological treatment. Then it shall have to decide whether it wants to take a long pipeline out to sea before it finally discharges. The final cost per head of the population may be anywhere between, somebody said between five and ten dollars this morning; I would say based on experience in providing the money in the United Kingdom it could be anywhere between three and fifty dollars per head, capital, to set up a plant for the first time, entirely depends on the circumstances, the geogrphical circumstances of the city, and also the circumstances of what degree of purification you'll require a before your effluent ... finally goes into the sea. Add to that the complication of your typical seaside Mediterranean city may have a river coming through it which is carrying effluent from industry and population and agriculture the nutrients upstream, is it worth the city cleaning itself up before the river is cleaned up? It will depend on the upstream rivers, it will depend on the agriculture. But still I'm for it if we want to have a book on this

let's have it. The truth of the matter was, it is enough to say that any effluent can be cleaned. The cost of doing so will vary by two or three orders of magnitude,on certain industrial effluents more than that, and the desirability of doing this rather than the other will depend on the geography and the water which you wish to protect.

RITCHIE: Have you got anyone in mind for this?

KENNET: I haven't, no, but there are two or three professional institutions which are devoted solely to this in the United Kingdom any one of which would be paid to produce this information.

RITCHIE: And they could bring it down to the sort of village level of the Mediterranean. I mean small community level.

BORGESE: And it would include all the countries around the Mediterranean, this kind of survey.

KENNET: Well the cost is the same for a given job, more or less, the plant to do it costs the same, except that you may have to import it into certain countries, it adds a little bit to the cost but not all that much.

BORGESE: Well, I should think this would be valuable to us.

DOHRN: I just want to point out to your attention that perhaps you should distribute a few copies of the Italian translation of the German WWF elaboration of the cost of deporation(?) plants in Federal Germany taking industries as types of industry from a very schematic point of view, so many millions of installations expended, so many workers, so much in operation per year, so many millions income per year of sold goods, and thisa farily comprehensive list of the costs met with in Federal Germany made by World Wildlife Fund, who is a well endowed recognized authority which we could also lean upon, if this was made a parallel for the Mediterranean.

KENNET: They're marvelous people but I don't think one should forget that we are dealing here with one of the major public sector industries in the developed world, which is now something more than 100 years old; really it is no problem in getting these costs.There are catalogues, it is as easy as that.
But you don't go the WWF for the cost of a sewage plant you go to the sewage plant industry.

ROS:The cost of sewage treatment of municipalities is nearly the

same for all the municipalities of the same population, but there is one fact for the Mediterranean countries which is important and that is the lack of water in many countries of this area. For instance, in Spain we have one region of the Mediterranean Coast, the region of the southwest is very dry and the Canary Islands, too, where the agriculture is very rich and there is a lack of water. And in all these regions are now a lot of sewage treatment in two states secondary plants, utilize the water for irrigation. These plants are paid by the agriculture the people, the farmers around the town pay the municipalities all the cost of the construction and the maintenance of the plant That was four or five years ago, and all these plants work very well and are economic for the agriculture and the municipalities. We have maybe 21 or 22 plants, one of these is the Paloma, Canary Island, Las Palmas Canaria is a big plant, because there are 200,000 people and the benefits of the people of agriculture who pay all the cost of the plant. I think for many countries of the Mediterranean area, North Africa, south of Italy and Spain and Greece, many countries have the same problem, there is no

water and it is very expensive; agriculture is very rich because the climate is good and they can pay five pesetas per cubic meter that is eight or nine pence per cubic meter, and for Spain this has been a very effective experience, very valuable and we have twenty one plants of this kind. They don't send the water to the sea, they utilize water for the farmers.

RITCHIE: I think this is probably also the experience of Israel so that whether you're taking thedisposal of sewage as a non-cost or whether you're treating it as an opportunity is quite important. Could this be included Wayland?

KENNET: Not so easily, no, because I don't think there is any experience in England; I don't think there is any market for liquid sewage for agricultural purposes. There is for solid, for sewage sludge, its a very poor market too, because its full of industrial mess by then, but not for liquid, so I think that will have to be up to some Mediterranean country to produce.

MILLER: I have a colleague who is working for the government of Puerto Rico and his job is to find out what conditions of pollution are around Puerto Rico, who are, as you know, rapidly

industrializing and also depend a great deal on tourism.

And he reports that with the rapid growth of hotels along the beaches, that the existing sewage system could not take care of the hotels and they use another sewage system that is the storm sewers., and of course this goes right out into the beaches, which they are trying to attrack people to come to.

BORGESE: Professor Segre you said this morning that you had some things to say about your agriculture waste and pollution.

SEGRE: Yes, we have here in Italy some coastal planes, they are the most important places for industrial planning, settlement planning and for agricultural. Now it is necessary that the three things are co-ordinated. In reality it is not so, and we have studied one of these coastal planes like a natural body and we have seen for the first time that the unco-ordinated planning has put the waters of the sea inland until 8 or 12 kilometers from the beach with great damage to agriculture. This was done while it was not studied carefully, the mouth of the rivers, of the channels of Venice, of these coastal planes.

The study was carried on for one year, throughout all the seasons to see the variation of the phenomena and the correlation with all the climatic situation, and the artificial situation done by the planning, the industrial, agricultural and settlement artificial changing of natural conditions in the equilibrium of the coastal plane. So we found that this phenomena is much more important than was thought before.

RITCHIE: Thank you very much. Well, how shall we decide on this? Would you like to give us some material, just from what you've said now about Las Palmas, bring in that element. I'm sure Dr. Oren will give us some material from Israel, and Wayland.

ROS: I think it is very to compare the coast of Britain in plants and the desalting plants, because many countries of the Mediterranean area has the project of the desalting plants, in the Spain there are two desalting plants, the water is very expensive, much more expensive than treatment plants.

KENNET: Well this is very much a pollution matter; it involves putting concentrated brine back into the sea, at the site of

~~your desalnit~~

your desalination plant.

ROS: They don't concentrate brines in the salted water, we only concentrate, for instance in the I... Sea, is 32, 37, 38, the plant doesn't make the concentrated brine.

KENNET: What does it do with the concentrate ?

ROS: Its only two or three thousand more concentrate. The water of the southern plant is only two or three thousand more concentrate than the sea water; it is not brine water.

KENNET: What process of de-salination is this.

ROS: Multiflash desalination.We do not concentrate sea water and put the water in the south, they trade a big volume of water and take only two or three per thousand of water. The water that comes out to the sea is only two or three per thousand more concentrate than the sea water.

KENNET: There are other techniques of de-salinization which involve a higher concentration of brine.

RITCHIE: If you've taken the salt out of the water, you've got to dispose of the salt that's taken out of the water. And its always struck me as one of the future pollution problems

to know that you had huge desalination plants, what in fact you would do with the material.

BLAKE: You've got the cart before the horse, you don't take the salt out of the water, you take the water out of salt. You just take a small fraction of pure water out of sea water. You don't take any of the salt. You leave it there. You just evaporate a small fraction of the sea water, and then condense it.

ROS: The problem of desalting plants for pollution is ... pollution because the water is 4 or 5 or 7 degrees more.

BLAKE: For small plants not for very large one, the incoming water is not ... to the out going water...

ROS: Yes, but two or three degrees is a very big volume of water.

RITCHIE: We all seem to agree this is not a pollution problem, thank goodness we have one thing that's not. We have decided, before you came that Didney is coming in tonight we had better postpone the marine biological thing...

BORGESE:...till tomorrow and deal with the economics today. Actually we started with a survey with what we had decided today and of course got right fresh into the new discussion which is

perfectly all right. I wonder whether you still want a summary of our decisions this morning on the third area which was politics and law. We are going to deal with that tomorrow afternoon. That was the decision. Then I think we should go on now with the economic discussion. But I think Mr. Featherstone wanted to say something.

FEATHERSTONE: I didn't want to at all. Well, Mr. Chairman, as I said, I came unprepared to talk economics at all; but as I understand it what you want is some indication as to what the cost will be to stop oil pollution. Well this really divides up into several separate items. First of all, there is the accidental spill, the collision. Now, I take it that Pacem in Maribus does not want to talk about stopping ship collisions which is the old problem of how to avoid human error at sea, you've got men in charge of ships with the best instrumentation in the world, and the best advice and instructions; they still collide, they still put ships aground. And I take it you don't want to enter into that area.

BORGESE: What about some progress along establishing shipping lanes. Routing.

FEATHERSTONE: Well this infact is being looked at by INCO, and INCO has in fact reccommended routes in all the major straits of the world, including the Straits of Gibralter, and I think maybe elsewhere in the Mediterranean, I'm not certain about that, but Gibralter, certainly has a reccommended route. Well, a check was made in the Davis Straits a few months ago where you have recommended routes, they are marked on the charts of the Davis Straits, huge magenta lines, you can't fail to see them, and all shipmasters know of them. And you go on the south side going east and you come on the north side going west. In other words, you stay to the starboard side of the channel, and a check was made (I can't remember the exact figures only a few months ago) on the north side, the English side of the channel where all ships ought to be westbound and something like 30 per cent were going the wrong way. And this is a problem of supervision and enforcement; it can only be done as I see it, and I think probably as the industry sees it, by the governments of the world; can't be done by industry.

BORGESE: They don't have any interests in going wrong; it's not that it is more convenient for them to go wrong is it?

FEATHERSTONE: No, sometimes it is more convenient, if a ship is going to the Thames estuary for instance, then it's not as different as it was, but on the English side you've got more lights and buoys and beacons and therefore it's easier for a ship to go along to the English side of the channel going East and simply turn into the Thames, rather than going along the French side and then going in a wide angle over the channel once he's passed the Straits of Dover. And also, of course, it's a question of training masters. As I think most of us know, two ships sank off Folkstone a few months ago, the Texas ship, and since then, two other ships have run into the wreck and sunk with loss of life; everybody knew the wreck was there. If they read the notices promulgated to mariners and only a week ago another ship drove straight over the ship and yet it was marked by buoys, marked by a light ship, and the light ship was firing rockets, sounding guns... so I take it that this is

an area that Pacem in Maribus doesn't want to go into. It is under consideration by INCO and others.

BORGESE: Well I think we should take it under consideration, its not that we should do any research on it, but we should take it into consideration what INCO is doing.

KENNET: Maybe the key fact is, if I'm right, that INCO has now decided that the routes in the channel shall be compulsory.

BLAKE: There was a proposal just a week or so ago that I read about in the papers.

KENNET: It was accepted at INCO. Nobody has yet got round to thinking what that means.

RITCHIE: I think we should be having INCO at Pacem in Maribus, I think we might ask them to prepare a paper. Would you like to go on, Mr. Featherstone?

FEATHERSTONE: Well what I had in mind, sir, was to; in assessing the cost of stopping pollution of the sea, operational pollution. It might be interesting to start by looking at the situation we have today. Well, to start off, in case anybody doesn't know

what happens on board a ship at sea, an oil tanker, the tanker loads say, crude oil in the Middle East, goes to the port where it unloads the cargo, it discharges the cargo; that still leaves after the discharge an awful lot of sludge, crude oil holding on to the insidesof the ship, to the tanks and the girders. And when it gets back to the loading port, its got to arrive with clean water on board, because the ship has got to ballast down to a safe level, so that it can ride the seas. And when it gets to the loading port it has then got to discharge the ballast water it has. Well it can discharge dirty ballast water into the waters of the port where it is going to lay and therfore it has got to arrive at the port with clean water on board. The way it does that is it leaves the discharge port with a lot of dirty water on board, and it washes the tanks round while its at sea, discharges all the dirty water on board into the sea, until the water left on board is clean, and it arrives at the loading port puts that into the harbor and its clean water and nobody bothers you. And that until 1954 was the way it was done. And you simply discharged all your dirty washings into the sea. In 1954, under

a.c.?

the prevention of the pollution of the seas by oil convention this laid down areas of the world where ships were prohibited from discharging dirty ballasts into the sea, great big areas, but outside those areas, it was free to do it. And so what happened ships still went on discharging all their sludge at sea, but they chose free areas to do it, which included the Mediterranean, a large area of the Mediterranean. And in the Mediterranean as we said this morning, they used to discharge the lot, to go through the Suez Canal in a clean condition. Then in 1962 the convention was amended. It enlarged the prohibited areas, it provided for ships to report all the oil they discharged at sea and they had various other provisions, but it still left it open to ships to discharge oil at sea and that is the position now today. It is still quite legal for a ship to discharge its oil at sea in the free areas. Then in 1969 it was amended again to make legal the load on top=top system we were talking about this morning. And if you operate this system and provided its done rightly you eliminate about 98 percent of the oil put out into the sea.

Now the cost of operating the load on top-top system is this. The cost falls on the oil companies only, there is no cost to the shipper. The oil companies had to get, first of all, the agreement of all the refineries in the world as far as they were able to accept the 200 tons of sludge remaining in a ship into their refineries.

RITCHIE: I think some of us here would be very glad to know just what load on top is.

FEATHERSTONE: This is ann oil tanker and when it sails from the discharge port to make the ship safe it takes water ballast into that tank and that tank. Now that's simply filling those two tanks up with sea water and the water in the tanks will, of course, be filthy, because the tanks are filled with crude oil. And they decided that when they get to the discharge port, these two tanks will be full of the clean water they will put into the harbor. So they say the word and they start to wash these two tanks which now are empty apart from the oil on the sides of the tanks, and they start to wash them with these machines which throw very strong jets of water around the tanks and

break the oil away from the sides of the tanks. But instead of putting that water into the sea as they would have done, what they do is they strip it out into this after tank which is a slop tank and the pumps that they strip it out with only work quite slowly and they fill this tank up with the clean water and let the oil settle out on top, the oil of course rises to the top. And as the oil rises to the top, so you're left with clean water, and that you pump out into the sea as you go along, and you don't let any oil out of here at all. They wash these out that way until they are left with just oil on top of water in this after tank; and then, having done that those two tanks are absolutely clean, by this time (this process has taken several days) and so it can only be done on a reasonably long voyage, by this time these other two tanks which have had the ballast in them and have kept the ship safe at sea, the oil has settled out of those tanks by now and the top of the water. So they strip the water out of those tanks to sea and then you get this position: they've emptied these two tanks here which started off dirty, they've still got the oil on top. They have filled these two tanks

with clean water, and the ship is still safe, and they now strip the oil from these two tanks, again into this two tanks keeping the dirty oil on board. Strip the water out and they arrive at the discharge port with two tanks of clean ballast and in the case of the picture, with about 300 tons of sludge in this after tank. Now, what they have to do is to load the next cargo on the top of that sludge. It doesn't go into the sea where it would of gone, and the next cargo is loaded on the top of it. And that is why it's called the load on top system. And this is the system as I say if it were working perfectly, then at present you would, without this system you would have about 3½ million tons of this sludge going into the sea per annum. If this system were working 100 percent you'd have about 48 thousand tons under controlled conditions. The reason for that is that when you're stripping this tank out to keep the oil on board you're pumping water over the side and a man is looking over the side until the interface is arrived at and suddenly the clean water turns black and then you shut off the valve, but you do get this little swelter of oil, but the proportion

is in the region of 3½ million to 48 thousand. Now that's the load on top system and that is made cumpulsory by the 1969 amendments to this convention.

RITCHIE: Now tell me, what happens to the sludge eventually?

FEATHERSTONE: The sludge is on board the ship when it arrives at the loading port. The company buying it has already set up a desalination in his refinery which had to be done all round the world and which has been done. And he accepts this oil to his refinery and if the water content is too high, he simply puts it through the desalination plant.

Now if the oil is going to a refinery, if they won't accept it then this tank is left empty and the oil company pays the shipper what he would have earned in freight. But the difficult point, an admitted weak point of the system is where the ship is to a repair port. Now when its going to a repair port, of course he is not loading. and under these conventions, repair ports are supposed to have reception facility, because he will always be left with this 300 tons of sludge on board, and he

should put it out at the repair port. But of course, some repair ports don't have facilities, and ships would be delayed if they had to put their sludge aboard, because they'd have to line up to do it, and in the days of high freight that we've got, shippers are loath to accept delays of their ships. And in any event, under these conventions now, it is perfectly legal to put your 1300 tons out; and it must be admitted that repair ports, a great majority of ships turn up completely clean. It's only the ships belonging the major oil companies where the master would be fired if he didn't arrive with his sludge, than turn up with it. But this again, this is a system that works, and its a system where the economics are paid for by the oil industry but it requires governments authority to make it opperate a hundred percent. The economics of that are taken care of but the current economic problem faced by the oil industry arises from the NATO resolution. As you may know, NATO, the North Atlantic Treaty Organization, held a meeting in Brussels last year. It was the Americans who particularly wanted NATO to be involved with environment. And the NATO meeting passed a resolution resolving that all pollution by the sea by oil, 100 percent

either by 1975 or by 1980. At the moment, refinery efforts and certainly the water that goes out under this system, contains, and Dr. Blake could speak better to this than I, between 15 and 30 parts of oil per million. And there is no system that I'm aware of on earth that can get it to less than that. Once oil has been in contact with water, some of it is absorbed by water and there is just no way of getting it out. But the NATO resolution would call for discharging water which had no oil content, now to do this, the economics of it are already worrying the governments of Northwest Europe, because in order to do it no ship would be allowed to discharge any ballast water at sea at all; and therefore any ballast water in its dirty condition would have to be discharged at the loading port. That would involve setting up ballust reception facilities at every loading port in the world. And some of them of course, are buoys which are miles off shore. A cost on this, no one can say; but let's say it would cost a billion dollars to put it into the Middle East, the Persian Gulf, a billion dollars. This has been suggested as a figure. Well, a billion dollars to the oil industry:

A, they can afford it;B, at the moment, there is something in excess of a thousand million tons of crude oil shipped by sea a year, its over a thousand million now, but take that figure, well that would mean it would only cost you one dollar a ton to put these facilities into the Persian Gulf. And as there are something like 250 gallons to the ton, you could argue that its only going to cost a third of a cent if you put this system in. And this is the type of economic argument which is made which is totally false, and its false for this reason. Even if you discharge all your dirty ballast at the loading port, in the state of the ballast you could never separate all the oil, and therefore instead of the ship putting out any bit of ballast at the loading port, they'd have to put it all out through the shore system which would mean more pollution of the loading port, and as the Mediterranean is both a loading area and a discharing area unlike the Persian Gulf, which is only a loading area, this is a problem which the Mediterranean will have to face up to if they want to go for it. But I'm afraid that's a bit confused.

RITCHIE: No, its very clear to me. It's a very difficult problem but I see it very clear. I think it was very succinctly put, have you ever heard it more succintly put it now?

FEATHERSTONE: Well its been asked for by our government, the British government, they have been pressing my company to put a paper up and we've been resisting against this because A, there is no time, and B, we think it would be better done by the industry as a whole.

BLAKE: Well just a couple of footnotes, there is another alternative at which the feasibility is being looked. I have no idea whether its feasible or not, technically it would be, whether its economically feasible, I don't know. This is to have two separate sets of tanks on a ship. One exclusively for ballast; one exclusively for oil. Never mix the two. The other alternative which might be more particularly useful for the circumstances in which load on top is not practical to use nowadays. Mr. Featherstone mentioned that the process takes several days which is partly the washing problem, and it is partly the problem that some oil has density so close to water that they separate out very

slowly. There are such things as centrifugal separators and so which can be used to speed up this process, either for short trips or for oils which are nearly the same density of water. And these other alternatives look into the feasibility of oil/water separators other than just plain gravity aboard ship, but these are rather difficult engineering problems; and its going to atake quite a study to find out if these are feasible and so far as I know such a study has not yet been done.

RITCHIE: What would be the average run on the Mediterranean in terms of time?

BLAKE: I'm more familiar with the Alaka to California run. I have no idea.

ROS: Tripoli-Italy I think is two days. I think in one of the figures of the continental load on top for the Mediterranean is there is not enough time for two days. It is not valid for the Mediterranean travel.Another problme, too, I ask in the inquiries is when there is bad weather, the slop timetanker is not separate In reality in the NATO commission of the Brussels, there was one paper, I think it wasSwede, about the oil in the North Sea and they

don't have any disminution about this in the last year. They found the same patches of oil after the 65...

BLAKE: Well its the same problem in California, you just have valves discharge to reception facilities on shore.

RITCHIE: You say discharge both the ballast and the oil.

BLAKE: Yes, dirty ballast and separate it on shore. Its much easier to do it on shore than it is to do it on shipboard.

RITCHIE: While I've got two victims here can I ask a question which I had some doubts about expressing, and that was I think it was Sidney that raised this in Paris: that one of the reasons for unexplained oil, unreported oil slicks in the North Sea is the break up of ships from the Second World War. And somebody said that wasn't true, oil would have gone by dnow. But its an interesting question and I mention it incidentlally, one and three quarters million tons of allied shipping in the Mediterranean which was sunk during the war.

BLAKE: I don't know about the North Sea or the Med. but I know this same question was investigated off the East Coast of the U.S. within recent years.

As I recall the Coast Guard couldn't find much evidence to support this hypothesis. They couldn't find anything to prove it or disprove it, either way.

RITCHIE: Well I'd have thought so, I did know about this thing. But its an interesting point, the time factor.

BLAKE: Well the crude oil has existed for many millions of years there is no reason why it should vanish over night, so to speak, in the hold of a ship

PRESIDENT: If you've got three million tons Second World War shipping in the Mediterranean. One and three quarter million was allied shipping, which was quite a lot of Axis shipping, and it works out according to my estimation to about three million tons. I may say it was Potter? that dug that up for me. And if you can try to convert that into possible oil, tankers themselves and ships with bunker. And that may be one of the explanations of break up. Have you any views on that Mr. Featherstone?

FEATHERSTONE: No information on that at all.

RITCHIE: It's an interesting point because the accummulative affect of all things, kinds of things that have happened.

My point in here in my document was not only oil, I mean I had always thought of a lot of poison gas in ships during the war, I mean the ... terminal was one. And in every operation that I knew about, military operation, there were always supplies they might be going to use it, but if the other fellow was going to use it you had it in reserve. So there must be an awful lot of poison gas

BLAKE: That's a little bit different problem from the oil though it is very different indeed because it decomposes rapidly.

FEATHERSTONE: I would like to make one point about the oil that is in the last war the oil was normally refined at the first end, the loading end and what was largely being shipped was the kerosene gasoling for airplanes, petrol for land vehicles which is non pollutant. There was very little crude oil shipped into the Mediterranean in the war, there were no refineries to take it. It was all refined products for places like Malta.

RITCHIE: I don't want to make an awful outrageous suggestion to this, but isn't the answer to our problem of oil, oil refined on land?

KENNET: If we get that proposed at the Malta meeting, we'll

get the whole thing financed by the Arab league. Very practical suggestion.

BLAKE: I don't think you'd have the support of your own national security people.

DOHRN: To do this you need a lot of water to do the refining where the oil is found. Isn't there a lot of water in the .... now and in the Sahara which could actually give a background to such a proposal that the refining is again done far away from the clustering human beings such as around the Mediterranean.

RITCHIE: I'm a Sahara bloke myself and I don't even contemplate the pollution of the Saraha with a great deal of happiness.

DOHRN: I know, but what could still be a suggestion is that the system of pre-war that we have just learned about could be adopted again in view of our environmental bankruptcy ahead.

RITCHIE: We've dealt with the oil pollution or the pollution by oil at sea is there any other aspect of oil that we should be discussing at the moment?

ARANGIO: In advance of the Malta meeting could we possibly have some of the data which has been so kindly supplied today.

RITCHIE: I wish we could. Just what you said was the most succinct explanation I have.

BUONOMO: I would like to ask Mr. Featherstone if it would be possible to have some information of the cost of world transportation say, for instance, from the coast of Israel to Genoa, with a small oil tanker and an oil tanker of 200 thousand tons.

FEATHERSTONE: Well, of course, that depends on the state of the freight market at the time. Over the last two years, the cost of any sea afreightment has been very high. I have no idea what the rate would be from Escalon to Genoa. I've just no idea.

BUONOMO: These figures would be necessary if we are going to make a comparison in the cost of transportation by oil tanker and that of the pipeline.

FEATHERSTONE. Yes, indeed, but as I say I have no idea , I haven't seen any figures on the comparative cost of a pipeline and sea transport. One would have to take an average.

BUONOMO: The part to us makes the study of the cost of the pipelines, the oil companies should give us the cost of oil transportation value.

FEATHERSTONE: Well I'd certainly like to help, sir, and I will see what I can do. Every company does its own costing and makes it's own mind up.

RITCHIE: There is still one ather thing that is lurking in the back of my mind. This is the fact of the comparative costs of the big or smaller intermediate tanking. Apart from the long haul around the cape, what is the overwhelming arguement about large tankers, gigantic tankers.

BORGESE: I read an article in Der Spiegel that the large tankers, the two hundred thousand ton tankers, cut the cost of transportation by about 30 percent. Is that correct?

FEATHERSTONE: The state of the market at the moment, one overwhelming reason for having bigger ships, is that ~~A~~ the demand for oil is rising all the time and therefore the demand for ships is rising, and therefore the demand for men is rising. We can't get men of the right caliber to run your fleets. This is a great problem all fleets are faced with and this is really the big constraint.on how many ships you can run nowadays safely and properly.

RITCHIE: I was going to raise that question myself. You have in fact raised it in connection with the lanes. But I think that one of our biggest problems is manpower, both intelligence and training; I can't understand where the companies get their men from.

KENNET: If it were only a question of trained manpower then it would be a problem which would solve itself in time, because one could be educating young officers now in sufficient numbers to revert to smaller tankers later on, but there are other reasons in favor of larger tankers I think.

FEATHERSTONE: Yes, indeed, but the trouble is you train a young officer today and he's a very splendid chap and then he gets married and he wants to go and live with his wife and you've got an enormous wastage. Particularly among the best ones who are the ones who can most readily get a job ashore.

RITCHIE: Well I know one or two myself. What we have to, you wouldn't be able to take the wives aboard, you wouldn't be able to keep them aboard.

ROS: Another origin for the oil in the sea, very important in some areas, is the oil for the land right to the seaboard, the sewage water. I read that some study in the U.S., there are hundreds of thousands of tons a year arrive at sea by the outlets, for the cleaning of the motor oil. In Spain, too, and France and Italy, in every country the sewage outlets is a continuous pollutant/ a very important origin. Nobody controls this.

BLAKE:That's quite correct. The estimates in California are the amount of oil reaching San Francisco Bay, Santa Monica Bay or Santa Barbara Channel, for that matter, every year, through the storm sewers, street washings after it rains, and through the conventional sewage systems from industrial waste and so on exceeds by far the amount of oil that came out in the Santa Barbara blow out.

BORGESE: What can we do about that?

KENNET: You can do something about that. You can install treatment on the storm sewers, separation treatment, centrifuges on all storm water.

RITCHIE: Who pays for it? We can at least fix the oil companies

on the other one, I wonder who pays for the storm sewere?

DOHRN: I'm just wondering in which way the oil companies would assist their surplus ecologists used in their ships with the aim of controlling the various ecological consequences of the oil ships coming and going. We have heard in Rome FAO meeting an offer of ecology from Europe and also over the ocean, not finding sufficient employment. Now there would be to mind my that we find a solution to also having more ecologists around and why the oil companies do offer scholarships and support some research and so on, wouldn't that be a possible combination that the ships that are going would also be used by some ecologists, trying to figure out what can be done.

BORGESE: I'd like to convey to the heredical question of refining the oil in the sea to what seems to me that, the world market as one? to refine on land would, I think, be very well liked by developing nations, I mean it would be a very substantial measure in bridging the gap between developed and developing nations The transport would be a lot cheaper and it would cut out the pollution,

RITCHIE: I would like to ask Wayland what is our total capacity of oil capacity in the British Isles.

KENNET: In the British Isles, its about ten thousand tons per year.

RITCHIE: You see that's the answer. We're back where we always come to. The strategic question.

BORGESE: But once we start planning on a world wide basis, are we shooting ahead of where we are now, I think we really should give some consideration to it.

RITCHIE: Well the developing countries seem to me to be taking care of their proplems themselves. Their insisting more and more on the refining being done.

KENNET: We could look a little further into this because the developing country becomes hostile to the country importing its oil, it seems to me that its just as easy for the developing country to close off the oil well one way or another, as it is to blow up the refinery. I don't mean to infer that its a strategic danger to the importing countries to have the refining done at the exporting end.

RITCHIE: It seems to me, looking at the figures for Italy that

central Europe is almost hostage.

MOVAHED: After the Second World War, was under a special pressure by the governments of the European countries which they called the refinery to move from the source countries to the consuming countries and it was because of the pact that after the war, the ... condition was not very good in these countries, and they needed some measures to be taken to avoid industrial to provide people with work and so on. Of course they have talked too much ... and this sort of considerations. But the pact, I think, the point made is a very valid one and if you can control vast volume of oil to be transported from a very remote country you will be in a better position to control a smaller amount of refined product, and control-wise it will provide you with a better opportunity. So I think under the present under the present circumstances, industry must revert to its alternate position. ...Mediterranean for example, he talked of the possibility of using super tankers, but in this area it is impossible to use such big tankers. You cannot use such big tankers. It is good, viable for long distances but not here.

While the pipeline system must be consdiered, it will not be the final solution. It must be considered but there are obstacles in some places where a single country, a single source of supply is linked to the market, it can be considered. But when you talk of Middle Eastern countries you can't have ... shipping by pipelines. But to revert to the position that industry used to have, you cannot eliminate the whole refinery, but the growth of industry should concentrate itself, the growth must be apart of the countries and this puts a limit to the ever increasing pollution. And then you go and find other ways and means of preventing pollution.

BLAKE: I was going to say actually that the industry at the present time does refining at both ends of the trip, both the sourcing and at the receiving end on a large scale. However, one of the factors that has appeared, since World War Two it was not so important earlier, is a very large growth of the petrochemicals industry. Which means a tremendous variety of products in small volumes each. And it is far more practical,

far more economic to refine those close to the place of consumption rather than at the source, because the shipping of these small quantities of separate products is relatively expensive and to keep the shipping expenses down you put the petrochemical plant close to the point of consumption.

FEATHERSTONE: I was going to say what Dr. Blake said, if you do the refining inside ~~you,~~ stat you're going to increase the number of ships on the sea enormously because when you ship a cargo of crude oil you've got everything in it from nylon stockings to aircraft fuel; whereas you'd have to ship them all separately, if you refined inside you.

ARRANGIO: In addition to that there is also another difficulty with the idea of having the refining take place in sea . One thing, it's not the same whether you bring, whether you face a risk of being cut off on the crude oil or on the refined, because if you don't have the refineries you don't have the alternative of having the course to another source of oil, crude. While, if you have the refineries in case that from the source you cease to receive for political reasons, you still have the

possiblity of refining your own product by taking it from some other pump. So I have the impression that the other should be investigated and rather deeply before you really assess the possiblity of selling national governments the idea.

BORGESE: I have two more questions in this connection. One is that of course as the economies of developing nations diversify and they become more industrialized at least your objection might be partly taken care of. They would consume more of the stuff that would be produced.

BLAKE: Well this is one of the reasons why the major part of refining is done at the source, because of the reasons you mentioned.

BORGESE: This question ties in with Page 17 of Ritchie-Calder's paper. This is a question that interested me anyway that I wanted to ask more information about. He states there that

... approaching which could be used to supplement the diet of protein difficient millions can be produced by the action of certain types of bacteria in breaking up certain types of

oil residues as waste as an affliction. I would like to have more information if anybody has it on this and then ask whether if this works, this would not be an additional reason for refining in the developing nations.

RITCHIE: There is a reason, if I may say that has been looked into by tsome of the conferences that I have been connected with When in fact the protein from oil , I think its next month I'm opening up what is supposed to be the answer to the problem, Grangemouth, a new plant in Scotland, which is going to convert oil waste into useful protein on a really seriously commercial scale, but eventually you could have as it were a food plant, I'm coming to the oil in a moment, attached to every refinery. And it might be a local supplement. There are two ways of conversion. At the moment we are thinking rather cautiously on what I call germ protein, but you can always put it through the animal and eventually you'll have a perfectly safe protein as a dietary supplement. Not as a basic source of food.

OREN: We have a very great experience with the fish concentrate which nobody wants to eat.

RITCHIE: Well they eat it in Scotland now, they've even made it into morning rolls, but I agree with you. I never stop there because in my country and probably elsewhere in the world we never ate Indian corn as we called it, we fed it to the chickens and now forty years later, we eat Kellogg's cornflakes. It's only a question of the technology getting on to the job to make it palatable if its safe; I'm not talking about risk material, if its safe material it can certainly easily be made palatable. But what have the oil people got to say to the prospects of oil protein.

FEATHERSTONE: Well I'm very glad to be in the company... I have no technical knowledge of it at all.

RITCHIE: Again, without any disrespect to our present company one of our difficulties on all this is that the oil companies hug their bacteria, if I may say so, very close to their chests. The result is that in the scientific field we don't know what are the safe bacteria and so on which the companies have.

You know it hasn't been a pooled research put it that way.

BLAKE: Well perhaps I know more about what BP is doing than you do then. I don't know what the bacteria is. BP is certainly one of the most foremost companies working in this field, but all the other major oil companies are too, usually in collaboration with food companies of one sort or another. And while BP has announced some silascale(?) plant constructions most of the rest of us have not been that optimistic. Not that the thing is not wholesome or usable or anything of that sort, it seems to be quite wholesome, quite nourishing, but its a very expensive form of protein. There are much better ways of finding supplementary proteins for those that need them than this.

RITCHIE: I'm sorry this is a rather interesting economic question and that is I gather that the beginning of all this was the disposable and embarassing waxes in the oil industry and the exercise was to get a biological breakup.

BLAKE: This was one of the arguements used but it was by no means the only one, certainly. But I know that a number of

companies have been looking into the possiblity of finding these proteins, not as supplements for the diet in areas where proteins are deficient, but more as proccessing aids, emulsifiers and things of that sort, for use in our food, and also in pet foods or animal foods as you mentioned earlier. But at least so far as my knowledge goes, they just don't know where the promising in the present state of the arc.

KENNET: As so far as we're concerned with the pollution of the sea we ought to be very glad they're not promising anything. It would simply increase the amount of oil carried about as they work on it.

BLAKE: Not very much we once estimated that, well I use the amount of protein deficiency in the world given to me Will Chapman, the late ..., and the production rates that we were getting, forgetting the cost for the moment, that the entire world deficiency in world protein could be supplied by something like 2 or 3 percent of the oil production. So its negligible as far as that's concerned.

RITCHIE: Well I think just to come back to what Elizabeth was saying, I was citing that and I wish that we could accummulate a good deal more examples of what in fact, what I was trying to say, how could we make pollution a positive thing in the interest of companies, instead of saying to them this is something you've got to get rid of, you've got to spend a lot of money ameliorating whatever; to make them start thinking about what in fact is the nature of the material they are throwing away. I like to get a lot more examples, because the thing is on this argument you could persuade people that its a bad idea to throw out fumes or ... and look again. And this is what I meant this morning when I was talking about precycling instead of recycling. That is to say think of the benefits, before you start on your elemental product. I think you'll agree with me Wayland one of our problems is always ... or you can do that or to search out on the industry and by and large they looked at the elements the factors of what the product were before they started they might have seen a lot of ways.

KENNET: Well its very difficult for a government to be cleverer than an industry about the technology of that industry. I don't know whether you agree with that, but some people say that governments ought to do industry's work for them by pointing out to them that there is a profit to be made in some developemnt. But first of all, its very rare that the government sees that before the industry does and if it plans to have that sort of insight first, it has to develop a long term policy of getting onto its own payroll a small number of people in the country who can see it first. That means taking them away from industry, and this is the basic argument between socialism and capitalism, or one of them in any case, but in a mixed economy or capitalist economy it seems to be that the government is at best, limited in saying, you will clean up, and if you can do so in a less expensive way or even better in a profitable way then good luck to you, obviously I wish you well, but it can't be government's job to think it out.

RITCHIE: I agree with you but I don't take your point that the government can't do this because in point of fact a lot of the work which is done at National Chemical Laboratory was ignored; I don't know whether its still going on but there was a lot of things like, ofor instance, sorsonol, came out of sewage, call it first office die(?) or whatever you'd like but the thing is there is all that indicative knowledge, the kind of thing that you can do, but the point that I'd been trying to make implicitly or maybe explicitly was that you can say and this was my draconium tra... as you know, a company should be made responsible not only for its effluent but for their products when they became waste. We're talking about tires and things like that, containers, and if they were made responsible they would look at the original material that they are creating in a way that would anticipate their waste, in any event that would take care of the waste on hand. This was a punitive effort to make them think, think about what their doing.

BORGESE: The way you put it a minute ago about the positive aspects of pollution. They should be as endless as the profit that might

be in it. This is another way of trying to say what I tried to say at the beginning of the day: that the most efficient way or probably the only way to cope with pollution is to cope with planning, with positive planning.

KENNET: By chance we have two people in the audience today, and nobody I think from mining or engineering, as we talk about the economics of sewage disposal and those of oil transportation and pollution you still only cover only two out of the three great sources of pollution in any great sea and I wonder what we could do about the other one. Industry in general.

DEUETROPOULOS: The mining of copper and the company has been a bit worried about this so ; there as been a big outcry about this with tourists, and I think its attitude toward this was not a question of utilizing what they were throwing away, the iron, but hiding it somewhere finding a cheap way of dumping it in a big pocket, in the bay and this is ... what we've done. ...Company I think we have some figures of the amount that's been done there. They have consultants from America, but again this is the cheap way out. Well of course what they did was far cheaper than trying

to do anything in the beginning.

RITCHIE: I think there's a lot more to be done. I think this is the kind of thing which Pacem in Maribus can throw up without providing the answers because a great deal more thinking has got to be done, and its not necessarily up to us to do it. But it does seem to me that there's a very strong argument to be made for working,out, for example, the relative cost... two things first of all, the industrial waste becomes a social cost that eventually takes the form of bad health, takes the form of sewage disposal, and it takes the form of community deterioration and all this sort of thing. Today in Britain we're paying the social cost now of almost two centuries of industrial revolution. You can't attribute it to any given person; you can do what we did with open cast mining, and so you've got to put everyting back where you found it, apart from the coal. The thing that I'd be interested to see how we could start making people think about the relative cost of this thing. What in fact you could do if you said," that an industry apart from intelligent firms who may be doing it, I may say some of the biggest firms are not

necessarily the most intelligent about this, as I've discovered, and that is that they're buying materials which they're throwing away. And that is if you're big enough, and that includes ICI, you're actually buying the material thatyou're thrwoing away. They'd be much more intelligent to look at they're basic materials. The other thing is the question of latent cost .... of disposal. If you would just take that one point that I say, of saying you will be responsible for everything you have made, and I know its an exageration and an impossiblity, but make them think about their own product, what the nature of their own product is. We were talking earlier on, I think it was you Dr. Oren, about tires and things like that. I must say that it seems to me to learn something about the composition of tires, the most scandalous waste, even if you were going to use them to make artificial lagoons, its still a scandalous waste. Because the intrinsic materials are still valuable. I don't mean retread them or anything like that.

ARANGIO: What I mean is going back to ... I mean whatever you do with it. I don't think it all goes to be used as bumpers in

harbors or ought to be thrown in the sea, or ought to be dumped into cars, etc.

RITCHIE: It's been used in Britain as ..., I mean mascerated rubber has been used as re.., that's better than throwing it in a gully or on the seashore. But it still is a long way short of what I'm trying to avoid, recycling.

DEUETROPOULOS: I must say that our government in Cyprus is taking an interest in this copper. And we're going to start, I don't know if its next year or whether we're competent to do this, to find alternative ways of using this material. This is combined with that that whole study of pollution.

RITCHIE: Are you talking about rubbers or mining.

DEUETROPOULOS: Mining. But at least we are starting, something is being done, we know that something like that must be done.

KENNET: The recycling industry in advancing countries is their big growth industry, I know that it is in Britain and I know that it is even more in America; starting from the rag and bone man and the scrap metal merchant. This is now turned into a muti tens of million pounds industry in Britain yearly. And I'm still

not sure though if this is just a lay politicians instinct, I am not sure if this is growing as fast as it ought to for the economic benefit of the nation. Now its a new industry and the techniques are being found all the time and being put into operation; its only just now that people of high caliber are coming into it, in genius and inventive and properly trained people are coming into it. I think that in an economy like the British one there might still be a case for government favors to that industry. Whether in the form of outright grants or long term tax free loans, industry loans, or free land (its an industry that takes an enormous amount of land) buy land for them or give them loans for land purchase, this kind of thing. It would of course be a form of state aid to industry. I don't think it would upset any international arrangements, it would be marginal compared with other forms that are practiced around the world.

RITCHIE: Well I'm just thinking back, Wayland, to the war when we did all this. Really its rather shameful that we don't do it now. I mean the amount of recovery during the war, everything

bottletops the lot. And I remember that in Israel in the early days that recycling was very drastic, planes and all this kind of thing. It seems to me we ought to have a sort of techno-ecologist, since we've got to get on the bandwagon of these words, instead of talking about the rag and bone man, make this, as you say, a highly respectable occupation.

ARANGO: Possibly a lot already has been done, I mean even in Europe and even in this country I 'm sure there's a lot of waste which goes back. I've known since I was a child that there are people who go about getting cloth and they made paper out of it, or I don't know what.

KENNET: I'm sure there are people who take an actual sensual pleasure in throwing something away.Its enough to travel in a train through the Italian countryside to see all of the ...

MILLER: I know back in the states I think this discussion about charging or putting next to charge on that automobile that you buy of say something like 35 dollars to take care of its ultimate disposal.

RITCHIE: Funeral insurance.

What we come round to is exactly the point of non-pollution. Pollution or the creation of pollution, prevention or creation is a question of cost. Now either its people doing it on the cheap, trying to make profits or its people trying to get something cheap, the consumer. And when you're looking at this problem, it is really a question of cost and one of my arguments if you make this situation so that you had built into everything you make the fact that its going to cost money to get rid of it, then you would actually discourage in many cases of things being made. You know what I mean you could ... it out of the market. That's not a bad thingin some of these cases. That is to say if what you're representing in your cheap cost is something which carries a lower burden on the community, then its not a good product.

BORGESE: The other day, I think it was in Santa Barbara, somebody suggested that people should be buried in their cars instead of being buried in coffins.

RITCHIE: Well I don't know whether we want to bring this to a close. With your usual succinctness you might tell me what everybody's

agreed to do . . .

BORGESE: Well I don't know whether we've other aspects in economics to deal with. Nuclear waste, industrial waste.

ROS: I know for Spain, but not for all the countries. But I think its very important to speak, until now you have concentrated on oil pollution but in the Mediterranean coast there are a lot of other pollutions, that I think are worse than oil pollution. I also think they are more easily eliminated than oil pollution In Spain, I can explain, if you are interested, the principle industry on the coast. For instance, for nuclear pollution there is not the problem yet in the Mediterranean. Spain has only one nuclear plant. I think there is another plant in France and in Italy, maybe two or three, but it is not a problem. Ten years ago there is not the problem of nuclear pollution.

?: That's because they dump into the Atlantic.

ROS: That is a point I would like to speak on now, the solid waste disposal. The solid waste is industrial waste or nuclear waste. I think we must forbid dumping of nuclear waste in all of the Mediterranean Sea. And the solid industrial waste

in the FAO conference has one reccommendation to dump more than two hundred meters, but I think in the Mediterranean this is very dangerous. Two hundred meters in the Mediterranean is one area for fishing. The fish until one thousand meters in Spain now and I think it is very important to forbid all this area from solid waste. There are large problems for fishing with solid waste. Maybe in the Mediteranean there will be these kinds of problems with in the next year with the tons of solid waste. Maybe some people know this problem of the quantity of solid waste that is now being dumped in the Mediterranean. It would be interesting to know for all the countries.

RITCHIE: Rocky, I know you've got no expert knowledge on this but have you any insights. Have you run into trouble in the Mediterranean on this kind of thing. The fisherman's problems, not only the fisherman's problems but seepage problems. IBM oxilate machine dumping, amunition dumping and any amount of Xerox material dumping.

MILLER: All the experience I had was possibly staying away from the coast of Albania because of mines that may be broken

lose.

ARANGIO: ... I should be a little bit more careful in considering the problem in view of the fact that it is relatively new and that things have started pretty long agao already, but not so long ago as oil, or the oil pollution problem. And I think it would be rather peculiar, odd, if the Mediterranean countries agreed among themselves that no dumping should be made in the Mediterranean without giving any positive solution to the waste disposal problem. I'm speaking about nuclear waste. Now I do know that operations of that kind are being carried out by European countries occasionally associating themselves and that, for instance, a little bit of throwing away has been done recently in the Atlantic by an association of countries, one of which was your country, another of which was mine; and they simply dumped their nuclear waste into the Atlantic. .... to chart the necessary boat, make all the insurance coverage, etc, etc., and they did it under the aegis of ENEA, ... European Nuclear Energy Agency. I think this is pretty common practice. They put the thing into cement or into plastic or both containers and dump it there on the assumption

that it will take 1000 years or 500 years, I don't know how many, for it to decompose. If you want to take care of the Mediterranean from that point of view and prevent waste disposal of nuclear fields then you must say what should be done about it. Because simply to say, let's not dump it here lets dump it into the Atlantic or the Pacific, is a very uncooperative and uninternational way of taking care of the matter. It's like saying to the others, come and dump into the Mediterranean.

RITCHIE: Well I think its a question worth looking pretty hard at having looked at it when I was writing this paper. And I think its true to say that there are very few areas where any sensible people would allow the dumping of oil, because of the overlapping of the limit between countries. Similarly I would have said there are very few areas in the Mediterranean where you could, as an inland sea, be justified in dumping serious atomic waste. Now we may be talking at entirely cross purposes. The point is what we are taling about usually in this type of atomic waste is what the atomic energy people call trash.

ARANGIO: There's been a great issue and interview raised against France at one point against the French Comissi ariale Energere D'imique because the French were planning, I don't know if they did dump, in the Mediterranean Sea. I don't know what happened really because I'm not so concerned, but it occasionally occurs. It depends on a lot of things, but I think it was radioactive material coming out of nuclear reactors.

RITCHIE: Can I ask an indiscreet question, where does the French bury their high level waste? I'm not talking about their trash now. The stuff that cannot even be put in the sea.

ROS: The dumping of ... near to Portugal coast is ten thousand ... and the high level waste. This is not very much, a little experimental dumping. They say experimental dumping, but in the reunion of the experts of the NAR the expert of the British Atomic Commission told us that the United Kingdom dumped the last ten years, every year, much more than ten thousand couries in the Atlantic Ocean. Some of this dumping was done very near the French coast, forty meters depth, because the captain of the ship mistook the situation and the French fishermen

took the gear, the gear they dumped,the drums of atomic waste and they opened the drums. They found a lot of things like rutile(?) and so on. They took them home and there were very big troubles between the French and English governments.

BORGESE: How long ago did this happen?

ROS: Four or five years ago, no more. And the United Kingdom Atomic Commission told us because in this experience Spain and Portugal had with the NAR commission and Spain and Portugal opposed the dumping in this area because it was very close to Spain. But we have not scientific arguments for the opposition of this dumping and the arguments of the United Kingdom is: if you don't want, we will take this waste in this area with the one area you know and one area that is controlled by NAR we put it in another area which knowone controls. The argument is the NAR can control the dumping, If each country dumps its nuclear waste without any control, like the United Kingdom, like France, it is worse than if all countries together take one controlled point because this point after the dumping, German Portuguese and Spanish people have one control every year of

the radio-activity of the water, and effectively is better, one dumping control. But we cannot stop the dumping because they say we need to dump the nuclear waste and we put the waste in the sea. If you are right you know the place, if you are not in accord, we will put it in another place. That is the actual situation. After this dumping of the ten thousand couries there were two more dumping in another place close to England this time for the NAR too, because the English people said it was not dangerous at all. We say if it is not dangerous at all it is because you don't dump close to the coast. The second time they dumped near to the close. coast?

MILLER: With regard to atomic waste in the sea, just this last weekend something was given out in the press, I'm not sure of the complete context of it but, Dr. Von Bowin of our institution has been concerned with this all over the world and collected samples and this press release was concerned with his findings, and how critical was it. And the upshot was that there was no increase of activity but this needs to be checked into because I listened with only half an ear on the radio this weekend.

But it was given out in the press and there was no danger established

BORGESE: But the fact that we are being fed over the radio in these regards are often very misleading.

MILLER: I know this very well, but the point is this is something I can check very easily because he is one of my colleagues.

ARANGIO: This question should be looked at in the perspective of a fairly high number of vealism, even assuming that at the present time that there is no increase in environment radioactivity the consequence of the dumping that has taken place up to now since the discovery of atomic energy, the problem should be taken care of because it might arise as long as the containers start losing there capacity. Obviously if we go on, they say that it is a question of time, that with time the radioactive material is no more radio active, etc., etc., I don't know anything about it but I suppose that the matter should be looked into because I know that people that are concerned with atomic energy do think that there is a problem there.

KENNET: I address this onto tomorrow's political discussion, about this matter of radioactive waste. If you're going to have people

from the Eastern European countries in Malta, as I believe we are, I think its very important that we should get to the facts about the disposal of radioactive waste in the Mediterranean because this is a great political fight between the Soviet Union and the west european countries because they have all the land in the world to dispose of their waste and they have no sea, and we have all the sea in the world and no land. And for political reasons they're always saying that its very dangerous to put any radio-active waste into the sea. So let us get the facts, before we meet the Russians.

RITCHIE: I wonder how we can get the facts about the disposal. It takes an immense amount of land to remind us of what is possible, it is not just a question of pollution. The fact that it is going on I don't doubt it at all that atomic waste is being disposed of in the Mediterranean but if I were looking at the map I would find very good reason why it shouldn't. If you have an accumulation and aggregation of disposals in this area it would be potentially very dangerous. On this one I am absolutely and completely conservative. In nuclear terms I am a utter

conservationist, but I don't believe that anything that we have achieved in terms of radiation control including the limits of radiation control shouldbbe modified. That is to say, I would make every person, you're talking about the disposal of ten thousand curities, that's something like the disposal from our about twice as much as from as from cellifule(?) in terms of ... But what the Atomic Energy Comission wanted to do, wants to increase that, no they increased that to four thousand, and my advice to the county council (?) is that it is a good thing that Wayland wasn't the Minister at that time. Were you? Well, Wayland. The fact was, I simply said that if you don't get satisfactory answers to the figures, I mean really establish them and don't give way, because every time you concede on this thing you're going to give people opportunities to take more risks. I may say, Wayland, that the answer came out right. The county council accepted the fact that the Atomic Energy Commision figures were right.

KENNET: I wouldn't let them do it until I was sure that the county council was happy.

RITCHIE: Well atomic waste, solid waste in other forms, now what other points did we want to cover. I think solid wastes in terms of obstruction is also important.

BORGESE: What about atmospheric pollution, I mean the interaction between atmospheric pollution and water pollution.

RITCHIE: Now, I don't know how you arrive at these figures. This again, is really a question of what in fact is inland control, I mean what limitations are you imposing on factories in the way of pollution. Because you see its not even limited to that because its quite obvious that a great deal of the DDT in the Mediterranean was in fact airborne, wasn't just what we would call industrial waste. Anyone have any ideas on how we can deal with the insight into the nature of the economics of airborne pollution. I can't think of any myself.

OREN: There were some people who were dealing with the pollution especially in coastal areas. You could get some estimates on different materials which were transported.

RITCHIE: I wonder where, do you know where these figures come from, those of DDT, a thousand million pounds of DDT has been

released into the atmosphere.

DOHRN: There is some of this is the FAO conference. And also about the recycling of the wastes and utilization of whatever there is left over in the in the planning of the original one as we said before. It seems to be the most promising avenue.

RITCHIE: In regional planning? We will discuss regional planning tomorrow. The question is, we've looked at nuclear (interupt.) we've discussed, making it distinct from solid waste, we've discussed but only vestigially mining waste. And now we've got the question of airborne pollution.

MILLER: Perhaps I can contribute something. This area is known to be a place of cyclogenesis, that means that's a place that develops . And the point of considering the air in this whole context is rather important because of the exchange processes occuring between the sea and the air and how interdependant they are. Thus every piece of air that touches this water here has come from the land someplace and is going to the land someplace. So its available

monitoring and it is also available for tagging where it is going and where it came from. Now in that sense, I've had a pet idea that by monitoring just from another point of view to find out the moisture flux into the air, one can also then establish along with that monitoring system, a system for determining the aerosals and contaminates that might be in the air. Because the science has come a long way now in being able to detect the chemistry of the air qualities and whatnot.

RITCHIE: You've raised another point, Rocky, that ought to be very much in our minds for Malta and that is the whole question of monitoring, what we ought to propose in the way of invidulation to see if mischief is being done and also to see what ought to be done now. Take it up with the physiography and biology tomorrow.

DOHRN: I might ask what is the area we mean most specifically, is it the whole Mediterranean, is this part of the Pyranean Sea, is it the whole coast. You mean it as a unit, the entirety, perhaps including the Red Sea.

KENNET: Well I don't think there's any point in discussing it but if there are papers, conditioning papers. We haven't touched on

liquid industrial effluents which I conceive must be a far bigger trouble in the Mediterranean than the atmospheric interface, for one.

DOHRN: This is also in the plans of Professor DeJuvenal, its not just as to the future of the Mediterranean linked to the big rivers, Danube, the Po, which bring all the effluents into the sea for the next ten or twenty years. He's dealing with this.

KENNET: Well since we're talking about economics it would be particularly good to get some idea of the cost of reducing it I think would be interesting in certain sample industries and plants.

RITCHIE: Have you any information on the reduction of costs, Dr. Ros?

ROS: This is one very large and difficult problem to speak about because the cost of one plant of reduction of the industrial waste, it depends on the level of the waste you need. I think the first object is to study the level of pollutants we can send to the river or the sea. If you decide for mercury, for instance to the zero level, you must trade the plants, the mercurine(?) to 100 percent, zero percent, the cost is very very high, and for

each pollutant, for each metal, it is geometrically progressive because with the cost and the level you need, and we don't know if the level of each contaminant, each pollutant, we must deporate the water. It is the the same, one plant for that for instance of copper as for that of mercurine; copper is not very dangerous and maybe we can expect to 2 or 3 PPM's not danger ous at all with copper in the outlets, and this is very dangerous to mercurine. This level is very important in order to calculate because of the plant. And now all the factories, American or French or German are building treatment plants, need this data for calculation of the cost. What you need, exactly. In Spain we don't know what the level is exactly of depulation.

KENNET: You might get a plan if you went to a German source for this information, because I've been very impressed by the fact that the German industry has suceeded in talking their government into giving them tax reliefs on purification gear for liquid effluent. And I think that's more than any other European industry has done. France, I think, has been getting around to it; in Britain they haven't begun yet. And so they must have some pretty

good figures for this and that, for different substances. Confederation of german industry whatever its called, the industrial association it was they who went to the government and said here are our figures, now give us a subsidy.

ARANGIO: I have been dealing a lot on the German press on this matter and there are many cases before judges all over the country for industries of respecting standpoints in this connection. So I assume that some fortified or competent authority should be contacted in this country too, but I'm sorry, perhaps the association know something about it.

BUONOMO: We know that, unfortunately there is a difference among the penalties from one country to another against some industries.

ARANGIO: I wasn't referring to this. I was simply referring to what is exactly the situation with respect to the problem that was being discussed, in this country and I was wondering which is the authority which we contacted on this, in addition to the Minister of Industry, or for instance the Association Confidustra(?) With regard to this data which has been mentioned by our Spanish friend and Lord Kennet.

RITCHIE: I want to raise a very interesting question. When you were talking about mercury in levels of industrial effluent , what sort of effluence are you talking about, because it seems to me from what I was reading that one of the most serious, almost insoluble problems is paper making, I'm not just talking about paper making, you can stop from using just fungicide, but apparently paper pulp has a very high affinity to mercury even in the water which is being used. I mean its absorbing the mercury from the water which is being used. And when you burn the paper, this is one of the things which came out in Ottawa, where you've got a whole series of factors in this thing which is attributable to paper making.

ROS: YES,the paper industry, the chemical industry in ,... there is a large quantity of mercury, but it is very difficult to explain about cost of treatment of plants, because each plant, each situation of the plant is different from another plant, it is not the same of one plant on one coast with currents and big dilution than one plant in one bay. Each plant is one problem and it is not possible to say the cost of treatment of mercury or another.

KENNET: Just as its not possible to deal with the cost of sewage treatment plants because it depends on what conditions are about, or how much treatment. We were agreed to get some idea though in different sample situations, and I do think the same ought to be done with regard to liquid industrial effluents. If we're doing it for oil, we're doing it for sewage, we must do it for the metallic solutions and the effluents in the plastics industry and all this.

DOHRN: Well the result which came through the newspapers this week about the American Senate refusing clearance for supersonic jets. This has been , I guess, some of the effects of the testing for its environmental consequences. Among other factors this must have played a role. Do we here know about it?

MILLER: I don't know much about this supersonic bit, but one point discussed by some people in quiet, is saying it's easy to stop that kind of pollution, the noise pollution, or the question of the ultraviolet radiation, by simply refusing to accept a plane in one's airport. But just as I left Boston the other day, I found that where Logan airport in Boston was going to say no

we won't have the supersonic transport, now they have changed their minds, which means,,,

KENNET: Well this is a misconception anyhow, isn't it because the people that are trying to stop them are the people who live near the airport and they don't fly supersonic when they're landing and taking off.

MILLER: Well in one sense it does as some arguments with respect to the fact that they will fly high and will spew out the residue or whatever, the combustion and it will affect the radiating capabilities so that with regard to people, there was something said about skin cancer and things of that sort, a matter of health, I have no feelings on this one way or the other, except that I have a grandson that may be suceptible to skin cancer.

DOHRN:Because of the mechanism which I think has been playing a role in all of this enforcing that the Senate takes a position against President Nixon and many other industries, which is I think public opinion which according to the last Pacem in Maribus meeting in Malta we were attributing this to Professor Künstling from Basel, the only instrument the normal mortal being has to

bring pressure on the politicians.

MILLER: Well I have no feelings on this one way or the other, I report what...

PRESIDENT: Well I'm sure you'll think of a lot more things by tomorrow.

tape 6 side 1

February 4, 1971

PRESIDENT: We will take Dr. Ottaviani's paper this morning followed by a discussion of the physiographic and biological aspects of the Mediterranean. And this afternoon we will devote ourselves to the political and legal. Does anyone want any clarification on anything.

BORGESE:Tommorow morning we hear from Dr. Marchetti. You would like to leave tomorrow morning, well that changes the picture. We will have to hear from Dr. Marchetti this afternoon.

OTTAVIANI: I would like to give you some explanation about the oil... in the Mediterranean basin. The ... figures only relative to potential capacity, and there are also ... companies in Spain, Frace and Italy. I have also an outline of the charts in the Mediterranean. It is made on the basis of a factor

1.1 cubic meter of water, a metric ton processed crude oil, this factor is valid for the Italian situation. I don't know if it is for the other European countries, but Italian has the most of the valid capacity.

RITCHIE: Sorry for that interruption. Would you start again?

OTTAVIANI: The figures about the finest capactiy is a potential capacity, it is not definitive, and it includes also refineries It is charting the oil refineries in the Mediterranean basin.

BLAKE: Well what sort of effluents, cooling water you mean?

OTTAVIANI: Water, liquid effluents, oily water.

RITCHIE: On this thing you'll find item or basis oily waste water. About 1.1 cubic meter per metric ton of processed crude oil.

OTTAVIANI: Volume effluents is ... a factor, 1.1 cubic meter of water per metric ton of processed crude oil. This figure is correctsfor the Italian situation and refers to fresh water only. Sea water used for cooling is considered not polluted. CNR, Natural Research Council in Italy studied water used in Italian industry reports that the oil industry ... only 1.5

of fresh water to realize(?) in the different sectors of Italian industry. Now I can give you some information about the cost which 'n' group forces for water pollution control in some different branches of industrial activities in Italy. Any group has interests in many activities as refining petrochemicals, textiles mechanical and so on. We have an activity along with our other partners five refineries of which one is inland and four are coastal. We decided to have the same limits as regards pollutants in the treated affluents for all of them. That involves a biological unit to reduce oil to less 2 PPM. And in terms of quantity no more than 50 kilograms per day. Investment (industrial?) cost is about three million dollars for each refinery. Now we have 1.1 unit in operation and four under construction. The incidence of operating costs, capital cost, and production th value considered by everybody from crude to products is made in the order of 3,4 percent. About ½ million U.S. dollars a year for each refinery. For our petrochemical plant in Ravenna investment cost is estimated about 10 million dollars, and operation costs of a purification unit will affect the production

costs for about 2 percent. Generally speaking the treatment cost of such industrial waste water will be about 50 liras per cubic meter of water effluent, or if you like thirty cents per one thousand dollars. Textile industry, we have now about twelve factories in operation, will be affected by the water purification cost in another level, about one percent of the factory production value. But you say which is the situation, textile industry. Now a bit about the Italian situation, from the point of view of water purification.

NEA's conference in Rome of last June regarded the preliminary approach from the cost-benefit analysis of pollution control in Italy. has given the following figures about costs to be faced for industrial and domestic waste water purification. Valid for the situation in 1968. Domestic, including sewers need by the most part of villages and towns, about 2 billion dollars. Industrial, about 1.6 billion dollars which will become about 4 billion in 1985. We computed last June in Rome that these figures are high, but that it is possible to cope with this engagement planning expense in ..... Five of our

industry and ten for domestic sewage. Now something about ballast water, from tankers.

It was said yesterday the efficiency of a load on top system on Mediterranean routes, I want to mean, tankers transporting oil from North African producers to European countries is very low(?) The solution to the problem I think is three fold: efficient units for receiving and treating oily ballast water, near the tanker terminals in North Africa, and to oblige tankers to discharge their dirty ballast water, before beginning the loading of oil. This is a realistic solution adopted for instance in the Black Sea terminals of the USSR. Oily waters vilification is considered a port service and must be paid. The cost is about 20 liras per cubic meter of ballast water. Enforce captains of tankers to not discharge ballast in the sea is payment, must be done, also in the case that they have not dirty ballast on board. In this situations that is convienient to not wash tanks avoiding also explosion dangers and discharge dirty ballast water at the terminals. We are preparing a report

on this subject indicating also the cost of construction of the ballast treatment plants in the Mediterranean terminals and I hope that this report will be ready for the next Malta Convocation. As an order of magnitude, a ballast treatment plant assigned for a terminal having a loading capacity of ten million tons, acute rear, costs about 3 million dollars with a hydrocarbon content in the treated water lower than 5PPM. This limit can be obtained also without chemical treatment, but with mechanical separation by means, for instance of power plate interceptors and followed eventually by sand or carbon filters. Thank you.

RITCHIE: You have written this in English. Could we have a copy? Could we have it typed today and circulated. Yes if we get it by tomorrow it would be allright.

?: Actually my impression is that is could be Xeroxed.

RITCHIE: Thank you very much, any questions on that paper.

STIRN: Do you think that if all measures are taken it is possible that effluents from refineries still have harmfull effects in the sea. What is your opinion about the danger of effluents

coming out of refineries.

OTTAVIANI: In the present situation I think there is dangerous evidence. Now the most refineries in Italy, coastal refineries discharge water effluents with 40, 50 PPM of oil, and we propose to reduce this oil content to 2 PPM.

KENNET: The cost figures which you gave us from a meeting of NE in Rome last year, could you tell us once again what, how they would find, one was for the cost of installing domestic sewage treatment for the whole country, is that right? In Italy for the whole of Italy.

OTTAVIANI: About two billion dollars for domestic sewage treatment.

KENNET: Now on the industrial side.

OTTAVIANI: Industrial now, the situation in 1968 is 1.6 billion.

KENNET: That is the figure that had been spent or should have been spent?

OTTAVIANI: Should be.

KENNET: Now is that to clean up rivers or just the sea or both? Discharges to rivers, or only discharges to the sea.

OTTAVIANI: Any discharge, both in the river and the sea.

Domestic sewage figures include two thirds of this figure. Its needed for sewers and manifold to collect the water to treatment plant.

KENNET: That I can understand, but I have a lot of difficulty in understanding how you can have arrived at that figure for the whole of Italian industry, because what baseline did you take as regards the level of pollution which is tolerable in a given stretch of a given river. Did you conduct a survey of the conditions of all rivers in the country?

BUONOMO: These are figures that have been gathered by government studies, Italian government studies. Now I read, and I believe its true, that fighting pollution is becoming the greatest speculation of allso I wouldn't be surprised if this figure is so high.that it scares people. Because it looks to me that Italian government and other governments are trying to get out of fighting pollution wone of the biggest speculations. When in budget of the country you see a figure of billions of dollars (of many hundreds of millions of dollars) a yeardesginated to fight pollution as I think there is the risk that fighting pollution will become the greatest speculation of all

RITCHIE: I think I know what you mean by speculation, but I think that anti-pollution is going to become big business and this is perfectly true, and if big industry want to diversify into sewers and sewage, because this is where they can put their stuff into one end of the river and take it out at the other and be paid for doing it.

FEATHERSTONE: May I ask regarding the 2 PPm that you say you are going to have refinery effluent running at 2 PPM whereas now they run at as you said, I think between 15 and 45; yes 40 PPM.

OTTAVIANI: It is allowed from port authority in Italy from waste water discharged into the sea.

FEATHERSTONE: Well I understand that nowadays refineries can get down to about 15PPM with modern practice, maybe Mr. Blake knows more about this. I'm interest to know whether in fact you have got anrefinery effluent down to 2PPM on a full refinery. You said you were going to achieve 2PPM in refinery effluent I think at the end of your talk; I'm sorry Iyou said that you could achieve five PPM in effluent.

Ottaviani
~~MARCHETTI~~: Yes, but this is not a question of PPM, this is a question of treatment unit. You have a biological unit, you can reach also one PPM, but if you have not a biological treatment and have only mechanical treatment, the oil content in water is normally between twenty and fifty PPM. And in Italy all coastal refineries have API seperator and not the other. The first refineries was obliged to have a biological treatment this is an inland refinery, a Gulf refinery in Lombardy. Our refinery with a biological treatment unit now is San Lazaro above Paria(?) a refinery having a capacity of about 6 million tons per... And the plant is the first now in operation which started 6 months ago.

Marchetti
~~OTTAVIANI~~: The oil is not only the problem of the refineries. We have particularly in the case of the petrochemical industries we have the problem of other toxicants, the most important toxicant is mercury that in Ravenna I would say that the actual problem.

OTTAVIANI: Again about Ravenna, ten million dollars, that is investment cost, includes the mercury treatment and some process modification, in the unit discharging mercury, to avoid this

discharge.

BORGESE: Do you have any figures as to running operation costs after installment?

OTTAVIANI: Yes in the San Lozarro refinery we have running costs of about ½ million dollars per year. It corresponds to three percent of the production costs.

ROS: This three percent of production cost is only for biological treatment.

OTTAVIANI: All the units; mechanical, chemical and biological.

RITCHIE: What would that be on say, a gallon of petrol? What would it add to the actual cost of the petrol you buy? What would it cost a customer to achieve this object?

OTTAVIANI: It's the same figure.

ROS: The cost of 2 billion dollars for treatment plants of domestic sewage is for the total treatment of secondary treatment. Only secondary treatment, not third treatment, phosphates.

OTTAVIANI: The cost of domestic sewage treatment is mechanical and biological only.

ROS: And you don't study the possiblity of sea outlets?

To put in the sea the sewage without treatment, only with mechanical treatment.

OTTAVIANI: The study was made on this basis: all waters had to be treated.

KENNET: I have one more question and that is about monitering the level of the PPM's. How is that done? When you've got a plant which is supposed to be functioning at forty parts per million how do you check whether it is reaching forty parts per million or whether its going up to fifty or seventy?

OTTAVIANI: What I say about the present situation is only an estimation. The control of the water effluents from a refinery in Italy is made by port authorities. And I think now it's overanalysis are not true. Normally, they made one analysis every two or three months. This is not absolutely dcontrolled.

KENNET: Does the refinery operator have warning of the inspection?

OTTAVIANI: Normally it is the situaiion. But if you have biological treatment the risk of the limit is very reduced. Biological treatment, normally goes well or doesn't go.

FEATHERSTONE: Thanks very much. That's what I was trying to ask earlier and I didn't phrase it very well.

earlier and I didn't phrase it very well. Because this is the problem I think. I believe in the United States, the Coast Guard has been working for eight years and I know Esso has been working for about the same time to get a system to monitor continuously the content, not only of oil, but of course everything else, chemicals sewage, but to get a continuous monitoring system that will show you on a dial what the content is And this is a great problem. It will be solved I suppose, but its certainly not solved at the moment.

ARANGIO: You mean the monitoring is not done on a regular large scale national basis in the U.S. for instance.

FEATHERSTONE: NO, its not done as a continuous system so that the oil is pouring out of the effluent, is pouring out from the ship, the refinery the sewage works, the chemical works, and there's no system by which you can tell exactly what the content is in the effluent.

BORGESE: What is this for technological reasons?

FEATHERSTONE: Purely technological reasons, but there are systems which you can take a sample from the effluent, measure what is in

in it, and I heard the other day that you can use one of the main systems , in one sample that was used, it showed 50 PPMs. And they then did an infrared test of this which showed 150. So there's no standardization of the measurement and no continuous measurement. Those are the problems.

RITCHIE: So if you have to enforce a limit, it is going to be extremely difficult.

FEATHERSTONE: You can't really enforce a limit until you've agreed what the measurement will be and how you will do the measurement. Certainly not internationally.

BORGESE: Is this international standardization organization this this ISO doing anything about that?

BLAKE: I don't think that has anything to do with it. What Mr. Featherstone was saying about the difficulty of making these measurements is quite true at the very low level of concern for pollution purposes. At the higher level, much higher than what can be tolerated for pollution purposes there are perfectly good methods. But when you need the extreme sensitivity at these very low levels it becomes extremely difficult.

ARANGIO: ...the situation in Italy and many other nations is not a satisfactory one as far as monitoring is concerned. I should like to have a picture for instance in the United States and in the United Kingdom. Which is the degree of regularity or the frequency of the monitoring which is carried out by the Coast Guard, or by some competent United Kingdom authority.

BLAKE: Regulations in the U.S at the present time refer to oil on the surface of the water either in harbors or elsewhere. And it simply says there shall be no visible slick.

BORGESE: Well again it seems to be more of a question of organization of legislation than of technology.

BLAKE: We don't have the technology to measure these extremely small values continuously for monitoring purposes.

ROS: Is this really for the oil industry but the other problem of pollution it is figures.(?) For instance in the U.S. you have in the Patrickson river (r) estuary the continuous monitoring for 6 parameters, a very low level of pollution, continuous; it has been four years now. In France, Professor Vesier is a specialist

but in the U.S. in Concord, in the Patrickson River, it has been four years you have one system for monitoring at 6 parameters it is very very cheap.

BLAKE: There's no particular problem there. That's not what I'm talking about.

ROS: I don't believe that the oil content is so difficult as you seem to think. In the technology that now exists there is the possiblity of monitoring continuously the oil content in the sea water. I am sure, and I am sure that Professor ... can tell you the firm apparatus for the control, but for instance not for oil, but for chlorophyll in water is not different to measure this content as to measure the oil content in water.

BLAKE: Let's make sure were talking about the same problem. I'm not talking about a laboratory measurement of the oil content that we can do to a sample. This we can do to oil parts per trillion.

ROS: No, I said a monitoring continuous system , an automatic system with extraction. It's no problem today to take a sample to extract sample to measure its... with absorciometer and to put it a magnetic tape. We speak about the possiblitiy of an automatic monitoring system. That exists, expensive, but that

exists.

RITCHIE: Could I just make another appeal, speak one at a time.

BLAKE: Its becoming clear to me that we're not talking about precisely the same problem. As I understand you are talking about frequent measurements in the laboratory; sample measurement.

ROS: Continuous sampled measurement, automatic.

BLAKE: One part per million for all the water?

ROS: Maybe not one each minute, but one every hour.

BLAKE: For all the water coming out of the refinery ? or just samples?

ROS: From samples.

BLAKE: Ah... but that's not monitoring all of it. The oil is not uniformly distributed throughout the water. Unless you measure all the water you aren't measuring it.

ROS: But you can take some and to do chromaticgraphy of gases automatically.

BLAKES: I agree, but you're not measuring all the water.

ARANGIO: I think the two gentlemen were discussing two different problems obviously. One of them, our distinguished friend from Spain was referring to the technical possiblity of monitoring oil, I'm

sure that exists. But what I was asking is ~~how frequent~~ how frequent, how regular is monitoring in the U.S. with regard to oil or other effluents and how frequent, how regular, how reliable it is in the United Kingdom.

KENNET: In England, the law says that every new factory that's being built which will have a liquid discharge to the river or the sea must negotiate and agree with the relevant public authority, which is the river authority. And the river authority comes round outside the river mouther onto the coast to what shall be the volume of liquid effluent permitted and what shall be the concentration of different substances in that volume which will be permitted. The river authority will also tell the industrialist as the condition of his permission to discharge water, what measures for monitoring he must take. Normally it says he must do it himself. He must install the monitoring plant, and on the question whether one monitors the total volume of effluents or whether one takes frequent samples, common sense and politics would suggest that its enough to take frequent samples; it is of course to take each succesive sample from a different place

in the plan of the outflow, in the section of the outflow. In the case of old industry which was built before the new law came into effect, there is a continuous battle between the river authority and industry about the installation of cleaning gear on the effluent, even now. And what invariably happens is that the company says, "this is a very dirty plant I admit, but within two years, I shall close it down and build a new one and then we will install proper cleaning gear." And the river authority says, "well allright, that's reasonable." Three years later they remember about it and they say to the factory, " You were going to close that plant down weren't you?" And the factory says," Yes, we're terribly sorry we just have a letter in draft to inform you that there have been certain difficulties about the new plant, and we very much regret that it shall be two years more before it comes. Then this becomes political, you see. Now as to the way it works in practice, speaking now not on the technical level but on the human level, accurate measurement we find is not very important; you don't need to know within 10, 25, or even 50 percent whether the industry is hitting its target. The kind of thing that gives you trouble is when it

overshoots the permitted level by three or five hundred percent. By trouble I mean, when the public notices it because the river smells or it goes cloudy, or you can see a lot of oil on the surface when the fish are killed or when you get utrification. If none of those things happens in pratice, I don't think anybody bothers very much about rivers. Now on beaches, on the sea, something of the same situation exists, except that I think its probably safe to say that the factor of excess over a permitted level which will attrack public attention, in the sea is even greater than it is in rivers. Maybe you have to break your ceiling by ten times rather than by five times before anybody will notice. So, actually these very refined measurements I don't believe are important in the sense of making real progress. It's true you have to write things down so as there shall be something to litigate about if it comes to court. But if an effluent goes over by ten or fifty percent for a day or two, it usually doesn't matter too much.

BLAKE: I would agree completely that when the pollutant of concern is misable or soluble with the water that a sample measurement

is quite adequate, but the oil is not misable or soluble so that an occasional sample doesn't serve the purpose really. That's my whole point. It's not uniformly distributed through the water and so there's a sampling problem. Its a technical problem.

KENNET: I think that what you've just told us is a very impotant fact that American law says if you can see it its illegal. Now other biologists around would tell us that oil in water is dangerous even when you can't see it; does invisible quantities of oil in sea water on marine life.

HOLT: As far as I know even visible quantities are not known to be harmful. There's no evidence that even when oil exceeds the visible concentrations that it is harmful. This means that the visiblity criterion is probably a very safe one; but we don't really know because it's what happens to that oil rather than the oil itself that may have the effects.

KENNET: If you want to put it in a nutshell; people complain first.

PRESIDENT: It's rather like that story, Wayland, that you have Tom and Jerry building when they built and knocked on the wall

and the fellow said, " Can you hear me?'' And the other fellow said, " Yes, I can hear you very clearly." And he said,"Can you see me?" And he said, "No." And the fellow said, "That's a wall."

BLAKE: Just as one final note, may I describe the rather homely test we use in our big refinery in San Francisco Bay on our effluent water which we put into holing tanks before we release it into the Bay. We put some stickle-back fish in an aquarium full of this water and if they survive, its alright to let it go. And this is a much more sensitive test, than whether we can see any oil.

PRESIDENT: Well, it's like the canaries in the pit, you see.

MILLER: I think I ought to mention about Dr. Max Blumen, at Wood's Hole who has found that there have been harmful effects on the bottom in shallow areas such as where shell fish are, commercial product. And in our own town, he was able, through litigation, to make the town richer by 100,000 dollars, which helps our tax-rate.

KENNET: Well is that harm done by invisible quantities of oil?

MILLER: Well I don't know what you mean by invisible. There was a

barge spill and it eventually sunk to the bottom and affected the animal life.

MARCHETTI; I think it is not a question of accute toxicity, it is a question of chronic toxicity effected by oils. I am a toxicologist and I think I completely agree that oil is not as toxic in accute sense. But it can be accumulated by certain fish, mollusks and so on. There is a question also that this product can be biodegrable with reduced production of transeroginal substances. We know in the Adriatic Sea a great number of cancerogenal substances that we think are produced from oil pollution. I think that from this discussion, arises two interesting points for Malta: One point is the possiblities of monitoring the pollutional load coming into the sea. The second point, perhaps is the data of safe concentration for the fisheries and so on.

RITCHIE: On that point could we have a paper on this from anyone?

MARCHETTI: We have some consideration, a draft: when would you like this sort of thing?

RITCHIE:This afternoon, I think.

[illegible]

ARANGIO: From Sidney Holt, he mentioned that in spite of a certain degree of pollution by oil or any other thing, the possiblity that the test is whether the fish lives on somewhere exposed to the polluted water. Somebody said so. Would you be satisfied from the point of view of preservation of fisheries or leading resources of the sea, that the survival of that given fish which is exposed to that given polluted water is sufficient to tranquilize you; that fish would survive but in what condition? And what about the next generation of fishes?

HOLT: Well that is what he just said that oil is not acutely toxic.

MARCHETTI: I remember a year ago we had some experience of the sea detergents, you know the product which eliminates the oil? I have, obviously, started with some experience of only oil. Well if you give ... ariation, it is not toxic for the fish. I worked with fresh water fish, trout; a very sensible (?) sensitive fish for a long period. When you put the product for eliminating the oil, the detergent, the toxcicity is very strong. But it is not a question for accute toxcicity, it is a question of

the affect on X plankton or order.

ROS: I think this conference is the pollution of the sea and the 1PPM or 10PPM or 50 or 100 of the sewage of the rafinity coming to the sea and the sea is diluted by a grand mass of water and the only thing I am interested in is the concentration of the oil in the sea; the quantity sea there is in the Mediterranean sea now. Because we are all speaking about the pollution in the Mediterranean Sea for five years, and nobody knows how much oil that there is in the open sea. In some places very close to the coast, there is osome data, very little but in the open sea, the only data I know is Professor Oren one travel(?) of the Mediterranean Sea and nobody knows what is the concentration of the oil on the surface of the sea with the mass of water. I think it is very low. But I think that one of the important things we can do is to monitor for the Mediterranean Sea in oil and in pesticides and the other things. Because we lack completely the data.

RITCHIE: I think this is one of the important things we bring to Malta is the question of both, monitoring and the methods of

monitoring.

MARCHETTI: This is a problem not only of the oil. We don't know what absolutely is coming into the Mediterranean. It's a problem of sewages, of other industries, of refineries and so on. We have and I am aware of the impossiblity, of arriving at the evaluation of the load of pollution because it is there. I think that we need a group of very important persons. We have other possiblities of estimated budget of the pollutants which go into the Mediterranean by means of the theorectical calculation. At least, at the moment we have not the theorectical calculatons. We have tried to do this for Italy. We have concluded with this book that is not yet published, I can show to you. Starting from every country on the coast and we have reviewed a list of pollutants, if you are interested. For the Italian coast. This data concerns only the Italian coast, and in only the countries situated 20 kilometers along the coast. We have the total population, this data is from 1966 of a 16,161, 426. (population figure. Total of industries: 138,829. (factories). The chemical industires: 1,589. Total of tourists during one year which is

another source of pollution: 47,222,713. This is in one year, official data. This population give a BOD t/y a biological ... in demand the quantity of oxygen that we need for oxidated all organic substances produced by different. That amount to: tons per year: 874,905.

HOLT: Have you weighted the number of tourists by the fraction of a year.

MARCHETTI: Yes of course, we have the ... This is proportionate to one year.

HOLT: On the assumption that the average tourist weighs the same as the average Italian.

MARCHETTI: The data is the phospherous and the nitrium(?) produced by all the these two companies, tourist and population, the amount of phospherous in tons per year is : 16, 206. The nitrium is: 64,897. Phospherous and nitirum. We know that for each person produces 3 grams of phospherous and ten of nitrium. We can calculate it by this. By the market, we know that the person in Italy have the consumption of the detergent, of ... This calculation produced a figure of detergent, scientific detergent in tons per

of : 109,755 tons per year on the coast. And that you know the proportion of industrial and human population pollution ratio. is 1.22. The discharge is about distributed in coming from population in 2 parts coming from industries. These are some results of the theoretical calculation, but at least we have some idea. Now we have a point of departure. I would like if all the people of the Mediterranean tried to produce a figure like this.

RITCHIE: We have another question.

BUONOMO: M~ine is not a question. I heardd that monitoring is a technical problem or is a economic problem. I believe that it is both of these, but it first of all is a political problem. To do monitoring in the proper way it takes a political way of doing monitoring. Monitoring is the first part of fighting pollution. Fighting pollution in the right way means interfering with profit because it mean imposing on industries filters and treatments. Now just to give you a sample of the dificulties of saying that monitoring is a question of political will, I will say that very shortly the situation in Naples regarding

monitoring. Monitoring of the coastal waters around Naples is a job of port authority. There are regulation port authority in Naples that say that every industry that discharges waters into the coastal areas has to bring a sample of the water every three months. Now we have inquired and since this regulation started in effect in 1969 no sample has ever come to the capital of the port of Naples. The more the laws are severe as far as penalties are concerned, for instance there is direct... which was signed on December 31, 1970 , there are penalties for industry which range from 25,000 to 50,000 dollars per day. Now you can imagine that the more severe the penalties the more monitoring and persecution of pollution would be stopped by the same people who should do the work. Political office and public health office. So I think this is important because even if monitoring would be one of the biggest problems we should be aware of the difficulties and why monitoring is not done in the proper way and what to do to insure that it is done in the proper way.

PRES: Monitoring, surely must be done by completely independent

authorities. It can't be left ultimately to the industry itself nor, I should have thought, to the people who have to pass the judgment on it. I think this is our experience in Britain.

KENNET: Yes, it is, but what we do is we make the industry install the monitoring equipment and the public official goes and looks at it when he feels like it., and checks its functioning.

RITCHIE: Yes, but when an offense is reported, this is purely by inspection. An offense is determined by inspection?

KENNET: Yes, generally what happens is the public complains; they say that the river or the sea is getting dirty or something happened last night (or last week) and then the public official comes and looks at the monitoring gear which is installed and maintained as to costby the industry.

RITCHIE: I've noticed in London, for example, where we've had pretty effective and efficient smoke RESERVES and constraints on chimneys and so on, that when I come off the train at seven o'clock in the morning they seem to be doing the equivalent of washing out the bunkers at sea. The black smoke that comes out of these chimneys is quite unbelievable. If it's early morning nobody

notices.

KENNET: This is only a detail but this is the thermalgenerating stations starting up for the morning load from industry and the railways. And we have yet to findin Britain a way of starting a big boiler without making smoke. It only lasts ten or fifteen minutes.

I have a question for Dr. Marchetti. The tourists there, your 47 million that is of course, the crude figure for the number of tourists who come to Italy or 20 kilometers from the coast. What is the figure corrected for the number of days they stay because your 16 million is native years, your 47 million is not tourist years.

MARCHETTI: No it is tourist days, so you would, tourists remain about one day point 2.(1.2 days.) Unfortunately that is not people, that is tourist days.

RITCHIE: Would Dr. Miller like to start off our discussion of the physiography and biology of the Mediterranean.

MILLER: Well I would begin first with the observation that when one talks aboutthis subject you usually assume that your audience

is conversant with what you're talking about., and quite often they are not. So I shall assume you're not. So if you'll bear with me for a moment I'll speak something about general circulation, because on page 6 of the pollution report by Lord Rithie-Calder, the word is used about the Mediterranean dying or being pretty sick. And I don't know what manner of person can say the patient is daad, I don't know how one evaluates this. So let me then go into some certain fundamentals.

In the first place, in the general circulation system we have in the deep ocean an oxygen minimum layer. This oxygen minimum layer has come about by the gradual decay of organisms and whatnot in the final disposition of the result of the returning of life to its former state. Along with the disposition of this oxygen minimum layer there is a phosphate maximum if you will, they almost go together. And the reason I bring this up is because the vertical circulation is what makes the ocean tick, in terms of up welling, down welling, the question of bringing nutrients back to the surface of the sea in order to have animals and other life of sorts to survive. Now up welling comes out of

many causes. For instance on the coast of California, the general prevailing winds will drive the surface water away permitting the up welling water from underneath to come to the surface. This brings with it a supply of nutrient material which then allows the animal life to bloom. And correlating with this then is the fact that through out the world, in spectacular upwelling regions that is where the oil is found. But a farmer can appreciate this, an agriculturist because he knows that he just can't till the land indefinitely he's got to do something to it, nuture it in some way, and so now we come to the Mediterranean sea proper.

The Mediterranean is poor in terms of its nutrients, but it is efficient. In other words, mother nature allows this water that goes down, sinks, to come back up and recirculate and put these minimum amount of nutrients to a maximum amount of work. So we now come to the general circulation of the Mediterranean Sea. The water comes in by way of the Straits of Gibralter but this is water that has already been at the surface for some time so it is not a rich water, it is a depleated water. It comes in

with its natural supply of what might occur in the surface water outside in the Atlantic. That's your supply in the Mediterranean It enters through the Straits of Gibraltar and migrates to the east. In doing so, it increases in salenity as the evaporate effects take over. Part of this comes here, right here in the Mediterranean, part of it goes into the 'Algera' Promencal basin, but a good portion of this continues eastward through the Strait of Sicily which is another phenomenon similar to what is happening in the Straits of Gibraltar, in a lesser magnitude. So the Eastern Mediterranean draws upon the Western Mediterranean whatever the latter can supply. Now it goes to the Levant and it's continually getting saltier. It returns by way of the Cretes and all this area, then it starts its way back, I'm still speaking about the superficial water, it goes up into the Adriatic where it also goes through certain transformations. Now what happens in terms of all the salinity increase by removal of fresh water, the water itself becomes denser, but it remains at the surface because it is also accepting heat which balances off the effects of increased salinity. But then winter comes and particularly in the

Adriatic, now it becomes colder. Now it is denser and it can no longer stay at the surface and it collects in the pool in the lower Adriatic and finally spews out into the Eastern Mediterranean and becomes part of the deep circulation, the very deep circulation because the Adriatic in the winter will be providing a great deal of cold salt water. And another process is going on in the southern Aegean Sea and in the Sea around the Levant. Which is also cooling water which has been made salty. And in the southern Aegean Sea this water sinks to the bottom there, but it is an isolated sea, a little different from what is happening in the Eastern Mediterranean proper. There is exchange going across the southern Aegean Sea and the Eastern Mediterranean proper through the Straits of between Crete and Scapanto and Rhodes, and in fact, there's another more complicated exchange going on there. But in the Southern Aegean the stirring of this water that occurs in the winter is enough to oxygenate that water so that relatively the Southern Aegean Sea is rich in oxygen material. This becomes another part of the character of the Eastern Mediterranean water the Levantine

water, so the two major sources are: the Adriatic outflow and the Aegean or Levantine outflow producing what is called Levantine intermediate water. So now follow this back to the west. This water returns now, it is salty; not particulaly cold, it is a matter of scale that we're talking about, but the Easter Meditaerranean water comes back into the west, through the Strait of Sicily now it is denser. It comes into the western Mediterranean in two different paths. One goes directly against this water that is coming from the west, and another branch comes into the Teranean Sea and form-s a major part of this water here, underneath the Atlantic water. It then returns around by the east coast of Sardinia and goes into the Provencal basin and then hugs the coast of Corsica and Sardinia coming up ; through Arabia going around in a ring-like form through the coast of Spain and the Baleric Islands and there it stays in its essence. An intrusion between the surface water and the deep bottom water which is this Levantine intermediate water. It is now in its new environment, a salty warm barrier. Now in the winter here,

south of France, when the ... blow and the evaporation is still going on and the cooling goes along with this, then we have the phenomenon of this water finally reaching its maximum density and sinking through the bottom and in sinking through the bottom it penetrates this Levantine intermediate water mixes with it, becoming the final product which will eventually go out back into the Atlantic. Now in the Atlantic, the Mediterranean water extends across the entire Atlantic Ocean, from Europe to the American coast. But that is only one effect. I have a paper by a colleage, Gregorio Parillio which shows the other effect, and I will simply show a drawing of this in form where he considers this a vein of Mediterranean water going out Gibraltar and hugging the coast of the Iberian Peninsula, eventually to also take part in the general circulation of the Adriatic. So I mean the Atlantic. So the phenomenon is far reaching and not local;it is fundamental, and it involves how do you get rid of whatever is happening in the Mediterranean. The Mediterranean is a trap. I believe that if you threw a good part in here, the odds of it ever getting into the Atlantic Ocean, well one could make a

lot of money on this I think. The general surface flow is into the Mediterranean so it is a trap, It is also a trap in another sense: it is a trap for the people that work in the Mediterranean because the range of values that we're talking about is very narrow. And so it requires very careful observation. This narrow range of values is what makes it such an efficient medium for recirculating the nutrient material as it is, but it is a range of values that the margin of error in observation techniques is such that if you are not careful, your conclusions will be entirely wrong.

RITCHIE: I just want to come back to the Algero-Provencal basin and the upper Adriatic. What would be the effect, Rocky of the pollution effect of these areas, would that get into the circulation of the ~~Mediterranean~~ Mediterranean?

MILLER: I don't think anything is isolated, I think it eventually permeates the entires strata.

HOLT: Can you tell me what the average resident time of Atlantic water in the Mediterranean, and secondly can you explain something that puzzles me; you say its a trap but it seems to me that the

circulation system is such that its only a trap of floating pollutants whether these are plastic bottles or oil. But its essentially a flashing system for soluble pollutants, or am I wrong?

MILLER: It is a flushing pollutants for soluble pollutants yes, and as a trap in the literal sense, I meant in the surface water in other words, anything that is floating cannot go out, it's got the Ulysses complex. 80 years, I use as a basis of this my own calulations between and concerning the increase in salinity also one can make reference tot Spedrick, Johnson and Fleming who are more capable people than I have come to that general conclusion. Also there's a recent paper by Brücker, on using radio carbons on estimating the life from that point of view; they all agree.

RITCHIE: Now can you tell us in our ignorance what the resident time really implies in this case? Does this mean that the water is in a sense locked in the Mediterranean for 80 years and that after all that is happening to it...

MILLER: No, this means that taking the Mediterranean as a whole, as a complete homogeneous unit, then 80 years. But in detail

that means that some of this would be rapidly circulating in and out of the Mediterranean and other material would say for quite a long while depending on what area you're considering.

RITCHIE: Yes, but if we are talking about the deep water, that is to say non-surface waters, and the resident time of non-surface waters, that is to say deep waters is say, 80 years; what can we see as the effect of this, and again I come back to the pollutant. How long are you holding, is this 80 years of holding of pollutants, either in solvents...

MILLER: I don't think so. But I think I can use as an example what I began my remarks with and that is the oxygen minimum layer. There is no appreciable minimum oxygen layer in the eastern Mediterranean. Its very difficult to define. But, in the western Mediterranean there is and there are indications, and I'm going out on a limb here, that the two tons of Levantine intermediate water that might be observed between Sardinia and the African Coast, one ton is of recent origin from the East, the other ton is of origin within the Terranean Sea and may have been residing here for quite some time. Because it is lower in oxygen. So

think of it this way; if we send water to the west, through the Strait of Sicily, and one branch goes into the Terranean, how long does it take for that sub-surface water to lose it's oxygen in the natural course of things by the time it comes out off the coast of Sardinia.

RITCHIE: Could I then ask this question? We have what we call the stagnant sea in the Black Sea, I think here you might help me to define the word stagnant, if you would. But let's assume that we're talking about the Black Sea as a stagnant sea, what is stagnant?

MILLER: Stagnant in this sense in the Black Sea means that it is covered over like the Fjiords in Norway and it has nothing to do with man-made interference. It's the fact that there is a balance between the run off of Europe in the Black Sea so that it is riding over the sub surface water and isolating it from exchange in a vertical sense.

RITCHIE: Now could that happen by man-made methods?

MILLER: I don't know. I can't answer.

RITCHIE: But what I'm really asking is if we are looking at

the problems as we are of the Provencal Basin and of the Northern Adriatic which we do know something about in terms of pollutants and pollution, what would be the effect of any process there which would cut off oxygenation ? Do you think its serious? Oxygenation of the interface, the taking of the oxygen from the atmosphere and pushing it down into the deeper waters. Could you have a cut-off.

MILLER: I don't have a feeling for this and I think the natural normal situation takes care of itself. Well I think perhaps one controlling point might be the Sea of Marmara(?) in what you were just expressing because the Black Sea is hardly a saline sea, its brackish and the Sea of Marmora on the contrary is very saline; its higher than 38 parts per thousand. But in the Sea of Marmora the oxygen content is extremely low which means that its been sitting there for a long time. Otherwise, if it were something that came from the Black Sea it should be fresh. And since it is in the hneighborhood of over 38 parts per thousand its origin is from the Mediterranean side. But its low oxygen suggests that its either been there for a long time or something is using

up that oxygen. Now as far as what man can do to this kind of thing, I have no feeling for it. I think that this whole problem of pollution is a problem of scale and there are various misconceptions in the layman's world of imagining for instance that a gulf stream is a river, and thinking that the gulf stream has its source in the Mississippi. Well thats utter nonsense. The gulf stream is much more powerful that any river and drives so much more material, in fact its a mechanism of itself. And this problem of scale is very difficult to appreciate. There's an awful lot of water.

ROS: I think the trap you speak about in terms of the Mediterranean water, the Mediterranean trap is a trap of surface layer but I think it is not only for the surface of the sea that is for the solids that can float in the sea is a trap for the surface layer, maybe twenty meters depth that is all the sewage water than Malaga and the Costa del Sol Española doesn't come from the Atlantic, they come from the Mediterranean, and doesn't float. It is less dense than the sea water and this is the twenty or thirty meters on the surface. And all this move inside

the Mediterranean, not outside.

HOLT: That's a question of time stage surely(?) there are low pivots superimposed on his general pattern he's described, there are local movements but in fact in the long term all those surface solubles go back into the Atlantic because (interruption) that water . . . and meanwhile you've got osscilations in the whole system and it is this that is the cause of the evident pollution locally.

ROS: Yes but for instance, for California pollution from bacteria I think there are very few bacteria of Mediterranean origin that go out from Gibraltar, for Gibraltar. I think all are in enough time inside in order to disappear, non float the depth of water. I think it is not only the film.

MILLER: It's this matter of scale again. Were you talking about this: The Strait of Gibraltar, the cross section we've got 150 meters of depth in which this Atlantic water is coming in and 150 underneath or there abouts of the Mediterranean water going out this way. This kind of phenomenon is existing also in the Strait of Sicily. It's this sort of thing, and sometimes if the water is shallow enough it then becomes somewhat overbalanced.

I think in particular one should bear in mind the turning of the earth and that in this hemisphere, the circulation is such that if it is significant it will rturn to the right, as I pointed out in Señor Paolillo's paper here this is one aspect of the Mediterranean circulation where moving water is turning to the right; it is going up the Iberian Peninsula on the Iberian side. It is going up the coast of Sardinia and Corsica on the western side, it is leaving the Adriatic by the Italian side. It is leaving the Aegean by the western side of those straits. This is a rather important point. And if you are in the southern hemisphere well of course, then it would be on the opposite side, but we're not, were here.

PRESIDENT: Wayland you asked me a question about Gibraltar the other day. What was it? We were discussing the non-tidal Mediterranean and he said what about the Atlantic tides coming in.

MILLER: Oh yes, and cyclic phenomenon of probably considerable importance. But again in this same token if you see that the Strait of Gibraltar is controlled and I think fundamentally, this is what is overriding, everything that I've said, it is a control

of the Mediterranean. It is a place suitable for monitoring. Monitoring in the large sense, and perhaps we speak about expense here of doing things, perhaps on a larger scale these places at a more modest expense should be planned for in terms of monitoring. Such places as the Straitof Gibraltar, the Strait of Sicily, not the Strait of Messina, but the Strait of Sicily the Strait of Otranto the Strait of Scepanto, and possibly the Dardanelles, and certainly the Suez Canal.

RITCHIE: Could I just come back, now that you have reminded me. When we discussed you said that the fact that the rivers had very little effect on the Mediterranean. Has this always been true?

MILLER: I don't know. I mentioned the mechanism that exists now, but then you and I know that sea level has changed. And if sea level has changed what has that done to the Mediterranean? If in this phenomenon that we mentioned somebody put some kind of diking across the Strait of Gibraltar you could change the whole character of the Mediterranean. And so during the whole natural history of the earth certainly the character of the

Mediterranean has changed depending upon the character of these sills.

RITCHIE: No I was thinking particularly of the building up of the delta of the Nile which must have acted as an increasing buffer to the flow of the Nile itself, And I was wondering if for instance the Glomar Challenger results had shown that there was in fact, I think that I'm right in saying this, that there was at one time a very extensive of the Nile, must have been in terms of disposits and so on.

MILLER: I have no feeling for this perhaps...

OREN: Regarding the Nile, this is a regulated river for many thousands of years, since Pharonic times there have been barges on the Nile for irrigation of Egypt. And for several months a year there was no flow at all of Nile water into the Mediterranean. The maximum flow was usually in August or September after the rains on the Ethiopian plateau. But the sills from the Nile are covering most of the parts of the bottom of the eastern Mediterranean, the Nile cone(?) is an extremely big area of the bottom. Since this

construction of the Aswan Dam, and no more silting a lot of damage has been done on the shores of Egypt, and during the last year several villages have been just eroded from the coast. So the effect is greater now of the non-existant Nile than as long as it existed, because as long as it existed it built up its delta. Now all this is eroded. And the effect was only during a very short period on the surface waters of the eastern Mediterranean and this reached up to Alexandria and maybe even more to western. But Alexandria is the north eastern corner of the Mediterranean.

RITCHIE: But the Nile did in fact build the beaches of the Levant and they are now disapearing.

OREN: Yes, all the dunes along the Israeli and Gaza (?) ... this is all Nile deposits. Concerning what Dr. Miller said about the trap of the Mediterranean, I think this is even more true for the Eastern Mediterranean which is a rather deep basin and separated from the west by a very shallow sill. So that whatever settles or whatever goes into the deeper parts of the eastern Mediterranean hardly leaves this basin(?). And this of course is evident from

what Dr. Miller mentioned: the non existance of the oxygen minimum in the Mediterranean. And this is also shown by the high concentration of nutrients like phosphates in the deep waters of the eastern Mediterranean, which very little affected the production in the upper layers, because the vertical mixing practically never reaches into very deep waters of the eastern Mediterranean. It always mixes a layer of about 2300 meters or so, 400 meters. So whatever the load is, remains. And this is merely one of the reasons the eastern Mediterranean is even poorer, much poorer than the West.

RITCHIE: Could I just interrupt here a question which was raised at one stage which I didn't deal with in my paper and that was the suggestion of that there might be a pumping system which would bring out the nutrients of the deeps into the system. Is that possible? Forget the scale.

OREN: There have been ideas of using the high difference or the great difference in temperatures of the bottom water, surface water to produce somekind of a pump which will heat itself and cool itself by the difference in temperature. And I think that something has been constructed or planned to be constructed off

Dakar. People had the same idea to do something in the Mediterranean or even in the Red Sea, ignoring the basic fact that the amtitude between the minimum and maximum in the Eastern Mediterranean is about 13 degrees only, in high summer. In winter it is only 2 or 3 degrees. So it is impractical. In the Red Sea it is even worse, because the whole amptitude is only $7\frac{1}{2}$ or 8 degrees in mid-summer and in the winter it is practically non-existant. The minimum temperature in the Red Sea is $21\frac{1}{2}$ degrees in the greatest depth. When in the open ocean it is one, two or minus one or minus two degrees.

RITCHIE: No, what I was coming to, even if we could conceive it, the possiblity of pumping the nutrients from the bottom the question I was going to raise, aren't we also pumping the nutrients as well?

OREN: This is not a question, the boundary between what you consider pollution, and what you consider fertilization. Because if you pump these large quantities of phosphates into the surface layer of course blooms of plankton and later of higher animals. And the blue colour of the Mediterranean will very soon disappear.

RITCHIE: Well, what I had in mind is (of course you have all kinds of

mineral pollutants there now over all these centuries, and that would be coming back into the food layers. That was my only point. The point is that your bottom silt or whatever you call it consists of, not only of nutrients, it also consists of all the other things that have gone in there in the way of metallic minerals and so forth.

OREN: Well if this is material in dispersion or solid material this will settle eventually and this has no effect on, except maybe long range when this eventually dissolves. But when we talk about nutrients we talk about mainly the salt materials in solution.

KENNET: We want to talk this afternoon about politics and law in an international context. There is one question that I think we're now ready to ask as it were. What general description, what profile can we oceanographers give us of the following: Ignoring oil entirely and ignoring those substances which may be nutrient in one situation and pollutant in another, what is the evidence about the state of pollution in the Mediterranean Sea, more than 20 kilometers from any coast? At any depth but more than

20 kilometers from any coast.

OREN: In my opinion the only areas which are affected are probably here, the Gulf of Naples, the Northern part of the Adriatic and the Gulf of LINE(?)by industrial and domestic sewage.

HOLT: But youre asking other than the nutrients of the oil. This comes down to the new synthetics and the heavy metals essentially.

MILLER: I don't know what a pollutant is. But I think in regard, I asked that question yesterday and you gave me a very fine answer and the question of the chemistry and I think this is perhaps what you meant by your question... continued

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per Inquinamento Mediterraneo

a ISCHIA dal 1 al 4/9/71

FOGLIO N. 1

data	bobina traccia	ORATORE prog.	ORATORE nome	durata dal	durata al	lingua	note	Trascriz. si - no
1/4	1-I	1	~~RITCHIE~~				Inizio Riunione	
		1	Borgese	0.2	0.3	Fr		
		2	Mesmini	0.3	0.8	It		
		3	Borgese	0.8	1.1	Fr		
		4	Bonaduce	1.1	1.8	"		
		5	Borgese	1.8	2	"		
		6	RITCHIE	2	3.2	"		
		7	MILLER	3.2	4.8	"		
		8	RITCHIE	4.8	5.8	"		
		9	Kennet	5.8	6	"		
		10	RITCHIE	6	6.2	"		
		11	ARANGIO	6.2	6.3	"		
		12	Borgese	6.3	6.9	"		
		13	RITCHIE	6.9	7.2	"		
		14	STIRN	7.2	7.3	"		
		15	RITCHIE	7.3	7.8	"		
		16	ROS	7.8	8.2	"		
		17	~~STIRN~~ HENNET	8.2	8.3	"		
		18	FEATHERSTONE	8.3	8.8	"		
		19	RITCHIE	8.8	8.9	"		
		20	MILLER	8.9	9	"		
		21	FEATHERSTONE	9	9.2	"		
		22	RITCHIE	9.2	9.3	"		
		23	BUONOMO	9.3	10	"		
	2-I	23	"	0.2	0.4	"		
		24	RITCHIE	0.4	0.7	"		

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FOGLIO N. 2

data	bobina traccia	ORATORE prog.	ORATORE nome	durata dal	durata al	lingua	note	Trascriz. si - no
1/4		25	FEATHERSTONE	0.7	0.9	Fr/		
		26	RITCHIE	0.9	1	"		
		27	DOHRN	1	1.2	"		
		28	FEATHER.—	1.2	1.6	"	(con Presidente)	
		29	Presid e Borgese	1.6	1.8	"		
		30	BLAKE	1.8	2	"		
		31	KENNET)	2	2.3	"	↓	
		32	BLAKE)	2.3	2.6	"		
		33	ARANGIO	2.6	3	"		
		34	DOHRN	3	3.1	"		
		35	FEATHER...	3.1	3.3	"		
		36	Presidente	3.3	3.4	"		
		37	FEATHER.—	3.4	3.7	"		
		38	MILLER	3.7	3.8	"		
		39	ROS	3.8	4	"		
		40	Presidente	4	4.1	"		
		41	DOHRN	4.1	4.2	"		
		42	Presid.	4.2	5	"		
		43	STIRN	5		"		
		44	Presid.		5.1	"		
		45	KENNET	5.1	5.2	"		
		46	MILLER	5.2	5.4	"		
		47	Presid.	5.4		"		
		48	BUONOMO	5.6	5.9	"		
		49	Presidente	5.9	6.2	"		
		50	ARANGIO	6.2	6.5	"		

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FOGLIO N. 3

data	bobina traccia	ORATORE prog.	ORATORE nome	durata dal	durata al	lingua	note	Trascriz. si - no
1/4		51	Kennet	6.5	6.9	Fr		
		52	Presid	6.9	7.3	"		
		53	ARANGIO	7.3	7.8	"		
		54	STIRN	7.8	8.2	"		
		55	Presidente	8.2	9	"		
		56	ROS	9	9,2	"		
		57	DOHRN	9,2	9,3	"		
		58	BLAKE	9,3	9,4	"		
		59	Presid	9,5		"		
		60	HENNET		9,6	"		
		61	Presid	9,6		"		
		62	HENNET					
		63	Presid					
		64	FEATHERSTONE					
		65	Borgese				↓↑	
		66	Presidente					
		67	KENNET					
		68	Borgese					
		69	Presidente					
		70	ROS					
		71	Presidente					
		72	DORHN					
		73	Presidente					
		74	Borgese		10			
1/4 - II		74	"	0.2	0.3			
		75	ARANGIO	0.3	0.9			

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FOGLIO N. 4

data	bobina traccia	ORATORE prog.	ORATORE nome	durata dal	durata al	lingua	note	Trascriz. si - no
1/4		76	HENNET	0.9	1.2	Fr		
		77	Borgese	1.2	1.3	"		
		78	Presidente	1.3	1.7	"		
		79	DUPUI	1.7	1.9	"		
		80	Presidente	1.9	2.1	"		
		81	HENNET	2.1	2.2	"		
		82	Presidente	2.2	2.3	"		
		83	DOHRN	2.3	2.4	"		
		84	Presid.	2.4		"		
		85	HENNET			"		
		86	Ros	3		"		
		87	Presidente			"		
		88	Borgese			"		
		89	Ros			"		
		90	Presid.			"		
		91	HENNET		3.4	"		
		92	Presid.	3.4	3.5	"		
		93	ARANGIO	3.5	4	"		
		94	Presidente	4	4.6	"	(tutti fuori microfono)	
		95	Buonomo	4.6		"		
		96	Ros	4.8		"		
		97	HENNET	5		"		
		98	BORGESE			"	) Presidente	
		99	HENNET			"		
		100	ARANGIO	5.4	6	"		
		101	Presidente	6	7.2	"		

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FOGLIO N. 5

data	bobina traccia	ORATORE prog.	ORATORE nome	durata dal	durata al	lingua	note	Trascriz. si - no
1/a		102	Borgese	7.2	7.9	Fr		
		103	Presidente	7.9	8.1	"		
		104	Miller	8.1	9	"		
		105	OREN	9	9.3	"		
		106	Presid.	9.3	9.4	"		
		107	Miller	9.4	9.6	"		
		108	Presid.	9.6	9.7	"		
		109	OREN	9.7	9.9	"		
		110	Presid	9.9	10	"		
	2-II	110	"	0.2	0.3	"		
		111	OREN	0.3	0.5	"		
		112	Miller	0.5		"		
		113	OREN ↘			↑	(Presidente)	
		114	Presid.					
		115	ARANGIO	0.9	1.1			
		116	Presid.	1.1	1.2		↓↑	
		117	Borgese	1.2				
		118	OREN	1.3	1.5			
		119	Borgese	1.5	1.6			
		120	Presid.	1.6	1.8			
		121	KENNET	1.9	2.1			
		122	Presid.	2.1				
		123	OREN	2.3				
		124	Presidente					
		125	DEMETROPOULOS	2.5				
		126	OREN		3		(fuori microfono)	

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FOGLIO N. 6

data	bobina traccia	ORATORE prog.	ORATORE nome	durata dal	durata al	lingua	note	Trascriz. si - no
1/4		127	DOHRN	3	3.3	Fr		
		128	Presid.	3.3	3.5	"		
		129	Borgese	3.5	3.6	"		
		130	Presid.	3.6	3.8	"		
		131	KENNET	3.8	3.9	"		
		132	MILLER	3.9		"	(KENNET)	
		133	Presidente			"	(Borgese)	
		134	Borgese	4.6	5.1	"		
		135	Presidente	5.1	5.4	"		
		136	DOHRN	5.4	5.9	"		
		137	STIRN	5.9	7	"		
		138	Presidente	7	7.4	"		
		139	Borgese	7.4	7.8	"		
		140	Presidente	7.8	8.2	"		
		141	Buonomo	8.2	8.5	"	(STIRN - KENNET	
		142	ARANGIO	8.5	9	"	↓↑	
		143	Presid.	9	9.2	"		
		144	ARANGIO	9.2	9.8	"	(Kennet	
		145	BUONOMO	9.8	10	"		
		145	"	0.2	0.3	"		
	3-I	146	Presidente	0.3	1.2	"	(KENNET	
		147	ARANGIO	1.2	2	"		
		148	DOHRN	2	2.1	"		
		149	STIRN	2.1	2.9	"		
		150	ROS	2.9	3.5	"		
		151	Demetropoulos	3.5	4	"		

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FOGLIO N. 7

per INQUINAMENTO MEDITERRANEO

a ISCHIA dal 1 al 4/4/71

data	bobina traccia	ORATORE prog.	ORATORE nome	durata dal	durata al	lingua	note	Trascriz. si - no
1/4		152	Presidente	4				
		153	Kennet	4.8				
		154	OREN	5				
		155	Demetropoulos	5.3				
		156	Kennet	5.6				
		157	Presidente	'				
		158	Dohrn	5.7				
		159	Kennet	'				
		160	OREN	6				
		161	Kennet	7				
		162	OREN	7.8				
		163	Kennet	8				
		164	ROS	8.1				
		165	ARANCIO	8.3			(Presid - un po' tutti)	
		166	Dohrn	8.5				
		167	Presid	8.8	)			
		168	Kennet		)			
		169	Presid.	9	)			
		170	Borgese		)		Dohrn	
		171	DUPUI	9.6	)		Oren - Kennet	
		172	Borgese		)			
		173	TEATHERSTONE		)			
		174	Borgese		)		(e tutti)	
		175	STIRN		10			
							fine lavori mattino	

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FOGLIO
N. 8

data	bobina traccia	ORATORE prog.	ORATORE nome	durata dal	durata al	lingua	note	Trascriz. si - no
1/4	4-I	176	Borgese - F	0.2		I/	INIZIO LAVORI POMERIGGIO	
		177	RITCHIE	0.3		"		
		178	Borgese	0.3		"	(Ritchie - Miller	
		179	RITCHIE (Presid)	1.8		"		
		180	Kennet	2.1		"		
		181	Presid	1		"		
		182	Arangio	2.4		"		
		183	Presidente	2.6		"		
		184	FEATHRSTONE	3		"		
		185	Borgese	1				
		186	Presidente	3.2				
		187	Featherstone	3.3				
		188	Presidente	3.4				
		189	Featherstone	3.5				
		190	Buonomo					
		191	Presid.	3.8				
		192	Dohrn	4			(Presidente -	
		193	Borgese	4.4				
		194	Presid.				(Kennet	
		195	Borgese	4.8				
		196	Kennet					
		197	Presidente	5				
		198	OREN	5.2				
		199	Kennet	|				
		200	Presid.	|				
		201	OREN	5.5				

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FOGLIO N. 9

data	bobina traccia	ORATORE prog.	ORATORE nome	durata dal	durata al	lingua	note	Trascriz. si - no
1/4		202	Dohrn	5.6		Fr		
		203	STIRN	5.7		"		
		204	Kennet	6.8		"	(Presidente - Borjese	
		205	Dohrn	7.2	7.8	"		
		206	Kennet	7.8		"	Presid - Dohrn	
		207	Ros	8.1	9	"		
		208	Presid.	9		"		
		209	Kennet	9.1		"		
		210	MILLER	9.5		"	(vari interventi)	
		211	SEGRE	9.5	9.9	"		
		212	Presid	9.9	10	"		
		213	Ros	10		"		
	3-II	213	"	0.2		"		
		214	Kennet	0.3		"		
		215	Ros	0.4		"	(Kennet	
		216	Presid.	0.5		"		
		217	Blake	0.6		"		
		218	Ros	0.7		"		
		219	Blake		)	"		
		220	Presid.	1	)	"		
		221	Borjese			"		
		222	FEATHERSTONE	1.4		"	(Borjese) Kennet - Blake	
		223	Presid.	2.8		"		
		224	Featherstone	2.8	6.6	"	(Presid -	
		225	Presid.	6.6	6.7	"		
		226	BLAKE	6.7	7	"	(Presid.	

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FOGLIO N. 10

data	bobina traccia	ORATORE prog.	ORATORE nome	durata dal	durata al	lingua	note	Trascriz. si - no
1/4		227	Ros	7		It	(Presid-Kennet-Blake	
		228	Presid	7.7		"	(Blake e voci OREN	
		229	Featherstone	8.5		-		
		230	Presid	8.7		"	Kennet-Blake	
		231	Dohrn	8.8		"	(Presid	
		232	Presid.			"	(Arangio	
		233	Buonuomo			"		
		234	Featherstone	9.2		-	(Buonuomo	
		235	Presid	9.5		"		
		236	Borgese			"		
		237	Featherstone			"		
		238	Presidente	9.9	10	"		
	4-II	239	Kennet	0.2		"		
		240	Featherstone	0.3		"		
		241	Presid.	0.4		"	(Borgese	
		242	Ros	0.5		"		
		243	Blake	0.8		-		
		244	Kennet	1		"		
		245	Dohrn	1.2		"		
		246	Borgese			"	Presid e voci	
		247	Kennet	1.7		"	Presid	
		248	MOVAHED	[illegible]	2.8	"		
		249	BLAKE	2.8		"		
		250	Featherstone	2.9	3.	"		
		251	Arangio	3	3.3	-		
		252	Borgese	3.3		"		

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FOGLIO N. 11

data	bobina traccia	ORATORE prog.	ORATORE nome	durata dal	durata al	lingua	note	Trascriz. si - no
1/4		253	Blake	3.4		Ital		
		254	Borgese	3.4		"		
		255	Presidente	3.5	4.1	"	(OREN -	
		256	Featherstone	4.1		"		
		257	Presidente	4.2		"		
		258	Blake	4.5		"	(Presidente - Kennet	
		259	Presidente	4.9		"		
		260	Kennet	5.3	5.6	"		
		261	Presidente	5.6	6	"		
		262	Borgese	6	6.1	"		
		263	Kennet	6.1		"		
		264	Demetropoulos	6.3		"		
		265	Presid.	6.5		"	(Arrugio	
		266	Demetropoulos	7.8		"	(Presidente)	
		267	Kennet	7.9		"		
		268	Presid.	8.1		"	(Arrugio	
		269	Kennet	8.4		"		
		270	Miller			"		
		271	Presidente			"		
		272	Borgese			"		
		273	Presid	9.2		"		
		274	Ros		10	"	(Presidente	
	5-I	275	"	0.2	0.3	"		
		275	Presid.	0.3		"		
		276	OREN	0.4		"		
		277	MILLER	0.5		"		

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FOGLIO N. 12

data	bobina traccia	ORATORE prog.	ORATORE nome	durata dal	durata al	lingua	note	Trascriz. si - no
1/4		278	ARANGIO	0.6		It		
		279	Presid.	1.3		"		
		280	Arangio	1.6		"		
		281	Presidente			"		
		282	Ros	1.9	3	"		
		283	Presid.	3		"		
		284	Miller	3.1		"	(Borgese	
		285	Arangio		)	"		
		286	Kennet			"		
		287	Presid.	4		"	Ros - Kennet	
		288	Borgese e Presid.			"		
		289	OREN	5	5.1	"		
		290	Presid.	5.1		"	[illegible] Dohrn - Borgese	
		291	Miller	5.8	6.2	"		
		292	Presid	6.2		"		
		293	Miller e Dohrn		)	"		
		294	Kennet			"	Presid	
		295	Presid			"		
		296	Ros	6.8	7.6	"		
		297	Kennet	7.6		"	Arangio	
		298	Arangio	7.9		"		
		299	Buonomo	8		"		
		300	Arangio	8.1		"		
		301	Kennet		)	"		
		302	Presidente	8.3		"		
		303	Ros	8.6		"		

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FOGLIO N. 13

data	bobina traccia	ORATORE prog.	ORATORE nome	durata dal	durata al	lingua	note	Trascriz. si - no
1/4		304	Kennet	8.8		Fr		
		305	Dohrn	8.9				
		206	Miller	9			(Kennet	
		307	Dohrn	9.5				
		308	Miller	~				
		39	Presidente		10		fine lavori 1/4/71	
2/4	b-I	310	Presid. e Borgese	0.2	1		Inizio mattino 2/4/71	
		311	OTTAVIANI	1			Presidente	
		312	Kennet					
		313	OTTAVIANI		4		Kennet - Blake	
		314	Presidente	4	4.2		Arangio	
		315	STIRN	4.2				
		316	(Ottaviani)		45			
		317	Kennet					
		318	(Ottaviani)		5			
		319	Buonomo	5			Arangio e tutti	
		320	Marchetti					
		324	Presid.	5.5			e fuori microfono	
		322	Featherstone					
		323	Ottaviani					
		324	Marchetti	7				
		325	Ottaviani				(Borgese e Ros	
		326	Kennet	8			e Presidente e Ros	
		327	Ottaviani				Kennet	
		328	Featherstone	8.4				

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FOGLIO N. 14

per INQUINAMENTO MEDITERRANEO

a ISCHIA dal 1 al 4/4/71

data	bobina	prog.	ORATORE nome	durata del	durata al	lingua	note	Trascr si-no
2/4		329	Araugio					
		330	Feldstone				Borjese	
			Presidente					
			Borjese					
			Blake		9			
			Araugio					
		331	Blake					
			Borjese					
		332	Ros					
			↓ Blake ↑					
	5-II	333	Presidente					
		334	Blake					
		334 bis	Ros				Blake	
		335	Araugio		1.2			
		336	Kennet		1.4			
		337	Blake		2.4			
		338	Kennet		2.5			
		339	HOLT		2.7			
		340	Kennet					
		341	Presidente		2.8			
		342	Blake					
		343	MILLER		3			
		344	Kennet					
		345	MILLER					
		346	Marchetti	3.3			President	
		347	Arzugio	3.6			Holt - Marchetti	
		348	Marchetti	3.9				
		349	Ros	4.2				
		350	Presidente	4.8				

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FOGLIO N. 15

per Inquinamento Mediterraneo

a ISCHIA dal 1 al 4/4/71

entro 20 Km dalla costa

data	bobina	prog.	ORATORE none	durata dal	durata al	lingua	note	Trascr si-no
2/4		351	Marchetti	4.9	7.5 →		1967 Popolaz. 16.161.426	
		352	Presid	7.5			Industr. 138.829	
		353	Buonomo	7.6			" chem. 1.589	
		354	Presid.	8.1			Turist. 47 222.713	
		355	Kennet	8.2	← Presid		BOD t/g 874.905	
		356	Presid		→		P " 16.206	
		357	Kennet		→ Marchetti		N " 64.897	
		358	Presidente	8.9	←		Sgndof 109.755	
	6-II-	359	MILLER	9	10			
		359	"	0.2	3			
		360	Presidente	3				
		361	Miller	3.1				
		362	Holt	3.2				
		363	Miller	3.3	→ Holt			
		364	Presidente	3.7	←			
		365	Miller	3.8				
		366	Presidente	3.9				
		367	Miller	4				
		368	Presidente	4.3				
		369	Miller	4.4				
		370	Presidente	4.6				
		371	Miller	4.8				
		372	Ros	5.2				
		373	Holt	5.5				
		374	Ros	5.7				
		375	Miller	6	→ Presid. Kennet			
		376	Presid.	6.8				
		377	Miller	6.9				
		378	Presidente	7.1				