

Page 405 1 In The Superior Court 2 Of The State Of Delaware 3 In And For New Castle County 4 -----X 5 Monsanto Company, : 6 Plaintiff, : 7 : Civil Action Number 8 v. : 88c-ja-118-1-cv 9 Aetna Casualty & Surety Company, : Non-arbitration 10 et al. , : Case 11 Defendants. : 12 -----X 13 Deposition Of James R. Savage (Volume 3) 14 Wilmington, Delaware 15 Thursday, May 20, 1993 16 Deposition of James R. Savage, called for further 17 examination pursuant to agreement by counsel, at the law 18 offices of Smith, Katzenstein and Furlow, 1220 Market 19 Street, Fifth Floor, at 9: 50 a. m. before Kristine A. 20 O'connor, Court Reporter, when were present on behalf of the 21 respective parties: 22 -- continued --	Page 407 1 C O N T E N T S 2 Witness Examination 3 James R. Savage (Resumed) 4 by Mr. Brock 408 5 E X H I B I T S 6 Savage Deposition Number Identified 7 Exhibit 100 - 10/2/72 memorandum 409 8 Exhibits 101, 102, and 103 - Correspondence 411 9 Exhibits 104 and 105 - 6/17/59 memorandum and 420 10 4/20/59 progress report 11 Exhibit 106 - 2/8/60 memorandum 430 12 Exhibit 107 - 10/27/61 progress report 442 13 Exhibit 108 - Supplemental information 448 14 Exhibit 109 - 9/21/61 memorandum 469 15 Exhibits 110 and 111 - 6/8/59 progress report and 473 16 6/23/59 memorandum 17 Exhibit 112 - 1/27/59 progress report 482 18 Exhibit 113 - 7/14/66 process document 489 19 Exhibit 114 - 9/30/71 progress report 505 20 Exhibit 115 - 1/9/59 memorandum 541 21 Exhibit 116 - 2/11/59 memorandum 542 22 Exhibit 117 - 7/19/62 memorandum 542 23 Exhibit 118 - 12/14/62 memorandum 542 24 Exhibit 119 - 1/4/63 memorandum 542 25 Exhibit 120 - 11/14/63 handwritten document 543 26 Exhibit 121 - 6/7/63 progress report 566 27 Exhibit 122 - 10/13/60 memorandum 578 28 Exhibit 123 - 6/15/59 memorandum 593 29 Exhibit 124 - Raw data sheet 596 30 Exhibit 125 - 10/15/59 letter 599 31 Exhibit 126 - 4/20/66 memorandum 604 32 Exhibits 127, 128 and 129 - Correspondence 615
Page 406 1 Appearances: James F. Burnett, Esq. 2 Potter, Anderson & Corroon 3 350 Delaware Trust Building 4 902 Market Street 5 Wilmington, Delaware 19801 6 On behalf of Plaintiff Monsanto Company. 7 Stephen F. Brock, Esq. 8 Manta and Welge 9 One Commerce Square 10 Thirty-seventh Floor 11 2005 Market Street 12 Philadelphia, Pennsylvania 19103 13 On behalf of Liberty Mutual Insurance Company. 14 Charles Meyer, Esq. 15 Jackson & Campbell 16 One Lafayette Centre 17 1120 Twentieth Street, N. W. 18 Suite 300 South 19 Washington, D. C. 20036 20 On behalf of The American Home 21 Assurance Company, Birmingham 22 Fire Insurance Company, Granite 23 State Insurance Company, The 24 Insurance Company of the State 25 of Pennsylvania, Lexington 26 Insurance Company, and National 27 Union Fire Insurance Company of 28 Pittsburgh, Pennsylvania.	Page 408 1 P R O C E E D I N G S 2 Whereupon, 3 James R. Savage 4 resumed the stand and, having been previously duly sworn, 5 was examined and testified further as follows: 6 Examination (Continued) 7 By Mr. Brock: 8 Q Good morning, again. Mr. Savage, let me start 9 today with some things I maybe should have covered at the 10 very beginning but didn't. Where do you reside, sir? 11 A In Kirkwood, Missouri. 12 Q What is the street address? 13 A 1461 Oak Bluff Lane. 14 Q Do you have any relatives who work for Monsanto? 15 A No. 16 Q Do you have any relatives who have worked for 17 Monsanto in the past? 18 A No. 19 Q Can you describe for me briefly what you did to 20 prepare yourself for your deposition in this case? 21 A Very little. Met for a couple of hours with 22 Mr. Burnett the day before.

Page 409 1 Q Did you review any documents? 2 A Yes. We looked at some documents that he thought 3 we might see. 4 Q And approximately how many, or how big was the 5 stack? 6 A I don't remember. Less than 50 documents, I 7 think. 8 Q Have you spoken about your deposition with any of 9 your former colleagues at Monsanto -- 10 A No. 11 Q -- other than lawyers? 12 A No. I may have mentioned to them that I was 13 going to do it but that's all. 14 (Savage Exhibit 100 identified.) 15 By Mr. Brock: 16 Q I've marked Exhibit 100 for the record. 17 Mr. Savage, is this a copy of an October 2, 1972 memorandum 18 sent to you and some others in the course of your 19 employment with Monsanto? 20 A Yes. 21 Q Could I direct your attention to the bottom of 22 the first page where it says " September rains were above	Page 411 1 Q Do you recall any investigation or study around 2 this time into the question of whether there were, in fact, 3 Pcb's in the ground around the Krummrich plant? 4 A I don't remember that there were. 5 (Savage Exhibits 101, 102, and 103 6 identified.) 7 By Mr. Brock: 8 Q For the record, I've marked three new exhibits, 9 Exhibits 101 through 103. Exhibit 101 has Bates numbers of 10 Ann 1539040 and 041. Mr. Savage, can you explain to us 11 what this document is? 12 A I don't remember this specific form. It's 13 obviously some kind of work request that was filled out to 14 begin a project. I worked with similar forms. I don't 15 remember this one. 16 Q The objective of this is to develop design and 17 operating data for full-sized effluent pond? 18 A That's what the objective of this project is, 19 that's right. 20 Q If you look to Exhibit 103, is that a memorandum 21 from you to Cliff Stutz and some others dated November 19, 22 1958 regarding pilot effluent pond?
Page 410 1 normal and probably was a factor in Pcb flow to waste 2 treatment plant as Pcb's from ground are leached with 3 rainwater. " Do you see that? 4 A Yes. 5 Q I asked several questions in the general area 6 yesterday. Can you explain to me your understanding of why 7 September rains above normal would lead to the leaching of 8 Pcb's from the ground? 9 A Well, I don't recall that there was ever any 10 particular evidence of cause and effect here. So to some 11 degree, this would be speculation on Mr. Stewart's part. I 12 think what he is speculating about is simply that there was 13 enough Pcb material on the ground or in the ground that it 14 would be leached by an unusual flow of rainwater. 15 Q Do you know whether that was ever checked out, 16 the correlation between above-normal rainwater and leaching 17 of Pcb's from the ground? 18 A I don't think there was ever any statistical 19 study of that. Some anecdotal evidence is what it amounts 20 to. 21 Q Do you recall what anecdotal evidence? 22 A Like this.	Page 412 1 A Yes. 2 Q Do these two documents relate to the same 3 project? 4 A Yes. 5 Q Can you describe for me what the impetus was for 6 undertaking this project with regard to a pilot effluent 7 pond? 8 A Would you repeat that, please? 9 Q Could you describe for me what the impetus was 10 for undertaking this project -- this project being 11 undertaken at the Anniston plant with regard to the pilot 12 effluent pond? 13 A There was an idea at the time that pond treatment 14 would be an economical way to treat the waste, reduce the 15 waste load to an acceptable level to be discharged to the 16 city sewers for subsequent treatment by the city treatment 17 plant. 18 Q Do you know whether this project related to 19 wastes from the Niran plant? 20 A Yes. It certainly related to the Niran plant 21 since it refers to Pnp. That waste only came from the 22 Niran plant.

Page 413 1 Q Before this pilot effluent pond project, do you 2 know how those wastes were discharged? 3 A That was -- the original design for the Niran 4 waste was it would go through the limestone bed and then to 5 the city sewers and from there to the city waste treatment 6 plant. And that was still the practice at this time. 7 Q So -- 8 A This work order is in July of 1958, which is only 9 three or four months after I arrived at Anniston. 10 Q So the pilot effluent pond was contemplated to be 11 a step before the limestone bed? I mean the waste would go 12 to the pilot effluent pond before the limestone bed? 13 A As I recall it, it would go through the limestone 14 bed first and then to the pond. I didn't think the pond 15 was intended to carry the entire flow anyway, it was simply 16 to take a side stream for test purposes. 17 Q Do you recall testing being performed in Snow 18 Creek in connection with this project? 19 A The memo of November 19, Exhibit 103, seems to be 20 about two different subjects because the flow in Snow Creek 21 is on the other side of the plant and as far as I know 22 there was no connection between that and Niran waste. And	Page 415 1 however. " Do you recall there being an investigation of 2 whether Niran wastes were finding their way into Snow 3 Creek? 4 A No. But the remainder of this sentence is, I 5 think, reasonably convincing. It says there's not enough 6 Pnp color in the water. Pnp is a material which creates a 7 visible color and just one or two parts per million in the 8 water. So this statement on its face is fairly convincing. 9 Q Do you know whether it was ever determined where 10 that quantity of acid did originate from? 11 A No, I don't remember. 12 Q Let's go to Exhibit 102. First of all, do you 13 ever recall or do you recall receiving a copy of the cover 14 memorandum? 15 A No, I don't remember that. 16 Q That memorandum attaches a September 11, 1958 17 progress report and you're listed as a copy recipient on 18 that progress report ; is that correct? 19 A Yes. 20 Q Do you recall there being a study undertaken by 21 Cliff Stutz in the September 1958 time frame regarding 22 Niran waste disposal at the Anniston plant?
Page 414 1 these flows, of course, are much larger than what the pond 2 would have taken. I'm reasonably confident the second 3 paragraph is a different subject. 4 Q Do you recall what the impetus was for -- this 5 seems to refer to some sort of testing with respect to Snow 6 Creek ; is that correct? The second paragraph of Exhibit 7 103. 8 A The second paragraph is some data about flow in 9 Snow Creek. The discussion here about a mark on the weir 10 suggests that because the purpose of a weir is a way of 11 measuring large flows in an open channel. 12 Q Do you recall what the impetus was for the 13 collection of that data regarding the flow in Snow Creek? 14 A No. 15 Q Down below it talks about the " acidity of Stream 16 No. 8, which is the ditch outside the fence. " Do you know 17 what that " Stream No. 8 " refers to? 18 A No. It must relate to some kind of map but I 19 don't know. 20 Q There's a statement down below that " This 21 represents a large quantity of acid and I do not know where 22 it originates. It probably did not come from Niran,	Page 416 1 A I know he was working on that subject at that 2 time. I don't remember the structure of the study. 3 Q Do you recall having any involvement in this 4 study? 5 A Not specifically. During that time it was 6 routine for me to take samples to the lab at Cliff's 7 direction, and I presume that I would have done that, but I 8 don't remember doing it. 9 Q There's a statement that " Studies are progressing 10 by Professor Jaffee on effects of other industrial wastes 11 at Anniston. " Do you see that? 12 A Yes. Excuse me. No, I don't. Where? 13 Q The second page of the exhibit. 14 A Yes, I see that. 15 Q Were you aware of studies progressing by 16 Professor Jaffee concerning -- 17 A No, I don't remember who he is. 18 Q I take it you don't recall having any dealings 19 with him on the subject of waste disposal? 20 A No. 21 Q Let's go back to the first page. The subject of 22 that is " mercaptan odor, " if I pronounced it correctly.

Page 417 1 A Mercaptan. 2 Q Mercaptan, thank you. What does that refer to? 3 A Mercaptans are a class of sulfur compounds that 4 are notoriously odorous. 5 Q Do you recall there being mercaptan odors at the 6 plant during this time frame? 7 A There were odors that were characterized that 8 way. Most chemists know what mercaptans smell like. 9 Without being very specific as to what particular mercaptan 10 it was, it was that kind of odor. 11 Q Was that a frequent thing, for there to be 12 mercaptan odors at the plant? For example, would you walk 13 in and be able to smell that? 14 A At the time of start-up and for a few months 15 after start-up, that was common. 16 Q You're talking about start-up of the Niran plant? 17 A Yes. 18 Q The cover memo contains a statement, " There is 19 one possibility which might result in a correlation between 20 Pnp level and odor. This is side reaction in the 21 condensation step. These would of course result in both 22 high unreacted Pnp and intermediate which would show up as	Page 419 1 A We did, in fact, later on take steps to improve 2 the yield, meaning suppress the side reactions. But by the 3 time we achieved that the odor was no longer a problem. 4 Q What were the steps taken to improve the yield? 5 A There were changes in the way the condensation 6 step was operated, improvement and agitation in the vessel, 7 drying facilities for acetone, reduce the amount of water 8 going to the condensation step. The water going to the 9 condensation step turned out to be the cause of a side 10 reaction and by reducing that, the yield improved. 11 Therefore the amount of Pnp and so forth going to the sewer 12 was reduced. 13 Q What was the general time frame that that 14 situation was taken care of? 15 A I don't remember. It was during my time doing 16 technical work in the Niran plant but I can't be any more 17 specific than that. 18 Q On the second page of the exhibit, that's the 19 first page of the progress report, there's a statement at 20 the bottom that " Pilot plant studies on treating Niran 21 wastes in lagoons under way. " Do you see that? 22 A Yes.
Page 418 1 soluble organics in the wash water. You may want to have 2 Jim Savage look into this problem. " Do you recall ever 3 looking into that problem? 4 A No. 5 Q The reference to side reactions in the 6 condensation step, what does that refer to? 7 A The last step of chemistry in making parathion is 8 a step that is called condensation. It's the reaction 9 between sodium paranitrophenate and the intermediate that 10 we discussed yesterday. What Fritz is talking about in 11 this paragraph is side reactions in that reaction which 12 could interfere with the raw materials. 13 Q Do you recall there ever being found a high level 14 of unreacted Pnp and intermediate? 15 A That's a relative term as to " a high level of 16 unreacted Pnp. " The Pnp that wound up in the waste leaving 17 the plant was unreacted Pnp from that step and I think that 18 what Fritz is doing in this paragraph is speculating as to 19 why that takes place, whether people are doing something 20 about it. 21 Q Do you recall whether or not that hypothesis or 22 speculation was ever checked out?	Page 420 1 Q Does that refer to the same pilot project 2 referring to the effluent pond? 3 A I think that's the same project. 4 Q So there weren't separate projects for something 5 called lagoon and something for -- 6 A No, I think those were the same thing. 7 (Savage Exhibits 104 and 105 identified.) 8 Mr. Brock: I've marked Exhibits 104 and 105 for 9 the record. 10 By Mr. Brock: 11 Q Mr. Savage, is Exhibit 104 a copy of a June 17, 12 1959 memorandum from John Mullendore to Karl Edelblut with 13 a copy to you? 14 A Yes. 15 Q And the arrow indicates that this was, in fact, a 16 copy that was sent to you? 17 A Yes. 18 Q The subject is a telephone call from Jim 19 Standridge concerning odor at the municipal sewage 20 treatment plant. Do you see that? 21 A Yes. 22 Q Do you recall there being a phone call or phone

Page 421 1 calls from Mr. Standridge concerning odors at the municipal 2 sewage treatment plant around this time? 3 A I can't place it in time. I know there were such 4 phone calls. 5 Q Do you recall undertaking any activities to deal 6 with the concerns expressed in the phone calls? 7 A I remember doing technical work to solve the odor 8 problem, which I knew was urgent, but I can't make a cause 9 and effect relationship between phone calls from 10 Mr. Standridge and the technical work. 11 Q Again, what was the technical work you did to 12 solve the odor problems? 13 A Some improvements to the effluent chlorinator. 14 Q There's a reference in the third paragraph, it 15 says " I asked him the status of the lawsuits of the people 16 living around the treatment plant. There are seven 17 individual suits with each party suing for 2500. " 18 A Yes. 19 Q Do you recall those lawsuits? 20 A No. 21 Q Do you believe that's a reference to the lawsuits 22 concerning paint damage to houses that you --	Page 423 1 technical work that you described? 2 A Yes. 3 Q Do you recall specifically what his instructions 4 were to you? 5 A It began with his asking for some work to improve 6 the waste chlorinator and just routine discussion. We 7 would talk about the urgency of that work. 8 Q Why was the work considered urgent? 9 A The first waste chlorinator was installed on a 10 crash basis and was made of vitrified clay sewer pipe, and, 11 while it worked remarkably well, it was not mechanically 12 sound and prone to leak and when it was leaking, sometimes 13 it could not be operated in a normal way and therefore what 14 I was doing was replacing it with one made of more durable 15 materials and larger as well. 16 Q You referred to that as a vitrified clay sewer 17 pipe? 18 A Yes. It was a small tower that had been put 19 together just as something that could be done quickly. But 20 it was made out of materials that really were not intended 21 for that purpose. 22 Q Do you know when that clay sewer pipe had been
Page 422 1 A No. 2 Q So you believe this is a separate -- 3 A The treatment plant was south of the city, 4 outside the valley. The houses that were alleged to be 5 discolored were, I think, west of the plant within a half 6 mile or so. So the two locations are separated by 3 or 4 7 miles. 8 Q Do you recall there being any lawsuits filed 9 against Monsanto alleging odors from the Anniston plant? 10 A I don't remember that there were. 11 Q It states " In closing the conversation, I asked 12 Standridge to ask Slovensky to notify either Jim Savage or 13 me if he experiences problems either treatment or odor. " 14 Do you recall being notified by Mr. Slovensky about 15 treatment problems or odor problems around this time frame? 16 A No, I don't recall having any contact directly 17 from him. 18 Q Do you recall having contact with people working 19 for him or at his behest concerning those subjects? 20 A No. What I recall is that my instructions on the 21 subject came from John Mullendore. 22 Q And those instructions resulted in you doing the	Page 424 1 installed? 2 A No. It was quite early in this period but I 3 don't remember. 4 Q When you say " quite early, " you mean the start-up 5 of the Niran plant or earlier? 6 A No. It was after the start-up of the Niran 7 plant, after the problem -- the odor problem was 8 discovered. 9 Q When you say those pipes were bound to leak, how 10 frequently would they leak? 11 A I don't remember. 12 Q For example, would there be leaks more than once 13 a month? 14 A I have no idea. 15 Q In the second paragraph there's a statement, " I 16 told him that Jim Savage had visited the treatment plant 17 the previous evening and was working with Jim Slovensky on 18 ways we could dove-tail our flow with the flows received 19 from other parts of the city to minimize problems and 20 treatment. " And then it says "(not odor)." 21 A Yes. 22 Q Do you recall undertaking work along those lines

Page 425 1 to minimize treatment and problems -- or problems and 2 treatment other than odor? 3 A I don't remember that. 4 Q Let's go to Exhibit 105. Is this an engineering 5 department progress report regarding a mist eliminator and 6 scrubber for the incinerator at the Niran plant in 7 Anniston? 8 A Yes. 9 Q If you look on the right-hand column, your name 10 seems to be typed in without a specific box. Do you 11 recall -- 12 A If you look just above my name, you'll see 13 there's a slash after Mr. Hedworth's name, so I think it 14 was the intention that that copy be for both of us. 15 Q What was a mist eliminator and scrubber for the 16 incinerator at the Niran plant? 17 A That was the equipment that was developed to 18 correct the problem with the P2o5 plume from the 19 incinerator stack. 20 Q Do you recall undertaking any work in connection 21 with this mist eliminator and scrubber project? 22 A Yes.	Page 427 1 reinforced polyester fiberglass. 2 Q The term " mist eliminator and scrubber, " after 3 the new equipment was installed, what exactly did that 4 consist of? 5 A You recall I previously used the term " Brink 6 demister. " Mist eliminator is synonymous with that. 7 Q If you turn to the third page, reference number 5 8 or item number 5 is " Vapor between scrubber and mist 9 eliminator will be analyzed by the plant for chlorides. " 10 Do you see that? 11 A Yes. 12 Q Were you involved in that? 13 A I would have been involved in taking the samples. 14 Q Do you recall there ever being found a problem 15 with the level of chlorides in that vapor? 16 A The fact that there was chlorides in the vapor 17 was not in itself a problem. It was an indication that the 18 chlorides could be expected to be collected as part of the 19 acid that was collected in the mist eliminator. 20 Q Was there a certain threshold for the level of -- 21 I take it the mist eliminator would take out the chlorides 22 in the vapor, is that the way it worked?
Page 426 1 Q What was the nature of your work? 2 A I operated the small pilot plant unit that was 3 used to prove the principle of that mist eliminator and 4 scrubber system and to generate the design data needed to 5 build the full-sized unit. I provided plant liaison for 6 installation of the original unit and replacement units 7 that were later on required. I collected operating data, 8 took samples, made studies to improve the reliability and 9 efficiency of the unit. 10 Q Who was O. A. Fenner, F-e-n-n-e-r? 11 A Otto Fenner was the corrosion specialist at the 12 Queeny plant. 13 Q Why was there a corrosion specialist involved in 14 this project? 15 A This particular progress report describes a 16 severe problem that was recognized after start-up of the 17 original full-sized mist eliminator and scrubber, it turned 18 out that the rubber lining in that equipment was being 19 attacked by the acid that was being collected and that 20 therefore the life of the equipment would be very short. 21 Q Do you recall what the new lining consisted of? 22 A The new equipment was not lined. It was	Page 428 1 A The mist eliminator was there for the primary 2 purpose of collecting the small aerosol particles, 3 phosphorus pentoxide, which in that situation, since it was 4 wet from the scrubber, would have been by then converted to 5 small droplets of phosphoric acid. The mist eliminator 6 would collect those tiny droplets of phosphoric acid and 7 any other water soluble materials that were present would 8 be absorbed into the phosphoric acid in the mist 9 eliminator. So the final answer to your question is yes, 10 the chlorides would be taken out and the mist eliminator 11 was somewhat -- 12 Q Was there a certain threshold for the level of 13 materials that could be reduced by the mist eliminator? 14 A I'm not sure I understand. 15 Q Do you understand with a I'm trying to get at? 16 A No. 17 Q For example, if the level of chlorides or aerosol 18 particles increased, was there a certain level above which 19 the mist eliminator was less effective at reducing or 20 taking out those particles? 21 A No. If there was an overload of, particularly of 22 phosphoric acid to the mist eliminator because we were

Page 429 1 attempting to operate it at too high a rate, for instance, 2 the way that would be manifested would be that the pressure 3 drop would rise over the course of a couple of hours to the 4 point that we couldn't continue to operate because the 5 blowers couldn't generate enough pressure to overcome the 6 pressure drop. 7 Q Do you recall there ever being a time when there 8 was concern expressed that the mist eliminator was not 9 being effective in removing particles in the vapors that 10 were sent to it? 11 A Yes. What we found particularly on the first 12 couple of versus of the mist eliminator was that after a 13 period of time, the efficiency fell off due to 14 deterioration of the glass fiber in the mist eliminator 15 cartridges and when that -- when the efficiency reached an 16 unacceptable level, we would shut down and either put in 17 new cartridges or repack the cartridges. 18 Q When the efficiency of the mist eliminator fell 19 off, would those particles be released into the atmosphere? 20 A What you would then have was a situation similar 21 but of lesser extent, to the situation we had before we had 22 mist eliminator ; some visible plume coming from the stack.	Page 431 1 February of 1960? 2 A Since I was a member of Tsd, I would have 3 responsibility for appropriation requests for projects of a 4 size that could be handled at the plant, which generally 5 meant projects of less than \$100,000. Since it was a small 6 plant, it was very common, however, that we would cut off 7 at 40 - or \$50,000 and any project bigger than that be 8 handled by organic engineering. 9 Q Who was J. P. Ekberg? 10 A I don't recognize that name. 11 Q Do you recall developing information with respect 12 to expansion of the Niran plant in or about February of 13 1960? 14 A I don't remember the timing exactly but I did 15 work with Bill Garlette to develop the data on our 16 then-existing capacities in the various parts of the 17 equipment so that decisions could be made as to which steps 18 were the bottlenecks and therefore would have to be dealt 19 with as part of an expansion. 20 Q Let me ask you to turn to the second page of the 21 document, the page with Bates number 891. Under number 2, 22 the second paragraph starts with the sentence " The original
Page 430 1 Q Do you recall how frequently that happened after 2 the mist eliminator was installed? 3 A We found that we always had to repack at 4 intervals of less than one year. I remember six months but 5 I can't be very precise about that. But at that point it 6 was a visible plume but a fairly tolerable one, nothing 7 like the plume that existed before the mist eliminator was 8 installed. 9 (Savage Exhibit 106 identified.) 10 Mr. Brock: I've marked Exhibit 106 for the 11 record. The Bates numbers are Ann 1401890 through 898. 12 By Mr. Brock: 13 Q Mr. Savage, could you let me know when you've had 14 a chance to glance through this. 15 (Witness reviewed the document.) 16 A Okay. 17 Q Is this a copy of appropriation request 18 information sent to you and some others in connection with 19 your employment with Monsanto? 20 A Yes. 21 Q What, if any, responsibilities did you have for 22 appropriation requests regarding the Niran plant in	Page 432 1 design philosophy of isolation and remote operation of 2 hazardous units in the Niran Dept. will be continued in all 3 phases of this project. " 4 A Yes. 5 Q Do you know what those hazardous units were? 6 A It was considered that each of the reactors 7 required special treatment. To be more specific, the first 8 reactors there were thio acid reactors, that was the first 9 step of the process, then there were chlorinators, then 10 there were intermediate stills. There was still residue 11 storage and a condensation reactor. All of those were in 12 isolated cubicles remotely operated. 13 Q Why were those referred to as hazardous units? 14 A Because there had been an explosion in the 15 previous Niran unit at the Nitro plant and extremely 16 conservative design philosophy was adopted for the new 17 plant at Anniston. 18 Q Do you know when that explosion took place at the 19 Nitro plant? 20 A Sometime in the summer of 1957. 21 Q How did you learn about that explosion? 22 A It was on the bulletin board and in the

Page 433 1 newspapers. I was at the Queeny plant at the time. 2 Q Did you have any responsibilities with respect to 3 dealing with that explosion? 4 A No. 5 Q You mentioned still residue storage, what did 6 that consist of? 7 A The distillation generated the still residue, 8 which was to be fed to the incinerator. However, the 9 stills operated batchwise and then, therefore, would 10 generate a significant increment of still residue at the 11 end of each batch, whereas the incinerator ran continuously 12 at a slow rate. So there had to be a place to hold still 13 residue for feed to the incinerator. 14 Q Do you know whether anything was ever done with 15 that still residue other than send it to the incinerator? 16 A No. 17 Q There's a statement that " certain auxiliary 18 operations will be upgraded in order to improve operating 19 efficiency. Among these are soda ash handling, drying of 20 recovered acetone, and H2s gas removal. " Do you see that? 21 A Disposal, yes. 22 Q Disposal. I'm sorry.	Page 435 1 A No, we recycled all the acetone. 2 Q And the reference to H2s gas disposal, what did 3 that consist of? 4 A In the original design, H2s from a thio acid 5 reaction, first step, was piped to the incinerator 6 firebox. That was quite effective because it's easy to 7 burn hydrogen sulfide. But that represented additional 8 load on the firebox and therefore, both as a 9 debottlenecking step and to improve the flexibility of 10 operations, at some point the H2s gas was disposed of with 11 a flare mounted at the top of the old stack rather than 12 burning it in the firebox. 13 Q Do you recall any times when the load of the H2s 14 gas on the firebox was such that not all of the H2s gas was 15 incinerated? 16 A I remember the incidents in which the H2s load to 17 the firebox was larger than it should have been, but the 18 consequence was not that the H2s was not burned but rather 19 that a peculiar side reaction occurred which resulted in 20 sulfur, elemental sulfur being formed in the firebox which 21 plugged up the demister. 22 Q And what would happen when the demister was
Page 434 1 Mr. Brock: Off the record. 2 (Discussion off the record.) 3 By Mr. Brock: 4 Q Let's start with soda ash handling. What did 5 that consist of or what did that entail at the plant? 6 A As I mentioned previously, the original design 7 was that soda ash was received in bags and those bags were 8 manually dumped into a tank. What this refers to is an 9 essentially mechanical project to automate that, eliminate 10 the labor-intensive step. 11 Q And the drying of recovered acetone, what did 12 that entail? 13 A It's my recollection that at the time that this 14 was written, we were already drying acetone by contact with 15 calcium chloride. That was not considered to be a very 16 efficient way of doing it. And what I recollect is that 17 this expansion project, or expansion project that resulted 18 from this report was the occasion when a drying column was 19 installed to replace the calcium chloride dry. 20 Q The reference here is to recovered acetone, was 21 there also acetone which was a residue of the Niran plant 22 process?	Page 436 1 plugged? 2 A It would be a partial pluggage and we would have 3 to slow down the operation of the incinerator and the 4 demister for a period of time, perhaps a day or so while 5 the system cleaned itself up. The acid coming out of the 6 demister cartridges would eventually wash the sulfur off 7 the outside. 8 Q Were there occasional releases of sulfur to the 9 environment as a result of that? 10 A Sulfur is a solid. It doesn't go anywhere. It's 11 insoluble in water. 12 Q If we go to the next page, the page that ends in 13 Bates number 892, there's a discussion with the letter c. 14 It talks about this project providing for a complete new 15 chlorinator system and a complete new intermediate still 16 system. Can you tell me what the intermediate still system 17 consisted of? 18 A Yes, that was the second step of the process -- 19 excuse me, third step, I guess. After the chlorination 20 step the material we called intermediate, ethyl Pc-2 or 21 methyl Pc-2, would be distilled and that piece of equipment 22 was called the intermediate still.

Page 437 1 Q Why was it contemplated that there would be a 2 complete new intermediate still system at that time? 3 A In the original design there were two 4 chlorinators and two stills, each chlorinator was paired 5 with a still, operated together as a unit batchwise. So to 6 expand we simply added a third chlorinator still system. 7 Q Do you recall the reason why it was felt there 8 should be three chlorinator still systems rather than two? 9 A Well, that was 50 percent more capacity. 10 Q Let me ask you to turn to the pages that end in 11 Bates numbers 897 and 898. There's a heading " pollution 12 and toxicity problems. " Do you see that? 13 A Yes. 14 Q Do you recall addressing any pollution or 15 toxicity problems in connection with your work with respect 16 to the Niran expansion? 17 A I don't remember anything specific. This section 18 in this report would be just a normal topic to cover such a 19 report. 20 Q Why was that? 21 A It would be routine in studying a question of 22 expansion to consider whether there were any new problems	Page 439 1 Q First of all, was that your understanding at the 2 time? 3 A Yes. There had been appropriate tests run, 4 animal tests run on finished product and various 5 intermediates. We had that data. So we understood the 6 materials reasonably well. 7 Q Do you know when those animal tests were run? 8 A No. 9 Q Do you know who it was that had run them? 10 A The testing on parathion itself had been done 11 many years ago. It was known to be very toxic material. 12 Q Do you know whether those tests were run by 13 somebody outside of Monsanto or within Monsanto? 14 A Both. 15 Q And both had found the material to be toxic? 16 A Of course. 17 Q Was that information compiled somewhere within 18 Monsanto, the hazards from toxic materials in those 19 operations? 20 A I believe so. It would be normal, for instance, 21 that the standard manufacturing process would include a 22 material hazard data sheet on each one of the materials
Page 438 1 in toxicity or pollution. 2 Q There was a general recognition that the 3 chemicals involved in the Niran operations could present 4 some pollution and toxicity problems, is that a fair 5 statement? 6 A Well, since the product itself is extremely 7 toxic, of course. 8 Q Under " Atmospheric " it states " Total discharge of 9 wastes to the atmosphere from incineration of liquid 10 residues and H2s gas will increase by 50 percent. " Do you 11 recall there being any concerns expressed about that 12 increase? 13 A No. That was simply a direct proportion to the 14 increase in production. 15 Q Do you recall there being any complaints about 16 increased liquid residues and H2s gas being discharged from 17 the plant around that time? 18 A No. 19 Q On the next page under the " Toxicity " heading it 20 states " Hazards from toxic materials in the Niran-methyl 21 parathion operation are well established. " 22 A Yes.	Page 440 1 used in the process, even those that are ordinarily items 2 of commerce. 3 Q At the end of the memo there's a reference to 4 " provision of means for disposal of ' runaway ' batches of 5 material. " Do you see that? 6 A Yes. 7 Q What were "' runaway ' batches of material "? 8 A The materials handled at several steps of the 9 process were thermally unstable and it was possible, either 10 because of an error in operation or because of a failure in 11 control systems, for temperatures to go above normal and if 12 that was not properly anticipated and dealt with -- the 13 temperature is called an autothermal decomposition, meaning 14 that the decomposition generates heat and as the 15 temperature rises -- the decomposition reaction 16 accelerates. It was known that that was possible. We had 17 instances of that having happened, so it was important that 18 the design provide for handling incidents like that. 19 Q How was that material disposed of? 20 A Most of the time that was pumped to the still 21 residue hold tank and incinerated. If the batch actually 22 ran away and an overpressure occurred, then it would wind

Page 441 1 up in the water trench under the reactors. That happened a 2 few times. 3 Q Where did that water trench go? 4 A Normally didn't go anywhere. There was a static 5 trench full of water and it would normally just be there to 6 be available in case there was a discharge, other than 7 occasionally to change it if it became stagnant. It would 8 get frogs in it and so forth. 9 Q When that water was changed, where was it taken? 10 A It would be pumped to the -- into the sewers and 11 go to the limestone back. 12 Q I thought you said there were several incidents 13 that you recall involving runaway batches of materials? 14 A Yes. 15 Q Can you describe what you recall about those for 16 me? 17 A Those were very notorious occasions, I think I 18 described one or two of them yesterday, but in general 19 those involved an instrument failure or an equipment 20 failure. I can't give you a detailed reconstruction of any 21 more than what I've previously mentioned. They were always 22 studied in great detail and some action was always taken	Page 443 1 while I was doing technical work in the parathion group. 2 Q When you say when you were doing " technical 3 work, " do you mean before you became production supervisor? 4 A That's right. 5 Q Do you recall working on such a project with W. B. 6 Dunlap and J. C. Larkin? 7 A Bill Dunlap was an engineer working in Tsd. At 8 this time, Mr. Larkin had replaced Mr. Hedworth as the head 9 of Tsd and his name in parentheses just means that's our 10 boss. The study in this report appears to be mostly 11 analytical and statistical and probably was mostly 12 conducted by Mr. Dunlap. Statistics, at that point, was 13 his specialty. He had previously been the chief chemist at 14 the plant. 15 Q What would your involvement have been? 16 A I don't remember this study specifically but Bill 17 and I worked together on a number of studies and the way we 18 worked was that I would give him process guidance as to 19 what to look for and then he would generate statistical 20 data and try to find a correlation to connect causes and 21 effects. 22 Q There's a statement under the second paragraph
Page 442 1 to -- usually it was a further elaboration of the control 2 system to try to head off a recurrence of the thing that 3 had just occurred. 4 Q On those occasions, what material was it that was 5 constituting the runaway batches of material? 6 A The ones that I recall occurred in the 7 chlorinators and the stills. 8 Q What was the material? 9 A That would be crude ethyl or methyl Pct. 10 (Savage Exhibit 107 identified.) 11 Mr. Brock: I've marked Exhibit 107 for the 12 record. The Bates numbers are Ann 1402440 through 445. 13 By Mr. Brock: 14 Q Mr. Savage, is this a Tsd progress report that 15 you worked on in connection with your employment with 16 Monsanto at the Anniston plant? 17 A Yes, it appears to be. 18 Q Do you recall undertaking the project to identify 19 the major components of parathion waste streams and 20 locating their source in or about the 1961 time frame? 21 A I can't identify the time frame but that was a 22 subject that in general we worked on nearly all the time	Page 444 1 under the summary, " The major waste component is acetone. 2 Acetone and Pnp originating in the washing operation 3 account for the bulk of the load of the treatment plant. " 4 Do you see that? 5 A I see that. 6 Q What was the washing operation? 7 A At the end of the chemistry in the process, the 8 last step being condensation, there would be by-products 9 present in the crude reaction mass, including sodium 10 bicarbonate and so forth. So there was a substantial 11 amount of water soluble material. Some of it solid in that 12 reaction step, and that was separated from the product by 13 washing. 14 Q And how was acetone waste created in that 15 process? 16 A Acetone was used as a solvent in the condensation 17 step, and at the end of the condensation step acetone was 18 distilled off for recycle, first at atmospheric pressure 19 and then under a vacuum. If that was not 100 percent 20 efficient, then there would be some acetone left in the 21 crude reaction mass that went to washing. Since acetone is 22 water soluble, it would be extracted from the parathion and

Page 445 1 wind up in the spent wash water. 2 Q What was done with it on those occasions? 3 A The spent wash water was the largest component of 4 waste flow going to the sewers, not in terms of gallons but 5 in terms of pounds of Bod. 6 Q And how would Pnp wastes originate from that -- 7 the washing operations? 8 A Because the reaction between the ethyl or methyl 9 Pct and sodium paranitrophenate did not go to 100 percent 10 completion. There would be some unreacted sodium 11 paranitrophenate in the crude reaction mass and under the 12 conditions of washing, that would be extracted into the 13 wash water and at that ph would become Pnp paranitrophenol 14 rather than sodium paranitrophenate. We referred to the 15 presence of sodium Pnp and Pnp kind of interchangeably 16 because what form the material was in was just dependent on 17 ph. So leaving the wash column it would be sodium Pnp but 18 by the time it had mixed with other more acid wastes it 19 would be present as Pnp mostly by the time it got to the 20 sewer. 21 Q On the next page, number 4 refers to a study 22 being contemplated to identify the minor components	Page 447 1 from what? 2 A Well, if there were an excessive load, it would 3 be because something had not worked right in the plant, 4 that there had been an incident or a period of time when 5 yields were lower than normal. The importance of this 6 relates to the problem of -- the problems an additional 7 load would impose on the waste treatment plant. 8 Q Do you recall there being warnings or instances 9 of excessive loads in the waste streams from the Niran 10 plant? 11 A I'm stuck on semantics here. There certainly was 12 variability in the load and that was a bit of a challenge 13 in successfully operating our waste treatment plant after 14 we had one. There was a potential that a really massive 15 overload would interrupt treatment in the -- that the 16 treatment plant would simply stop working but I don't 17 remember that happening. 18 Q The reference to excessive loads -- I mean, in a 19 Tsd progress report such as this, what would that reference 20 mean? 21 A I don't know. This was -- Bill authored this and 22 I'm not sure I know what he means by that.
Page 446 1 locating their source and reducing their contribution to 2 department waste load. Do you recall there being such a 3 study? 4 A Not specifically. I certainly don't think we 5 ever identified the minor components. 6 Q Did you have an understanding as to what the 7 minor components of the waste load were? 8 A We had a general idea based on the chemistry, but 9 not on analysis. 10 Q What would be your general idea based on the 11 chemistry? 12 A Hydrolysis products of the intermediate. 13 Q What would those be? 14 A I don't remember. 15 Q If you turn to the page that ends in Bates number 16 443. Under the heading of " monitoring the waste streams " 17 there's a reference to a possibility of being warned of 18 excessive loads. Do you see that? 19 A Yes. 20 Q Do you recall any instances when there were 21 excessive waste loads from the -- strike that. 22 The reference to excessive loads, excessive loads	Page 448 1 Q For example, if we turn to table 1, I saw a 2 reference there earlier in the document to a flow sheet of 3 all waste sources. Is this what is referred to as a flow 4 sheet of waste sources? 5 A No. A flow sheet is normally a graphical 6 diagram. 7 Q Under the, for example, the acetone column, there 8 are some references to 30,000 parts per minute -- or 30,000 9 parts per million, I'm sorry, and there's a figure down 10 below for 40,000 parts per million. Do you see those 11 figures? 12 A Yes. 13 Q Would those figures be considered excessive? 14 A I have no idea. 15 Q If there were excessive figures on this, would 16 you recognize -- would you be able to recognize it? 17 A No, I don't recollect the meaning of those load 18 numbers to the extent that I could tell you what was 19 excessive. 20 (Recess.) 21 (Savage Exhibit 108 identified.) 22 Mr. Brock: I've marked as Exhibit 108 Monsanto's

Page 449 1 paragraph 1. a submission concerning the Anniston plant. 2 By Mr. Brock: 3 Q Mr. Savage, let me ask you to just read the first 4 page of this, the description of the solid waste landfill 5 area to yourself and let me know when you've had a chance 6 to do that. 7 A You're referring to item 1? 8 Q Yes. 9 A Yes, I've read it. 10 Q Were you familiar with a landfill associated with 11 the Anniston plant? 12 A During the time I was there I walked around most 13 of the property and I was aware of several areas that had 14 been used as landfill. I'm not sure from this description 15 I know exactly which piece of property is being referred 16 to. The Anniston plant property, as I recall, is something 17 like four or five hundred acres, most of which is across 18 the highway from the main part of the plant. Maybe it's 19 less than that, I don't remember. It's quite a long time 20 ago. No, that's too much. It was less than that. But at 21 any rate, the larger part of the real estate was actually 22 across the highway from the main part of the plant.	Page 451 1 shop at the plant at the time that I was there. 2 Q If you look on Exhibit 46, a little bit south of 3 the central shop there's a building that's referenced as 4 the Santowax Hb-40, do you see that? 5 A Yes. 6 Q During your tenure at the plant, were the 7 Santowax operations at another location at the plant? 8 A No, Santowax and Hb-40 were in approximately that 9 spot. It's probably the same place. 10 Q Where was the landfill that you're talking about 11 in reference to that building? 12 A To the northwest. 13 Q What's on the map now where -- or what's on the 14 map on Exhibit 46 where that landfill was during your 15 tenure at the plant? 16 A I can't be very accurate. It was somewhere in 17 the area marked " central shop " or above that to the west, I 18 think it says Pnp. It was somewhere around there but none 19 of the things that are shown on this map existed when I was 20 there in that area so I can't be very accurate about it. 21 Q What materials were disposed of in that landfill 22 area during your tenure at the Anniston plant?
Page 450 1 Q Were -- when you say you were familiar with a 2 number of pieces of land that were used as landfills, did 3 you visit each one of those? 4 A To say I visited them is making it a little more 5 specific than it was. Simply in walking around the 6 property at various times, I would observe that areas were 7 being used as landfill. 8 Q And those areas were across the highway? 9 A One of them was. 10 Q Where was the other one? 11 A Near the Santowax department inside the plant. 12 Q Let's go to Exhibit 46, it's the map of the 13 plant. 14 A Okay. 15 Q The landfill area that was near the Santowax 16 department inside the plant, can you indicate for me on 17 Exhibit 46 where that was during your tenure at the 18 Anniston plant? 19 A This map appears to have been drawn considerably 20 after my time at the Anniston plant. What I recall is the 21 area where there's Santowax somewhere to the west of the 22 block marked " central shop. " There was no such central	Page 452 1 A The only thing I can recollect is various 2 Santowax materials, fractions and still residues. Some of 3 that, as a matter of fact, turned out to be valuable during 4 the time I was there and some of it was dug up and 5 redistilled. 6 Q What were Santowax fractions? 7 A When biphenyl was produced, a substantial 8 by-product stream which is just generally called Santowax. 9 Originally it was considered a by-product but eventually a 10 substantial product line was developed using terphenyl, 11 which is the main component of Santowax, and we eventually 12 began operating the biphenyl furnaces in a different 13 fashion to deliberately increase the relative proportion of 14 this group of materials we generally called Santowax and 15 that, in fact, occurred after my time at the Anniston plant 16 but during the time that I was manufacturing manager, much 17 later. 18 But at any rate, the Hb-40 department, for 19 instance, used refined Santowax, which is mostly terphenyl, 20 as a raw material and the so-called solid Aroclors used 21 Santowax as a raw material. But there were some other 22 materials that were considered waste at various times in

Page 453 1 the history of the plant that at other times were 2 considered valuable raw materials. 3 Santowax itself, so-called Santowax R, which is 4 casually called terphenyl, is in fact a mixture. The two 5 biggest components, as I recall, are ortho and 6 paraterphenyl, which are specific compounds, specific 7 isomers. There's also some meta terphenyl present and some 8 higher polyphenyls and usually that was mostly quaterphenyl 9 but we later on learned that we could distill further by 10 putting the still residue and isolate quaterphenyl and use 11 it as raw material and the impurity in it was 12 quinquephenyl, which is a whole bunch of different isomers, 13 but all five benzene rings. 14 So at various times in history that stream was 15 taken apart in different ways and in the ' 50s there was a 16 particular mix of terphenyl isomers that was marketed as an 17 organic coolant in nuclear reactors. Such a reactor was 18 built in Canada, supplied from Anniston. So the fractions 19 left from shuffling these different isomer streams in 20 different ways were disposed of in this area and if their 21 value changed later on, they might be dug up and distilled. 22 Q What form did those fractions generally take?	Page 455 1 anything under that, I don't know. 2 Q Was that landfill done away with at some point in 3 time that you recall? 4 A At the time that I began visiting the Anniston 5 plant again in the early ' 70s it's my recollection it 6 wasn't there anymore, but I'm not sure of that. 7 Q Do you have an understanding as to why that 8 landfill was done away with? 9 A I have no idea. 10 Q Were there other materials that were disposed of 11 in that landfill besides Santowax fractions? 12 A I don't think so. 13 Q Do you know how far back the practice of 14 disposing of Santowax fractions in that landfill dated? 15 A It substantially predates the time I was at the 16 plant but I don't know any more than that. 17 Q Who was it that disposed of the Santowax 18 fractions in the landfill? 19 A I don't know. I never had any responsibility for 20 the Santowax department while I was at the plant. 21 Q Do you know whether there were any steps taken by 22 Monsanto to prevent the migration or leaching of materials
Page 454 1 A They were dry, waxy solids, substantially 2 insoluble in water. 3 Q And how were they disposed of in the landfill 4 area at the plant during your tenure there? 5 A I only observed this a few times but there was 6 some kind of a container, and I don't remember what it was, 7 but some kind of a container would be taken from the 8 Santowax department to this area and material would run out 9 as a liquid and solidify immediately. 10 Q When you say it would " run out as a liquid, " are 11 you talking about emptying it into the landfill? 12 A Yes. 13 Q How big was that landfill? 14 A I don't remember that it was very large, probably 15 75 or 100 feet on a side. I don't remember exactly. 16 Q Was it square, round? 17 A It was irregularly shaped, as I recall. 18 Q Do you know what the bottom of it consisted of? 19 A I have no idea. 20 Q For example, do you know whether it was paved or 21 lined in any way? 22 A All I ever saw was dirt but whether there was	Page 456 1 into the ground or water from that landfill? 2 A No. No reason why I would know anything about 3 that. 4 Q How did you become familiar with the other 5 landfill, the landfill that was across the highway? 6 A There was an old rifle range in a little flat 7 area. The area across the highway was the slope of one 8 side of a mountain ridge and as I recall it was called 9 Horse Block Mountain and there was a flat area part way up 10 the slope that had been used as a rifle range and I went up 11 there and used it for that purpose a few times. 12 Q When you were up there, you would see the 13 landfill? 14 A I saw that there was a landfill. The part that 15 was visible, as I recall it, from the rifle range area was 16 not at use at that time. 17 Q What time frame was this? 18 A That would have been in 1958, 1959. 19 Q Was that a landfill that had been in use earlier? 20 A It appeared to be an old landfill but I don't 21 know. 22 Q What did you see? What did that landfill look

Page 457 1 like? 2 A I don't remember very much about it. It was kind 3 of a pit and I recall that there were some drums visible 4 but I didn't take particular notice of it so I don't 5 remember any more than that about it. 6 Q When you say " drums visible, " were there drums 7 sticking out of the ground? Were they laying on the 8 ground? 9 A I don't remember. 10 Q How big was that landfill? Was that landfill -- 11 would that landfill have been 30 acres or thereabouts? 12 A I don't know. 13 Q Do you know what wastes or materials were taken 14 to that landfill? 15 A No. 16 Q Are you familiar with an approximately 30-acre 17 landfill that the Anniston plant began using in the 1950s? 18 A No. 19 Q Are you familiar with any landfill to which 20 wastes from the parathion department were shipped? 21 A No. 22 Q Let's go to the second page of Exhibit 108.	Page 459 1 acid. 2 Q During your tenure at the Anniston plant, what 3 did the wastewater flow from the parathion department to 4 that limestone bed consist of? 5 A Do you mean in terms of origin or in terms of 6 chemical components? 7 Q Well, let's start with chemical components. 8 A Certainly Hcl was present as dilute muriatic acid 9 in waste. There was quite a lot of sodium chloride or salt 10 and there was sodium bicarbonate, sodium paranitrophenate 11 and some phosphorus compounds that were hydrolysis products 12 of the intermediate material. Those are the ones that 13 occur to me right now. 14 Q And the phosphorus compounds, how did those 15 result from the -- how did those come to be in the 16 wastewater from the parathion operations? 17 A They came from incomplete reaction at the 18 condensation step and subsequent hydrolysis of those 19 materials possibly in the condensation step or later on in 20 the washer system. 21 Q How frequently, if you know, would those 22 materials come to be in the wastewater?
Page 458 1 There's a discussion there of a limestone bed, do you see 2 that? 3 A Yes. 4 Q That's the limestone bed or pit that we've talked 5 about? 6 A Well, we've talked about two different limestone 7 beds. From the context of this paragraph it says it was -- 8 it mentions parathion and paranitrophenol. I presume that 9 this means the limestone bed associated with the Niran 10 department. 11 Q What was your understanding of the function of 12 that limestone bed? 13 A The function was to neutralize acid in the stream 14 entering it. 15 Q Did you have the understanding that the limestone 16 bed would remove any other materials from wastes sent there 17 other than acidity? 18 A The purpose wasn't to remove anything. In 19 neutralizing acidity, the alkaline materials in the 20 limestone would react with the acid material present, which 21 in that case was predominantly Hcl. Nothing was thereby 22 removed. It was simply reacted so it would no longer be	Page 460 1 A Continuously. 2 Q So there were always phosphorus compounds in the 3 wastewater? 4 A The wash column operated continuously and was 5 on-stream 80 or 90 percent of the time. 6 Q And the sodium paranitrophenate, if I pronounce 7 it correctly, how would that come to be in the wastewater 8 from the parathion operations? 9 A Same way. It was from an incomplete reaction in 10 the condensation step subsequently washed out in the wash 11 column. 12 Q And again, that would be something that happened 13 every time there was wastewater from the parathion 14 operations? 15 A That happened at any time that the wash column 16 was running, which was most of the time. 17 Q Do you know whether any steps were taken to 18 prevent the migration or leaching of those materials in the 19 wastewaters from the limestone bed? 20 A I remember seeing the design drawings for the 21 limestone bed which showed a membrane below the earthen 22 surface at the bottom of the trench. But that had been

Page 461 1 built before my arrival at Anniston, so I don't remember 2 ever seeing -- it's called either a membrane or a lining. 3 The design for such a thing was the excavation that would 4 exceed the final size of the bed, so that the lining or 5 membrane could be put down and then a layer of clay put on 6 top of that to protect it. 7 Q In what context did you see those design 8 drawings? 9 A All of the design drawings for the Niran 10 department were available to me and I was the custodian of 11 those drawings after organic engineering left the site and 12 I routinely studied those drawings at any time that I was 13 attempting to do any kind of a study or modification of the 14 plant. 15 Q Do you know who generated those drawings? 16 A They were generated by the organic engineering 17 department in St. Louis. 18 Q Do you know when they were generated? 19 A They were generated during the time that the 20 plant was being designed, which would have been the latter 21 half of 1957. 22 Q When you say the organic department in St. Louis,	Page 463 1 I don't know whether they did it in this particular case. 2 By Mr. Brock: 3 Q Did you ever hear or learn of any occasions on 4 which such a membrane had not prevented the leaching or 5 migration of chemicals from the limestone bed into the soil 6 or water? 7 A No, I don't remember hearing of that. 8 Q Are you aware of any repair projects that needed 9 to be done with respect to the limestone bed or the 10 membrane? 11 A I don't remember such a project. 12 Q If you look at Exhibit 108, there's a statement 13 that analysis has indicated that " parathion and 14 paranitrophenol have entered the groundwater from this 15 facility. " It's on the second page of the exhibit under 16 the heading " limestone bed. " 17 A Yes. 18 Q Did you ever hear or learn that parathion had 19 entered the groundwater from the limestone bed? 20 A No, I don't remember hearing that or learning of 21 it. 22 Q During your employment with Monsanto, did you
Page 462 1 do you have any particular people in mind? 2 A Organic engineering department. Fritz Rosenberg 3 was the leader, Bill Garlette was the process engineer. 4 The drawings would actually have been prepared by draftsman 5 or mechanical engineers working at the direction of 6 Mr. Rosenberg or Mr. Garlette. 7 Q Do you know what type of membrane was called for 8 in the limestone bed? 9 A No, I don't remember. 10 Q Do you know whether such a membrane was in fact 11 installed? 12 A Oh, I think it was. The plant in its entirety 13 was built from those drawings. 14 Q Were there inspections of that membrane? 15 A I don't know. 16 Q If there had been inspections, whose 17 responsibility would that have been? 18 Mr. Burnett: Objection. Lack of foundation. 19 You can answer, if you can. 20 The Witness: Inspections of equipment in general 21 were the responsibility, the joint responsibility of the 22 production supervisor and the maintenance supervisor. But	Page 464 1 ever have any responsibilities for the paranitrophenol 2 department? 3 A No. 4 Q Did you ever hear or learn that paranitrophenol 5 had entered the groundwater from the limestone bed? 6 A No. 7 Q Were you aware of wastes from the paranitrophenol 8 department being sent to the limestone bed? 9 A No. I had nothing to do with that operation. It 10 was built after I left. 11 Q You mentioned another limestone bed. Where was 12 the other one? 13 A The other one was the one in the front yard that 14 discharged into Snow Creek. 15 Q If I remember your testimony correctly, that was 16 where the wastewater from the Aroclor department went? 17 A Yes. 18 Q Do you know what, if any, wastes from any other 19 departments went there? 20 A Muriatic department, department wastes, muriatic 21 acid department wastes went in that direction. Anything on 22 that side of the plant would have gone in that direction

Page 465 1 because there was a high place in the middle of the plant 2 that would keep it from going to the other side. 3 Q What were the wastes that went there from the 4 muriatic acid department? 5 A There was a large water flow from the muriatic 6 acid department which would contain dilute Hcl, muriatic 7 acid. 8 Q Anything else? 9 A If there were any Aroclor entrained in the Hcl 10 going from the Aroclor department to the muriatic acid 11 department, that material might find its way to that sewer. 12 Q When you say might, why do you use the term 13 " might "? 14 A Because of the flows in the department. The gas 15 flow went first to the muriatic acid absorber, so one would 16 expect that if there were Aroclor in the Hcl, it would be 17 collected with the crude muriatic acid and then absorbed in 18 the carbon treatment before the muriatic acid was shipped. 19 Q Do you know whether that limestone bed was lined? 20 A It eventually was, but whether the original 21 version of it was or not, I don't know. 22 Q When you say eventually --	Page 467 1 entering the soil or groundwater from that limestone bed? 2 A I'm not quite sure how to answer that. During my 3 time as manufacturing manager, we were routinely measuring 4 the Pcb content of the water leaving the limestone bed to 5 enter Snow Creek and I wouldn't characterize the water 6 itself as being groundwater, but since Snow Creek was 7 simply an open channel through clay soil, I suppose that 8 was a path the groundwater took. 9 Q That's fair enough. I should have excluded other 10 than the passage to Snow Creek. Are you aware of any 11 concern that had been expressed? 12 A I don't remember that as a specific concern. 13 Q Are you aware of any instances in which before 14 the Pcb problems arose any investigations or studies into 15 whether materials were migrating or leaching into the soil 16 or groundwater from that limestone bed, other than to Snow 17 Creek? 18 A No, I don't remember any study like that. 19 Q If you look on the second entry, li of Exhibit 20 108 there's an entry for Snow Creek. Do you see that? 21 A Yes. 22 Q And it says " Pcb's from the Aroclor unit were
Page 466 1 A I'm referring to my time as a manufacturing 2 manager. I know that we had some projects to improve or 3 possibly replace the limestone bed and enlarge it. My 4 recollection is that there was a lining in that one, but 5 whether there had been a lining earlier, I don't know. 6 Q What was the impetus for the project to improve 7 or replace it? 8 A I don't remember. 9 Q Did you have any involvement in that project? 10 A I probably approved it because that would have 11 been the sequence for capital approval for such a project. 12 Q One of the improvements was putting in a lining? 13 Mr. Burnett: Objection. 14 By Mr. Brock: 15 Q Was one of the improvements putting in the 16 lining? 17 A The new bed had a lining, but whether that 18 represents a change from the previous design, I don't know. 19 Q Either during the time that you were at the 20 Anniston plant or during your time as manufacturing 21 manager, are you aware of any concerns that had been 22 expressed with respect to the possibility of materials	Page 468 1 found in sediments of Snow Creek and a related drainage 2 ditch downstream of the Monsanto plant. " Do you see that? 3 A Yes. 4 Q Do you recall Pcb's from the Aroclor unit being 5 found in the sediments of Snow Creek? 6 A No, I don't remember anyone making such a 7 measurement during my time. 8 Q I'm not just restricting it to the time you were 9 at the Anniston plant. 10 A Or as a manufacturing manager, I don't recall 11 that. 12 Q You don't recall that ever being brought to your 13 attention? 14 A We were quite concerned about the Pcb content of 15 the water itself going to Snow Creek, of course. 16 Q But you're not aware of any time during which 17 Pcb's were found in the sediments in Snow Creek? 18 Mr. Burnett: Asked and answered. 19 You can answer it again. 20 The Witness: I don't know. 21 By Mr. Brock: 22 Q When did you first become concerned about the Pcb

Page 469 1 content of the effluents to Snow Creek? 2 A When I became manufacturing manager and the 3 Anniston plant became part of my responsibility. 4 Q Was that just as part of the overall Pcb 5 situation you were addressing? 6 A Yes. 7 Q There's a reference to Pcb's being found in a 8 drainage ditch downstream of the Monsanto plant. Do you 9 recall hearing or learning that Pcb's had been found in a 10 drainage ditch? 11 A No, I don't know what ditch that refers to. 12 (Savage Exhibit 109 identified.) 13 Mr. Brock: I've marked as Exhibit 109 a 14 September 21, 1961 memorandum with a number of 15 attachments. The Bates numbers are Ann 1539644 through 16 663. 17 By Mr. Brock: 18 Q Mr. Savage, I'd like you to just take a moment to 19 glance through it. If it speeds your review, I believe 20 your name is mentioned on the page that ends in Bates 21 number 655. And let me know when you've had a chance to 22 look through the document.	Page 471 1 waste treatment processes used by Monsanto were obtained 2 from Mr. J. Savage, chemical engineer, Monsanto Chemical 3 Company, Anniston, Alabama ; and Mr. C. N. Studz, sanitary 4 engineer. " Do you see that? 5 A Yes. 6 Q Do you recall collecting or providing such 7 production and waste treatment information in connection 8 with investigation concerning the fish kill? 9 A No. Information about production on waste 10 treatment processes is something I would have known without 11 having to investigate, so I would have been the logical 12 person to ask, but I don't remember doing so. 13 Q During the time that you were at the Anniston 14 plant, did you ever deal with Jack Garrett concerning the 15 operations of the Anniston plant? 16 A Probably so. Mr. Garrett later on was my 17 neighbor, my partner and so forth and I know that I met him 18 before he was my neighbor, but exactly when, I don't know. 19 Q Do you recall working on any projects with him 20 concerning the operations at the Anniston plant? 21 A No. But I had met him before I moved to 22 Kirkwood, so presumably it would have been in connection
Page 470 1 (Witness reviewed the document.) 2 A Yes. 3 Q Have you ever seen this document before to your 4 knowledge? 5 A I don't remember seeing it. 6 Q Do you recall learning about fish kills in the 7 Choccolocco Creek and Coosa River in or about 1961? 8 A I heard of such things secondhand. I don't 9 remember who I heard it from. 10 Q Do you recall what you heard secondhand? 11 A The fact that fish kills had been alleged. 12 Q Did you hear that those fish kills had been 13 attributed to Monsanto? 14 A Well, that's why I would have heard of it, yes. 15 I heard it from somebody in Monsanto, but I don't know who. 16 Q Let's go to the page ending in Bates number 655. 17 There's a discussion of a Dr. Grsenda on that page. 18 A Yes. 19 Q Do you recall dealing with a Dr. Grsenda 20 concerning the subject of those fish kills? 21 A No. 22 Q It states " The data regarding the production and	Page 472 1 with something at Anniston. 2 Q Do you recall doing any work in connection with 3 the findings or allegation of a fish kill in this time 4 frame? 5 A No. I just remember hearing about it. 6 Q Did you hear -- aside from your initial 7 conversations in which you heard about it, did you 8 subsequently hear whether the fish kill could in fact be 9 attributed to the operations at the Anniston plant or not? 10 A I may have, but I don't recall. 11 Q I take it you didn't see any analysis or 12 discussion of that that you recall? 13 A I remember the laboratory talking about doing 14 such analysis, but I don't remember what that analysis 15 might have shown. It was considered a rather unusual event 16 for the analytical lab to be working on fish. 17 Q Do you recall there being any other times in 18 which concern was brought to your attention as to whether 19 the operations of the Anniston plant were causing harm to 20 aquatic life or other wildlife, and I'm restricting this to 21 the time you were at the Anniston plant? 22 A What are you asking me about that?

Page 473 1 Q We talked about the claims of a fish kill in the 2 Chocolocco Creek and Coosa River being brought to your 3 attention. Were there any other matters along those lines 4 brought to your attention, for example, fish kills, harms 5 to aquatic life or that kind of thing? 6 A I remember one letter to the editor of the 7 Anniston newspaper which I thought was kind of humorous in 8 which the writer claimed that her father or grandfather had 9 fished in Snow Creek, and I thought that was humorous since 10 Snow Creek would not have any flow without the flow from 11 the Anniston plant. 12 Q Do you recall any other concerns about harm to 13 wildlife or aquatic life from the Anniston plant being 14 brought to your attention? 15 A No. 16 (Savage Exhibits 110 and 111 identified.) 17 (Recess.) 18 By Mr. Brock: 19 Q Exhibit 110 has Bates numbers Ann 1540107 through 20 109 and number 111 has a Bates number of Ann 1539917. 21 Let's start with Exhibit 110. Mr. Savage, is that a Tsd 22 progress report that you drafted along with some others	Page 475 1 Q Let's go to the second page where it lists the 2 sources of odor and the first is waste disposal area. What 3 does that refer to? 4 A I believe that this date is before the waste 5 treatment plant was built. So at that time, we would 6 probably refer to the limestone bed and the tanks right 7 next to the limestone bed as being the waste disposal 8 areas. 9 Q What was the outlet weir? 10 A Well, the outlet weir was a device to measure 11 flow. It's obviously at the outlet of something, but I 12 don't remember -- I guess I do. It was at the outlet of 13 the concrete holding tanks, so it would have been the last 14 access to the stream before it entered the city sewer at 15 that time. 16 Q There's a reference to strong organic sulfide 17 odors being noticed frequently. Do you recall how 18 frequently those odors were noticed? 19 A No, I can't add anything to that statement. 20 Q What was the P2s5 room? 21 A That was within the Niran department. There was 22 an area below the control room at ground level where bins
Page 474 1 concerning odor investigations at the Niran plant? 2 A Yes. 3 Q Do you recall what the impetus was for this 4 investigation? 5 A No. I don't know of any occasion that triggered 6 this work. 7 Q That was just an ongoing subject being 8 investigated at that point in time? 9 A Yes. 10 Q Who are J. C. Johnson and Archie Sprague? 11 A Jim Johnson was a mechanical engineer in the 12 department. His boss was Russ Sprague who was the 13 superintendent of the maintenance department. 14 Q Johnson's position was what in the maintenance 15 department? 16 A He was mechanical engineer. I don't know what 17 his title was, but he was mechanical engineer. Is a 18 mechanical engineer I should say. 19 Q Something do you know what his input would have 20 been into this project? 21 A I don't know specifically what he did on this 22 project.	Page 476 1 of P2s5 were emptied. That was also the room where bags of 2 soda ash were dumped. That was just known as the P2s5 3 room. Let me correct that. P2s5 room was a separate 4 little room under the control room where P2s5 bins were 5 emptied. 6 Q There's a statement " leakage of the thio acid 7 pump packing allows thio acid to accumulate on the floor. " 8 Do you recall that happening? 9 A No. 10 Q Do you recall any changes being made in the P2s5 11 room to stop that from happening? 12 A No. I don't even remember there being a pump in 13 that room, from the words here apparently there was. 14 Q What was a condensation reactor vent? 15 A Condensation reaction took place at atmospheric 16 pressure. I don't remember the temperature conditions, but 17 there was a vapor line leaving the reactor and the 18 condensor chilled with a refrigerant whose purpose it was 19 to condense any acetone vapor leaving the reactor. The 20 vent, the condensation reactor vent would be the vent from 21 the condenser above the condensation reactor. 22 Q Do you recall there being odors emitted from

Page 477 1 the -- 2 A Not specifically. I can see what it says here, 3 but I don't remember. 4 Q Do you recall there being odors emitted from the 5 other sources of odor listed, the " jet effluent beater 6 vent "? 7 A That's header, h-e-a-d-e-r. 8 Q Header, I'm sorry. 9 A No, I don't remember the specific sources of odor 10 in the department. 11 Q Do you recall there being complaints about odors 12 listed in the sources of odors listed here? 13 A I can recall being told of complaints from 14 neighbors and sometimes the neighbors would believe they 15 could pinpoint what exact pipe in the plant the odor had 16 come from. We were skeptical at such statements. 17 Q Do you recall what, if any, pipes the neighbors 18 identified? 19 A They would identify the plume coming from the 20 vacuum jets because it was a visible emission, but what was 21 visible was steam, condensate from steam. 22 Q Under odor control program, it talks about	Page 479 1 be installed over the entrance to the limestone pit and the 2 outlet weir. " Do you recall why that was proposed? 3 A No, I don't recall this. 4 Q Let's go to Exhibit 111. 5 A Okay. 6 Q Does this appear to you to be Cliff Stutz's 7 response to your June 8, 1959 Tsd report? 8 A Yes. 9 Q Are those your notes on the left-hand column? 10 A Yes, that's my writing. 11 Q And Mr. Stutz writes " Apparently the odors at the 12 limestone pit and hold tanks are most severe when the waste 13 treatment chlorination unit is not operating properly. " Do 14 you see that? 15 A Yes. 16 Q Did you agree with that statement? 17 A Did I agree with it at the time? 18 Q Yes. 19 A I don't know. 20 Q Is it your recollection that that was the case? 21 A That what was the case? 22 Q That the odors at the limestone pit and hold
Page 478 1 " revisions to sewage chlorinator " and states " It is 2 proposed that the existing stoneware column be replaced 3 with one of Haveg-7710, " do you see that? 4 A Yes. 5 Q The reference to existing stoneware, can you 6 describe that? 7 A That's what I referred to earlier as vitrified 8 clay pipe. I guess stoneware is probably a more accurate 9 description of the material, but it's ceramic. 10 Q Let's go to the next page where it says " control 11 measures at waste disposal area " and there's a proposal 12 that " the existing obsolete caustic storage tank be 13 converted for hypochloride storage by application of a 14 suitable lining. " Do you see that? 15 A Yes. 16 Q In what sense was the caustic storage tank 17 obsolete? 18 A I don't remember. 19 Q Do you recall whether the old tank had a lining 20 or not? 21 A No. 22 Q It states " It is also proposed that spray nozzles	Page 480 1 tanks were most severe when the waste treatment 2 chlorination unit was not operating properly? 3 A Oh, certainly. 4 Q And the reference to not operating properly, what 5 would the upsets or breakdowns be? 6 A My recollection it had to do with failures of the 7 stone equipment, leaks and cracks which prevented it from 8 being operated properly. 9 Q And how often would that take place? 10 A I don't remember. 11 Q And under (a), Mr. Stutz writes " Provide dual 12 contact columns of adequate capacity so that treatment can 13 be provided at all times. " Can you explain to me what he's 14 suggesting there? 15 A I think he was proposing that essentially there 16 be a spare column, since for ordinary purposes, only one 17 column would be needed. 18 Q And you write " I'm agin it. "? 19 A Yes. 20 Q And it says "\$ 2000 extra. " Were cost factors a 21 significant factor in Monsanto's dealing with odor or waste 22 disposal situations in the late 1950s?

Page 481 1 A I think we were always conscious of what things 2 cost. 3 Q Did Monsanto attempt to implement the least 4 expensive methods of waste disposal and waste control? 5 A No, I don't think so. I think our first concern 6 was that we provide facilities that would be effective, but 7 we didn't want to spend money unnecessarily. 8 Q Do you recall any waste disposal or pollution 9 abatement projects that were not put in place because of 10 cost factors? 11 A No. This particular instance in my recollection 12 we in fact only put in one column. 13 Q So Mr. Stutz's suggestion was not adopted? 14 A Not that I recall. 15 Q And down below there's a paragraph by Mr. Stutz 16 that " if these improvements are made, it would seem that 17 the proposal to install hypochloride storage and spray 18 equipment at the entrance to the limestone pit and over the 19 hold ponds would not be necessary. " Do you see that? 20 A Right. 21 Q And you write " but it's cheaper. " 22 A Yes, I see that. I don't remember having written	Page 483 1 A Yes. 2 Q Do you recall this process or this type of 3 experiment being tested in the late 1950s? 4 A Yes. 5 Q Tell me what you recall about it? 6 A I recall approximately what's reflected here on 7 the front page, that it was partially successful, that the 8 organic loading in the stream could be substantially 9 reduced, but it didn't meet our objectives. 10 Q Why did it not meet Monsanto's objectives? 11 A We wanted to reduce the organic loading in the 12 stream more than this. 13 Q Can you tell me what the lagoons consisted of -- 14 strike that. 15 Do you know where they were at the plant? 16 A Roughly in the area of the limestone pit and the 17 holding tank. We've marked that on a map yesterday. 18 Q Marked the lagoon? 19 A Well, lagoon and -- 20 Q Right. We did mark temporary lagoon. 21 A Yes, I think that's the same thing. 22 Q In some earlier exhibits today, there were some
Page 482 1 these comments obviously they're my writing and they're 2 also my style. 3 Q Do you recall what steps were adopted, if any, to 4 address this situation of odors at the limestone pit and 5 hold tanks? 6 A The only thing I remember clearly is that we 7 installed this new column and that it worked very well. 8 It's my recollection that this general problem area after 9 that was not of nearly so much concern. 10 Q Do you know whether the hydrochloride storage and 11 spray equipment referenced was installed? 12 A I don't remember that we did that. 13 (Savage Exhibit 112 identified.) 14 Mr. Brock: I've marked as Exhibit 112 a document 15 with Bates numbers Ann 1539264 through 266. 16 By Mr. Brock: 17 Q Mr. Savage, could you let me know when you've had 18 a chance to glance through this document. 19 (Witness reviewed the document.) 20 A Yes, okay. 21 Q It references an " Experimental treatment of Niran 22 wastes by lagooning. " Do you see that?	Page 484 1 references to a pilot effluent pond. 2 A This was the same thing. My recollection is that 3 over some period of time we modified and enlarged that pond 4 or lagoon, but I don't remember the reasons. 5 Q Do you recall what the modifications were? 6 A Just to make it bigger. 7 Q Were there any other modifications to it? 8 A Not that I remember. Oh, yes, the original 9 lagoon was just a simple lagoon that got its oxygen 10 transfer just through the surface as any natural body of 11 water would. At some point we installed a compressor to 12 bubble air through the lagoon or pond. I don't remember at 13 what point that was done, but I remember that that was a 14 second step at some point. 15 Q Was that lagoon ever used on a permanent basis? 16 A It was used for an extended period of time. It's 17 my recollection that it was too small, far too small to 18 effectively treat all the wastes from the plant, but that 19 enough reduction was going on that it seemed useful to 20 continue its operation until the big waste treatment plant 21 was ready to put in service. So it's my recollection we 22 ran it for some extended period of time, but I don't

Page 485 1 remember how long. 2 Q Was it used for a time during which the big waste 3 treatment plant was also used? 4 A I don't think so. I don't think there would be 5 any reason to do that. 6 Q If you look on the second page of the exhibit 7 under " lagoon tests, " there's a small -- or there's a 8 description of lagoons. Do you see that? 9 A Yes. 10 Mr. Burnett: Did you say " lagoons "? 11 Mr. Brock: A small lagoon. 12 By Mr. Brock: 13 Q Do you recall how many temporary lagoons or was 14 there one temporary lagoon or was there more than one? 15 A There was one lagoon that was actually operated 16 as two units by putting a partition in it at some point. 17 Q And were different materials sent to one side of 18 that lagoon than the other side? 19 A I think they were operated in sequence, believing 20 that that might be more efficient. 21 Q Do you know whether that lagoon was lined at all? 22 A I think it was.	Page 487 1 (Whereupon, at 12: 35 p. m. , the deposition was 2 recessed, to be reconvened at 1: 30 p. m. this same day.)
Page 486 1 Q What do you think it was lined with? 2 A I don't know. 3 Q What leads you to think that that was lined? 4 A Because that would have been a fairly normal way 5 to build something like that. 6 Q Did you ever see the design drawings for that 7 lagoon? 8 A I don't remember seeing those drawings. 9 Q Why would it have been fairly normal for such a 10 lagoon to be built with a lining at that time? 11 A So that it wouldn't leak. 12 Q Do you know whether in fact that lagoon had a 13 lining? 14 A I'm not sure. 15 Q Did you ever hear or learn that there had been 16 migration of chemicals or leaks from that lagoon? 17 A No. 18 Q Are you aware of any investigations or studies 19 into that subject? 20 A No. 21 Mr. Brock: Now is probably a logical time for a 22 lunch break.	Page 488 1 Afternoon Session (1: 45 p. m.) 2 Whereupon, 3 James R. Savage 4 resumed the stand and, having been previously duly sworn, 5 was examined and testified further as follows: 6 Mr. Brock: My understanding is that Monsanto's 7 counsel has agreed with us that Charlie Meyer can go out of 8 turn and do his questioning and then I can return and do 9 mine. Certainly I'll make every effort as long as there's 10 not duplicative questioning or repetitive questioning and 11 that type of thing. I certainly intend to avoid and make 12 every effort to avoid any such type of questioning. 13 Mr. Burnett: That's correct. And it's my 14 understanding that both of you still believe that we'll be 15 able to comfortably conclude the deposition sometime 16 tomorrow. 17 Mr. Brock: Yes, at present that's my 18 understanding and intention. 19 Mr. Meyer: Well then, for the record, my name is 20 Charles Meyer with the law firm of Jackson & Campbell. 21 And, Mr. Savage, I'll be asking you some questions relating 22 to your tenure at the Anniston, Alabama facility. I'd like

Page 489 1 to have introduced and marked as our next numbered exhibit 2 a Monsanto document known as a manual of operating 3 instructions for the waste treatment plant lagoon prepared 4 by Mr. Gene Coley dated as of July 14, 1966. 5 (Savage Exhibit 113 identified.) 6 Examination 7 By Mr. Meyer: 8 Q Sir, with all the exhibits that I'll be 9 introducing, what I would like for you to do is spend as 10 much time as you would like in reviewing them and when you 11 feel to your satisfaction that you've had a chance to 12 review them, look up and indicate to me that you're ready 13 for me to start my questioning. Naturally by so 14 indicating, that doesn't preclude you from at any point 15 during the questioning stopping and and rereviewing a 16 document. Do you understand that? 17 A Yes. 18 (Witness reviewed the document.) 19 Okay. 20 Q Mr. Savage, I realize that this is authored a few 21 years after you left the Anniston plant for the record. I 22 was wondering, sir, if the description of the waste	Page 491 1 A It was done in a tower inside the Niran 2 department. 3 Q So the wastes were first chlorinated in the Niran 4 department and then they flowed to the waste treatment 5 facility? 6 A Yes. Also there's a reference here to flow to 7 lagoon as being a part of the ongoing process and I don't 8 remember that. 9 Q Now, sir, from the reference on page 2 of the 10 document to entries on first of all a lagoon and then also 11 a limestone pit, would I be fair in inferring from that 12 that the two were separate installations? 13 A Yes, yes. I think so. 14 Q Were the hold tanks in existence when you were at 15 the plant, sir? 16 A It's my recollection that the hold tanks were 17 part of the original Niran installation. So yes, they were 18 there when I arrived. 19 Q Finally, sir, how about the aeration basins? 20 When you were at the plant, did the waste treatment 21 facility have aeration basins? 22 A The first aeration basins were built while I was
Page 490 1 treatment plant lagoon is familiar with you based on your 2 prior experience at the plant? 3 A It's generally familiar, but there are some 4 features that were not present at the time I was at the 5 plant. 6 Q Could you please identify the features that were 7 not present? 8 A The Pnp department did not exist at the time that 9 I was there. They brought in Pnp that was made in another 10 plant, so any reference here from waste from the Pnp 11 department is something that I'm not familiar with. 12 Q Because it would not have existed at the time 13 that you were at the plant? 14 A That's right. 15 Q How about the actual components of the waste 16 treatment system, were there any additions from the time 17 you had been at the plant, sir? 18 A Well, I notice for instance that chlorination is 19 done in a contact basin. My recollection is that didn't 20 exist at the time that I was there. 21 Q Where was the chlorination done when you were at 22 the plant?	Page 492 1 at the plant. 2 Q How many of them were there that were built at 3 that time? 4 A There were two at that time. 5 Q Prior to the construction of those aeration 6 basins, was any effort made to oxygenate the waste? 7 A What I recall is that during the time that the 8 lagoon or pond was in operation that we aerated the pond or 9 lagoon. I don't recall that as handling the entire flow 10 however. 11 Q And that would go back to your previous testimony 12 before the lunch break that initially the lagoon through 13 the surface contact would oxygenate and later on some 14 installation was put into it? 15 A That's right. 16 Q When you said pond, were you using that 17 interchangeably with lagoon? 18 A Yes. 19 Q So those are one and the same? 20 A According to my recollection, yes. 21 Q Sir, do you recall what the construction of the 22 aeration basins was when you were at the plant, the ones

Page 493 1 that had been constructed before you left? 2 A They were concrete. 3 Q Were they built above-ground level then? 4 A No. Ground was excavated and forms put in the 5 ground much the way a concrete basement for a house would 6 be built. 7 Q So you saw the construction? 8 A Yes. 9 Q Did you have anything to do with the design basis 10 for the aeration basins? 11 A No. 12 Q Who would have been responsible for designing the 13 aeration basins? 14 A Cliff Stutz was the lead engineer as I recall 15 from a process standpoint. He probably would not have been 16 the one to do the detailed design on the concrete. I don't 17 know who did that. 18 Q Do you recall a Mr. Gene Coley? 19 A Yes. 20 Q Could you tell me what you recall of Mr. Coley? 21 A Mr. Coley at the time that I was at the plant, he 22 may have started with a couple while I was at the plant. I	Page 495 1 Q What is your understanding of a trickling filter 2 system? 3 A A trickling filter is another kind of biological 4 treatment plant, it's quite common. 5 Q So as opposed to inserting bacteria, this would 6 have some other way of filtering out the pollutants? 7 A No. Bacteria are still involved. It's just 8 whereas in an activated sludge plant, the bacteria right in 9 sludge particles are settled in a settler and recycled with 10 pumps. In a trickling filter, the bacteria reside in some 11 kind of sludge that's in a stationary phase and the waste 12 is trickled across that sludge. 13 Q Sir, to your knowledge did the Nitro facility 14 have a site that was close to a large river? 15 A Nitro plant is situated on the Kanawha River. 16 Q And is that river to your knowledge larger than 17 Snow Creek would have been in Anniston, Alabama? 18 A Certainly. 19 Q As part of designing a waste treatment facility 20 in this era, and we're discussing the late 1950s, early 21 1960s, would the size of the receiving waters of an 22 effluent stream have mattered in terms of the design basis
Page 494 1 believe he was in the analytical lab when I knew him, but 2 I'm not sure about that. 3 Q Was the waste treatment facility at the Anniston 4 plant also sometimes referred to as O-2? 5 A Not to my recollection. 6 Q Do you recall what Mr. Coley's background was, 7 sir, prior to joining Monsanto? 8 A No. 9 Q And Mr. Stutz, sir, would have been at 10 headquarters in some capacity? 11 A He was a sanitary engineer working in organic 12 engineering department in St. Louis. 13 Q How long had, to your knowledge, the organic 14 engineering department had a sanitary engineer department? 15 A Not very long. It's my recollection that 16 Mr. Stutz may have been the first such engineer in organic 17 engineering. 18 Q Now, sir, did the Niran facility in the plant at 19 Nitro, West Virginia have a waste treatment facility? 20 A I was told that there was a trickling of filter 21 there, but whether that was a full-sized facility or some 22 kind of pilot facility, I don't know.	Page 496 1 for a treatment facility? 2 A Yes. But Snow Creek was not the receiving 3 stream. Choccolocco Creek was the receiving stream. 4 Q Well, but then the answer to my question is yes? 5 A Yes. 6 Q So the size of the receiving water would make a 7 difference? 8 A I think that question really goes beyond my 9 expertise. 10 Q All right. And you don't know how long Mr. Stutz 11 or the unit he worked for had been in existence prior to 12 your involvement with him? 13 A When I met Mr. Stutz, he had already had 14 substantial experience in waste treatment. It's my 15 understanding that he had not been with Monsanto a long 16 time. But previous to that, worked in waste treatment of 17 domestic waste. 18 Q So this would have been say with a municipally 19 owned system? 20 A I think so. 21 Q Now, how about Mr. Coley, do you think he had a 22 similar background in municipal treatment plants?

Page 497 1 A I don't know what his background was. 2 Q Sir, to your knowledge when you were at the 3 plant, did a manual like the one that is embodied in 4 Exhibit 113 exist for the waste treatment facility? 5 A I don't remember that it did. 6 Q Which department within the plant would have been 7 responsible for operating the waste treatment facility? 8 A At the time that I was there, the Niran waste 9 treatment plant was considered to be a part of the Niran 10 department. It was operated by the same supervision. 11 Q Now, in that time frame, sir, did each operating 12 department within the Anniston plant have its own 13 maintenance group? 14 A The plant was functionally organized, meaning 15 that the plant manager's staff level there was a production 16 superintendent and a maintenance superintendent. And so 17 from the formal standpoint, all the maintenance people 18 reported up to the maintenance superintendent. However, 19 within the maintenance department, there was a subdivision 20 according to production departments so that at the 21 supervisor level there would be a certain production 22 supervisor who was responsible for each part of the plant.	Page 499 1 that was off site that you were testifying to earlier 2 today? 3 A Yes. 4 Q Yes? 5 A Yes. 6 Q Sir, I believe it was your testimony earlier 7 today that you referred to a geographical feature across 8 the road on that Monsanto owned land as a horseshoe 9 Monsanto? 10 A Horse Block is the name I remember. 11 Q Could it also -- 12 A Strange name. 13 Q Could it also have been known as Cold Water 14 Mountain? 15 A I remember that name too. That may have been the 16 name of the larger feature. I don't know. 17 Q Sir, do you recall anyone ever telling you 18 whether or not that Monsanto owned property across the 19 road, had at one time had iron ore pits? 20 A Yes. That was part of the history of the plant 21 that it was ore. I remember it being called ferromanganese 22 ore.
Page 498 1 Q And then would there have been Anniston log of 2 maintenance supervisor that was attached to that particular 3 production department? 4 A Usually. 5 Q And was that true of the Niran department in that 6 era? 7 A That's my recollection, yes. 8 Q And would that then also have been true for the 9 Aroclor biphenyl department? 10 A I think so. 11 Q Sir, to your knowledge was Snow Creek immediately 12 adjacent to the outfall at the Anniston plant? 13 A Snow Creek was on the opposite side of Highway 14 202 from the limestone bed in the front yard that served 15 the Aroclor department. 16 Q And approximately how far would that have been 17 then from the outfall to the, I believe you said across 202 18 where Snow Creek was? 19 A Just the width of that right away. I don't know 20 what that would be. Perhaps 40 feet. 21 Q Now, would Alabama state Highway 202 also be the 22 road that divided the main plant from the landfill property	Page 500 1 Q Were those pits then excavations in the ground? 2 Mr. Burnett: What pits? 3 Mr. Meyer: The ferromanganese pits. 4 The Witness: If it was used for mining, I would 5 presume that, but I never studied the land enough to reach 6 any conclusion like that. 7 By Mr. Meyer: 8 Q Well, let me ask you, sir. In the times you went 9 over there, I believe you testified to do shooting, would 10 that have been skeet shooting? 11 A No. I had a rifle and it was the very primitive 12 type of target shooting, setting up tin cans and shooting 13 at them. 14 Q In those times that you went over there, do you 15 ever recall seeing pits in the ground? 16 A Yes. I think I mentioned that I saw something 17 that looked like a landfill where there were some drums in 18 evidence. 19 Q How about something that might have looked like 20 at one time it was a mining operation? 21 A I don't remember that. I'm not sure I would know 22 what a mining operation looked like anyway.

Page 501 1 Q How did you gain the knowledge that at one time 2 there might have been some ferromanganese pits over there? 3 A There was a written history of the plant that 4 anyone could have access to which described the Old 5 Southern Manganese Corporation, which was the original 6 owner -- not the original owner, but the original developer 7 of that property. 8 Q Which later on became Swan Chemical? 9 A Yes, in between it was called the Federal 10 Phosphorus Company, but eventually became Swan Chemical. 11 Q Now, sir, I believe earlier today you were 12 describing an on-site landfill. Could that have also been 13 generally known within the plant as Cleghorn's Lake? 14 A Yes. I remember that term. 15 Q And Mr. Cleghorn as I understand it was at one 16 time the supervisor of the Aroclor department? 17 A Yes. At the time that I arrived at the plant, he 18 was supervisor of that entire area. 19 Q Including biphenyl? 20 A Yes. 21 Q Now, sir, going back to your description of what 22 was being pumped to the Cleghorn's Lake configuration, I	Page 503 1 there was a Santowax Omp, for instance, that was sold. In 2 the Montars, as I recall it was, there was a number suffix, 3 it would be Montar 1 or 2 or something like that, which 4 reflected the origin of that particular grade of Montar. I 5 don't recall which one went with which product. 6 Q Could there have been as many as nine numbered 7 Montars, one through nine? 8 A Could be, I don't know. 9 Q Sir, prior to the construction of Cleghorn's Lake 10 and I believe you said it was a feature that already 11 existed when you arrived at the plant? 12 A That's my recollection. 13 Q You don't know for how many years it had been in 14 existence, do you? 15 A No. 16 Q Do you know what was done with the still residues 17 prior to the construction of Cleghorn's Lake? 18 A No. 19 Q Sir, was Cleghorn's Lake physically on the land 20 as you looked at it, in actuality, two physically distinct 21 impoundments to your recollection? 22 A Yes. Now that you ask that, I believe there was
Page 502 1 believe you described them as Santowax fractions ; is that 2 correct? 3 A Yes. 4 Q Would that have also included a substance known 5 as Montar? 6 A It might have. Just because Montar, even though 7 it was a trade name that we used when we sold certain 8 grades of still residue, it was also used pretty broadly 9 for any still residue from that part of the plant. So 10 Santowax still bottoms might have well been called Montar 11 and Santowax still bottoms I think were placed in that 12 landfill. 13 Q Now, wasn't Santowax also a trade name? 14 A Yes. 15 Q So Montar was also a trade name? 16 A Yes. 17 Q So documents might have referred to one or the 18 other interchangeably? 19 A Well, when the products were sold, there was a 20 letter or number after it. Santowax R, for instance, was 21 the name given to refined Santowax when it was sold and 22 that was the usual Santowax product that was sold, but	Page 504 1 more than one place. 2 Q Do you recall, sir, if there was any effort made 3 to funnel one type of still bottom to one of the 4 impoundments versus another, in other words, to keep them 5 segregated? 6 A The only one I remembered clearly was the one I 7 mentioned before and it was my understanding that it was 8 entirely Santowax material that went to that one. But I 9 have no comprehensive knowledge of what went to that place. 10 Q Now, sir, what would the still bottoms from the 11 production of liquid Aroclor have been known as? 12 A I think it would have been called Montar with 13 some number after it, maybe one of several numbers. 14 Q So would the still bottoms from solid Aroclor 15 production have also been known as a Montar? 16 A I think so. I'm not sure about that, but I think 17 so. 18 Q How about a substance known as Santotar? 19 A Santotar, I'm I don't remember that term. 20 Q Sir, do you recall from time to time when the 21 Montar or Santowax was being placed in Cleghorn's Lake, 22 that the hot Montar which was in liquid form as it was

Page 505 1 being placed on top of the surface of Cleghorn's Lake, that 2 a vapor would arise, a very density cloud? 3 A I don't remember that, but I only remember seeing 4 the Santowax type material. It's not just something that I 5 happened to have observed. 6 Mr. Meyer: I would like to have marked and 7 introduced as our next numbered exhibit a Monsanto progress 8 report from the technical services department at Anniston 9 dated September 30, 1971 and for the record its title is 10 " Plant improvement and environmental control " and the 11 witness is shown as having received a copy of the document. 12 (Savage Exhibit 114 identified.) 13 By Mr. Meyer: 14 Q Sir, since this is a longer document, please take 15 your time to review and study and familiarize yourself with 16 it. 17 (Witness reviewed the document.) 18 A Okay. 19 Q Sir, do you generally recall the subject of the 20 memorandum? 21 A In general. Each plant had a plant improvement 22 project of some kind.	Page 507 1 improvement programs that deferred certain projects as a 2 cost-saving measure? 3 A Yes. We've had campaigns from time to time to 4 reduce costs which sometimes involved deferral of expenses. 5 Q Would I be reading this correctly, sir, that 6 prior to the enactment of these various laws that are 7 referenced in the second paragraph of the executive 8 summary, that the Anniston plant had planned several 9 pollution control and other projects, but that those had 10 been deferred on account of this profit improvement 11 program? 12 A It seems to be a reasonable inference from this 13 paragraph. 14 Q Sir, I would like to direct your attention to the 15 fourth page of the document which for the record has a 16 Anniston Bates number 1401854. Are you with me, sir? 17 A Yes. 18 Q Under the general subject matter " water, " there 19 is a description of various kinds of sewers at the Anniston 20 plant. And I was wondering, sir, if at the time you were 21 at the Anniston plant, whether or not those four categories 22 of sewers existed?
Page 506 1 Q Around this time, 1971? 2 A During most of my time in manufacturing this was 3 a standard procedure. 4 Q Sir, do you recall who Mr. Ankeny was? 5 A No, I don't. 6 Q How about Mr. Taffee, T-a-f-f-e-e? 7 A Bill Taffee was at the Anniston and had 8 previously been my boss at the Krummrich plant. 9 Q Do you recall what his function was at this time 10 at the Anniston plant -- 11 A I think he had plant improvement responsibility. 12 Q -- as well as environmental control? 13 A Yes. I think he was involved in both of those. 14 Q Sir, I want to direct your attention to the 15 executive summary on page 1 and in the second sentence 16 which begins " these projects. " Are you with me? 17 A Yes. 18 Q There's a reference to something known as a 19 " profit improvement program " in 1969. Could you shed some 20 light on what that program might have been? 21 A I don't remember that specific program. 22 Q Did Monsanto from time to time have profit	Page 508 1 A I can recognize several of these categories. I 2 don't remember that there was a storm sewer system, but it 3 could be. I have never been particularly familiar with the 4 sewer maps of the plant. 5 Q How about something known as an " acid sewer, " did 6 the plant have an acid sewer when you were there? 7 A There were acid sewers, yes. As to whether there 8 was a single system called acid sewer, I don't remember. 9 Q And of course since when you were at the plant, 10 they didn't have a Pnp section yet. The sewer would have 11 been known probably only as a Niran sewer. Do you recall 12 if there was a Niran sewer? 13 A Yes. 14 Q And then finally, I'll assume that there was some 15 sanitary sewers? 16 A Of course. 17 Q Sir, I would like to direct your attention to 18 page 7 of the document which bears a Bates stamp number 19 1401857, " solid wastes, " the general category. Are you 20 with me? 21 A Yes. 22 Q Sir, was there some particular meaning back in

Page 509 1 1971 to the phrase " a sanitary landfill " as described in 2 that paragraph? 3 A I think the term here is used to distinguish it 4 from a less carefully operated facility. 5 Q So the steps that are then described after that 6 description would to your mind be steps taken to improve 7 the operation of a landfill such as fencing? 8 A Yes. 9 Q Now, sir, in the second paragraph in this solid 10 waste category, the reference is made to the fact that a 11 cost center had been established for the landfill. What 12 would the ramification of Monsanto establishing a cost 13 center for the landfill have been? 14 A That's an accounting action. Normally when it's 15 decided to establish a cost center, that's done either 16 because the costs involved have become large enough that 17 it's desirable to track the costs more carefully or 18 sometimes it's done because a certain facility is providing 19 services for more than one department and what's needed is 20 a mechanism for allocating that cost between the 21 departments that are served. 22 Q Which do you think would have been the case with	Page 511 1 A We used them as a general contractor, but 2 particularly projects that involved piping. They had some 3 good welders. 4 Q Could that piping have also included sewer lines? 5 A Might have. 6 Q Do you recall a contractor named Bill Hall who 7 was expert in the operation of a backhoe for digging line? 8 A No. 9 Q Sir, I would like to turn your attention to the 10 series of maps that are appended to this document. And 11 specifically, actually figure 1, which bears a Bates stamp 12 number 1401866, are you with me? 13 A Yes. 14 Q Sir, earlier today you were testifying to the 15 fact that the Niran or parathion department had an 16 incinerator, was that correct? 17 A Yes. 18 Q As part of the incinerator, was there a 19 neutralization pit associated with the parathion 20 incinerator? 21 A I think there eventually was. There was not in 22 the original installation of the incinerator because there
Page 510 1 the landfill at Anniston, what purpose? 2 A It was based on the events at the time. It's 3 probably because it had become more expensive than it was 4 before. 5 Q Sir, do you recall when you were at the plant a 6 Monsanto contractor known as either Anniston Concrete or 7 Anniston Paving owned by a Mr. Ed McGuinness having some 8 involvement with the landfill? 9 A No, I recognize that name, Ed McGuinness, as 10 being somebody who lived in the town but I don't recognize 11 those two company names that you mentioned. 12 Q Sir, was any replacement or repair of sewers done 13 during the period that you were working at the Anniston 14 plant? 15 A Well, probably so because I was there for five 16 years, but I don't remember any specific project. 17 Q Well, that was a pretty broad question. Do you 18 recall a company known as Crestview Heating and Plumbing 19 being a Monsanto contractor at the Anniston plant? 20 A Yes, I worked with them on some projects. 21 Q Could you tell me what that work would have 22 involved?	Page 512 1 was no scrubber originally associated with it. 2 Q Why would the scrubber have made a difference? 3 A Because the scrubber used city water which was 4 recycled to some extent, but there was a discharge stream 5 from the scrubber which would have been a fairly dilute 6 acid. 7 Q Which would have required neutralization? 8 A That's right. 9 Q Now, before the scrubber was installed, would the 10 incinerator have had an acidic characteristic to the waste? 11 A Well, it was nonaqueous, so that the term acid is 12 not meaningful. 13 Q I see. So it was when the scrubber added a step 14 whereby a quenching of part of the waste was occurring that 15 the acid became a problem? 16 A That's right. 17 Q Do you recall generally, sir, where the 18 neutralization pit that was added in later years would have 19 been located? And I can probably help you out. 20 A Yes, I think it was uphill to the west. 21 Q If you were to refer, sir, to a figure 3 in this 22 same document, which is a couple pages on, there's actually

Page 513 1 something that's labeled " parathion incinerator scrubber 2 neutralization pit. " Are you with me? 3 A Yes. 4 Q Is that your recollection of where that was 5 located? 6 A Yes. 7 Q Would I be fair in assuming, sir, that the two 8 ovals that are -- I don't have a directional symbol on this 9 figure, but to the left of the incineration scrubber 10 neutralization pit, could that have been Cleghorn's Lake? 11 A Could be. That's not part of the scrubber pit, 12 at any rate. 13 Q Now, sir, was the scrubber neutralization pit 14 accomplishing neutralization using limestone? 15 A Yes. 16 Q Could you provide an estimate of its approximate 17 dimensions? 18 A No. The dotted line here that's labeled as 19 neutralization pit can be compared with those circles near 20 it, which I think are storage tanks, and give some idea how 21 big it is. 22 Q Well, how long --	Page 515 1 pit eventually ending up at the Snow's Creek outfall ; 2 correct? 3 A That's what it shows, yes. 4 Q Now, sir, as part of that flow, is it possible 5 that some traces of Pnp, which was a constituent of 6 parathion, could have ended up in the parathion incinerator 7 neutralization pit? 8 A I think that's pretty improbable. The feed to 9 the incinerator was from steps that were upstream of the 10 point in the process where Pnp is introduced, so it's not 11 evident to me how that could happen. 12 Q So this would have been at the stage where you're 13 still at the intermediate stills and the chlorinators and 14 all that? 15 A That's what I remember. 16 Q Sir, below the parathion incinerator on that 17 figure 1 of this exhibit is something, a little box known 18 as an Aroclor department sump. Are you with me? 19 A Not yet. 20 Q Could I point it out to you, sir? 21 A Yes, please. Okay, yes. 22 Q Do you recall, sir, in the tenure that you were
Page 514 1 A Maybe 30 by 40 feet or something like that. 2 Q So how large would those storage tanks, the 3 circles to the right of the pit, be typically? 4 A I think those were 12 feet in diameter, I'm not 5 sure. Maybe 15. 6 Q All right then, for the record it would look as 7 though the neutralization pit would probably be about 30 8 feet wide then and perhaps -- 9 A Perhaps 50 feet in the other direction, or 60. 10 Q Now, sir, after the neutralization had been 11 accomplished, to your knowledge, where did the liquid then 12 go? 13 A Well, I haven't even thought about this in 30 14 years. This diagram shows that material going to the other 15 side of the plant, and I believe that's correct. 16 Q And the other side of the plant would be 17 sometimes known as the biphenyl limestone pit? 18 A Yes. 19 Q Which is down near the Snow Creek outfall? 20 A Yes. 21 Q And that might be further confirmed if we go back 22 to figure 1 which shows the flow from the neutralization	Page 516 1 in the Aroclor department, the Aroclor department having 2 something known as a sump? 3 A No. No, this diagram is in 1971. I don't recall 4 that when I was there there was such a thing. 5 Q Was P2s5 produced at the plant while you were 6 still there? 7 A No. 8 Q So that was added later? 9 A That's right. 10 Q As well as the Pnp? 11 A That's right. 12 Q So both of those feed stops were brought in from 13 outside the plant to make parathion? 14 A That's right. 15 Q Sir, I wanted to go back to figure 3, which was 16 the map that we saw the parathion incinerator scrubber 17 neutralization pit on. Are you with me? 18 A Yes. 19 Q I believe it was your testimony, sir that the pit 20 that's shown down near the Snow's Creek outfall was known 21 as the biphenyl limestone pit. 22 A Yes, usually.

Page 517 1 Q Now, was there one or were there more than one 2 pit down there? 3 A There was more than one, at least at different 4 times, because we built or replaced the limestone pit at 5 some point or -- whether there was more than one existing 6 at the same time other than as a stage of construction, I 7 don't remember. 8 Q Was the concept of using a limestone pit for the 9 neutralization of acid wastes something that you would 10 regard as generally a practice in the chemical industry? 11 A Yes. 12 Q Was there any kind of literature on the design 13 basis for these limestone pits in this era in the late 14 1950s? 15 A I'm not familiar with such literature. It would 16 be reasonable to expect that there was such literature but 17 I'm not familiar with it. 18 Q Would it make sense that someone would have been 19 doing some testing to see how much limestone you needed as 20 a contact surface to neutralize so much volume of waste? 21 A Yes, but that might not be a matter that could be 22 covered in a general way because each waste tends to be	Page 519 1 recollection is that the reason for that usually was some 2 mechanical failure in the muriatic acid department so that 3 it wasn't able to take the gas. 4 Q So you don't recall any customer demand 5 considerations factoring into that decision? 6 A I don't remember that. It could have been but I 7 don't remember that. 8 Q Do you recall a grade of muriatic acid known as 9 Staley grade? 10 A Yes. 11 Q Could you describe for me what you know of Staley 12 grade? 13 A It's my recollection that that was a high quality 14 grade. 15 Q What would high quality mean? 16 A I don't remember. There was a particular 17 specification for that grade. 18 Q What would it mean that it was extra potent, as 19 in more than 20 percent Hcl? 20 A I don't remember that. We did occasionally make 21 different strengths of acid, but our muriatic acid absorber 22 was rather difficult to operate, particularly if we
Page 518 1 somewhat unique in all the components that are present, and 2 while Hcl is very easy to neutralize with limestone, the 3 active parts of limestone being calcium carbonate and 4 magnesium carbonate, other kinds of acids don't react as 5 quickly with those materials, and therefore, a correct 6 design to some extent would have to be premised on the 7 composition of a specific feed. 8 Q Now, sir, it's true, is it not, that the biphenyl 9 limestone pit received muriatic acid from the Hcl 10 department. 11 A Yes. 12 Q And it's true, is it not, that the practice 13 sometimes at Monsanto in the Anniston plant was to divert 14 the quenched Hcl off-gas from the Aroclor production down 15 something known as a ditch directly to the limestone pit? 16 A That's right. 17 Q And that sometimes when the Hcl or muriatic acid 18 department didn't have any particular customers, the 19 practice would be, since they couldn't use any more 20 off-gas, it would all be simply sent down to the limestone 21 pit? 22 A Sometimes it was sent to the limestone pit. My	Page 520 1 attempted to make stronger grades of acid. So my 2 experience as a supervisor was to avoid making a stronger 3 grade of acid if I could avoid it. 4 Q Now, would that have been the coke scrubber that 5 was supposed to remove any entrained organics from the Hcl 6 off-gas? 7 A There was something called a coke scrubber 8 upstream of the absorber. It's my recollection that it was 9 always used, but I'm not sure of that. 10 Q Was it 100 percent successful in this period? 11 A I don't know. 12 Q Could Staley grade have also referred to a 13 customer not wanting any quantity or appreciable quantity 14 of organics in the muriatic acid? 15 A That might have been but I don't remember what 16 that specification was. 17 Q Now, sir, I believe earlier today you mentioned 18 that Hcl was also going to the limestone bed that was 19 associated with the Niran department. 20 A Yes. 21 Q Now, that would be Hcl as an off-gas coming from 22 the chlorination that was occurring in Niran?

Page 521 1 A That's right. 2 Q Was the Niran department at all connected with 3 the muriatic acid department? 4 A No. 5 Q Did it in the normal course of events produce an 6 appreciable quantity in relation to the Aroclor department 7 of this Hcl off-gas? 8 A The Hcl produced in the Niran plant was less and, 9 substantially less than the amount produced in Aroclor but 10 probably within the same order of magnitude. 11 Q All right. So just so I understand, it's my 12 understanding that at a certain period of time, the Aroclor 13 department had eight chlorinators. Would that have been 14 true when you were there? 15 A Yes, I think so. 16 Q And I believe your testimony earlier today was 17 that the Niran department started out with two and then 18 went to three chlorinators ; is that correct? 19 A That's right. 20 Q So would the relationship of Hcl off-gas being 21 produced in Niran have borne the relationship that the 22 number of chlorinators, which is to say, three to eight,	Page 523 1 more like a quart, or maybe more. But it's a fairly 2 arbitrary package that contains 76 pounds. 3 Q Do you recall approximately what the price was 4 back when you were the production supervisor in the 5 chlorine plant? 6 A It was on the order of \$4 - to 600 a flask. 7 Q Do you recall, sir, as an item of expense when 8 you were the production supervisor in chlorine 9 approximately how many flasks you might have used in, say, 10 a month? 11 A In order of magnitude, five or 10, I don't 12 remember exactly. 13 Q Now, as the operation of the Denora cells 14 occurred, was something known as a mercury butter or 15 amalgam created? 16 A Yes, sometimes. 17 Q Could you describe for me what the butter or 18 amalgam consisted of? 19 A The butter, as the name implies, was a semisolid 20 amalgam. My understanding is that it contains calcium as 21 well as mercury. Possibly some other metals. 22 Q Was any effort made in this period when you were
Page 522 1 would have borne? 2 A No, I think that's irrelevant because the 3 chlorinators in Aroclor were much smaller pieces of 4 equipment. And anyway, the flow rates were related to many 5 engineering factors. The number of chlorinators was a 6 minor point. 7 Q To your knowledge, sir, why wasn't an effort made 8 to mix the Hcl off-gas coming from the parathion department 9 with water and convert that also into muriatic acid? 10 A It probably wasn't deemed to be worth the 11 trouble. Muriatic acid sold for a very low price. 12 Q Did you have any operating experience, sir, with 13 the chlorine department? 14 A Yes, I was the production supervisor for two 15 years. 16 Q During that period of time, sir, did you keep 17 track of mercury usage in the department? 18 A Yes. 19 Q And it's my understanding that a pint of mercury 20 weighed about 70 pounds? 21 A Well, it wasn't a pint. There was -- the unit of 22 commerce for mercury is called a flask. It, I think it's	Page 524 1 the supervisor to recover the mercury from the butter? 2 A We certainly considered it and studied it, and we 3 had some, we made some kind of primitive attempts to 4 collect mercury from the butter. I don't remember that 5 that was particularly effective. During my time, I 6 advocated the installation of a small still to recover 7 mercury. I don't remember if that was ever done. 8 Q What, sir, to your knowledge was done with the 9 amalgam or the butter as it was accumulating? 10 A I don't remember. 11 Q Where would it accumulate at the end of the 12 Denora cells? 13 A It accumulated in two places. One was a place 14 called the outlet end box. 15 Q Excuse me? 16 A The outlet end box, which was a compartment at 17 the outlet end of the cell, and the other place that it 18 sometimes accumulated was in the mercury pump tank, which 19 was below the cells. The butter would be found floating on 20 the surface of the mercury. It was heavy but not as heavy 21 as mercury. 22 Q So would someone have had the duty, then, to skim

Page 525 1 the butter off from time to time? 2 A Yes. 3 Q Do you recall what was done with the butter that 4 was skimmed off? 5 A No, I don't. I think we had some place where we 6 accumulated it because often it was -- just spontaneously a 7 mercury layer would be formed at the bottom of the butter 8 and could be recovered. We did some other things to try to 9 encourage that but I don't remember what it was. 10 Q So to your knowledge it was not sent to the 11 landfill? 12 A I don't remember doing that. 13 Q Sir, when you were production supervisor, for 14 instance, in Aroclor, could you describe for me the role 15 the shipping department had in retrieving wastes from an 16 operating department? 17 A My recollection is that they would bring in 18 something called a skip, which was a little like a dumpster 19 on chains on the back of a truck. The operators would 20 drain still residue into the skip and the shipping 21 department would take it away. 22 Q And that was in Aroclor?	Page 527 1 Q Would this have been pure sulfur? 2 A The sulfur that formed in the incinerator and was 3 a pluggage problem, in my opinion, was probably pure 4 sulfur. The sulfur that formed in the chlorination 5 reaction would have been mixed up with a lot of other stuff 6 and certainly would not have been described as pure. 7 Q To your knowledge, sir, in 1971 did the Anniston 8 plant still have this incinerator? 9 A I think it did but I had nothing to do with it at 10 that time. But the only basis for my opinion of that was 11 visiting the Anniston plant in those days relative to 12 responsibilities on the so-called biphenyl side, and I 13 could see in the distance some of that equipment was still 14 there. 15 Q So it would be your testimony that appreciable 16 quantities of sulfur would not have been sent to a 17 landfill? 18 A Not from any operation that I'm familiar with. 19 Q Well, sir, I wanted to go back to the design 20 basis for the limestone pits. If an aqueous flow was going 21 through a limestone pit that had suspended particles in it, 22 would the suspended particles eventually have accumulated
Page 526 1 A That's what I remember. 2 Q Now, when you were -- were you a supervisor for 3 production in Niran at all? 4 A No. 5 Q At the time that you were at the Anniston plant, 6 would the Niran plant have produced any appreciable 7 quantities of solid sulfur waste? 8 A The chlorination reaction to a great intermediate 9 called ethyl Pct or methyl Pct made sulfur as a 10 by-product. There was something on the order of 2000 11 pounds of sulfur made in every batch and that was 12 present -- that wound up in the still residue after 13 distilling off the Pct, and so that sulfur would be in the 14 form of small flakes or semiliquid gobs dispersed in the 15 still residue which was sent to the incinerator. 16 There was one other intermittent source of solid 17 sulfur. In the event of improper operation of the 18 incinerator, some solid sulfur would form and tend to plug 19 up the scrubber and the demister. And that would 20 eventually be rinsed out of the system. 21 Q So -- 22 A That was a small amount and occasional.	Page 528 1 on top of the limestone? 2 A Possibly. You mean if there's suspended 3 particles in the waste being fed to the limestone? 4 Q Correct. 5 A Depending on velocities and a lot of other 6 things, that's one of the things that might have happened, 7 is it would be found on the top of the limestone. 8 Q Now, sir, did you ever actually see, let's start 9 out with the biphenyl limestone pit, did you ever actually 10 see it in operation when a charge of aqueous flow was going 11 through it? 12 A Well, aqueous flow was always going through it. 13 Q Could you estimate its depth in the limestone 14 pit, the flow of the aqueous substance? 15 A No, I don't remember. 16 Q Now, if a flow was always going through the 17 limestone pit, would the limestone have remained impervious 18 to any channelization forces that the aqueous flow might 19 have put upon it? 20 A I don't know. 21 Q Is limestone an impervious type of substance? 22 A This was crushed limestone, and simply as a

Page 529 1 matter of random dumping of irregular particles, one 2 normally expects that the flow tended to distribute itself 3 reasonably uniformly. It's really a fairly complicated 4 subject. 5 Q But it would have been studied when the decision 6 was made as to what kind of limestone to put in? 7 Mr. Burnett: Objection. Lack of foundation. 8 You can give an answer if you can. 9 The Witness: I really don't know. There are 10 commercial grades of crushed limestone. I don't know that 11 there was any technical study as to which particle size to 12 purchase. 13 By Mr. Meyer: 14 Q Well, sir, do you recall if limestone that might 15 have been -- again, we're still on the biphenyl limestone 16 pit -- that might have been placed there, would that have 17 been good for a year? 18 A I don't think so. 19 Q Do you recall whether or not there was an ongoing 20 maintenance program that required the excavation and 21 replacement of limestone in the biphenyl limestone pit? 22 A The limestone was consumed by the acidity in the	Page 531 1 that was responsible? 2 A It might have been. 3 Q But you don't know? 4 A The only alternatives was the maintenance 5 department or the shipping department, I should think. 6 Q Sir, going back to the shipping department, in 7 Aroclor, I believe you said that from time to time they 8 would come by and pick up skiffs? 9 A Yes. 10 Q Did they also from time to time pick up barrels? 11 A Yes, I think so. 12 Q Could you describe for me what might have been in 13 those barrels? 14 A That would have also been Montars. 15 Q Might those barrels have been known as Carbide 16 barrels in reference to a product that at one time had been 17 shipped from the Anniston plant known as Carbide, which was 18 of a specific gauge of steel? 19 A I don't remember that but that could have been 20 some old nomenclature. 21 Q Sir, do you recall whether or not the Aroclor 22 department had a filtration process in the stills or after
Page 530 1 waste and what I recollect was that this would depend on -- 2 well, entirely on how much acid there was in the waste 3 because each unit of acid would dissolve a certain amount 4 of limestone and you could see that the limestone would 5 slump downward and particularly right near the entrance as 6 the limestone was consumed, and as that progressed, 7 additional loads of limestone would be brought in and 8 dumped on top. 9 Q But to your knowledge, a whole charge of 10 limestone and -- for instance, the biphenyl limestone pit 11 was not excavated all at once and replaced with a whole new 12 one. 13 A That was done from time to time. 14 Q Could you provide an estimate of how often from 15 time to time might have been? 16 A I don't know how often that was done. 17 Q Who would have been responsible within the plant 18 for managing that? 19 A I don't know. I don't think it was the 20 production supervisor because I didn't do it at the time 21 that I was a supervisor. 22 Q Could it have been the maintenance department	Page 532 1 the stills? 2 A Yes, it did. 3 Q And was that for solid or liquid Aroclor? 4 A Liquid. 5 Q And to your knowledge, what was done with the 6 filtration paper after it had accomplished its purpose and 7 was spent? 8 A It was placed in some kind of container and 9 hauled off. 10 Q Finally, sir, do you recall whether or not the 11 Aroclor department used lime in distilling? 12 A Yes. 13 Q Could you tell me what the function of the lime 14 was? 15 A The lime was added to the still pot at the 16 beginning, I believe at the beginning of every batch. The 17 lime was used as a chloride scavenger because it was fairly 18 well known that any ionizable impurity in the final product 19 would hurt the electrical properties of the fluid. So it 20 was a necessary step to getting good quality. 21 Q So that would have been for electrical grade 22 Aroclor?

Page 533 1 A It was done for all liquid Aroclor because we 2 didn't discriminate at the time of production as to whether 3 the final product would be sold as electrical grade or some 4 other grade. 5 Q Oh, so it all had to meet the electrical grade 6 spec? 7 A We attempted to make everything reach the 8 electrical grade spec so we didn't have to keep track of 9 inventory. 10 Q I understand. Sir, what happened to the lime, 11 was it consumed in the distillation process? 12 A Trivial amount would be consumed. Most of it 13 would wind up in the Montar. 14 Q And then finally, sir, was one or the other of 15 the Aroclors filtered through something known as Fuller's 16 or attapulugus earth? 17 A Those are the same filters that you asked about 18 before. There was a step called clay treatment after 19 distillation where diatomaceous earth was mixed with the 20 Aroclor, and that was then filtered through filter paper, 21 and this was a platen frame filter press where pieces of 22 paper are placed over frames and the clay would accumulate	Page 535 1 please. 2 (Witness reviewed the document.) 3 A Okay. 4 Q Sir, this, again, is a 1971 document and my 5 reading of that paragraph would seem to indicate that at 6 this point in time wastes going from the muriatic acid 7 department for neutralization could have gone to one of two 8 pits. Is that a fair reading of the document, sir? 9 A Yes. 10 Q Now, sir, there seems to be some suggestion in 11 here that switching between the two pits was done in order 12 to reduce the amount of Pcb's that would have otherwise 13 flowed through the pits and out into the outfall. And I'm 14 wondering, sir, if you recall discussions that culminated 15 in that operation decision. 16 A No, I read this paragraph the same way but I 17 don't recall it. 18 Q I suppose, then, you don't remember your memo 19 dated September 15, 1971. 20 A No, I don't. 21 Q Why not? 22 A Because it's a long time ago.
Page 534 1 in the spaces between the paper, and when the filtration 2 was finished, some kind of gas -- nitrogen, I think -- was 3 used to blow the free liquid out of the filter, and then 4 the press would be opened and the paper and the clay 5 dropped into some kind of container. 6 Q And by clay, you're referring to diatomaceous 7 earth? 8 A Yes. 9 Q Also possibly known as Fuller's earth? 10 A It's sometimes called that. I don't know that we 11 called it that at the Anniston plant. 12 Q Also known sometimes as attapulugus earth? 13 A Yes, most of it comes from a town in Georgia. 14 Q Called Attapulugus? 15 A Yes, there's a company there that uses that as 16 its trade name. 17 Q Sir, I wanted to go back to the exhibit and I 18 wanted to direct your attention to page 8 of the text, 19 which has a Bates stamp number of 858. Are you with me, 20 sir? 21 A Not yet. Okay. 22 Q Could you take a few moments to study that,	Page 536 1 Q I understand. 2 A As I mentioned earlier, this was an extremely 3 busy time and it was necessary to delegate things and not 4 get involved in anything that I didn't have to get involved 5 in. 6 Q Well, sir, would the flow that was coming from 7 the muriatic acid department, would it have had solids in 8 the liquid, entrained in the liquid -- I guess it wouldn't 9 be entrained, but in the liquid itself? 10 A Not likely. 11 Q So you don't recall, sir, how the number one 12 biphenyl limestone pit was rebuilt in 1970 in order to 13 conform to some plan of settling out solids? 14 A My opinion that these solids, the term " solids " 15 in this context refers to solids that actually originated 16 in the limestone pit. Limestone is not a pure material and 17 it contains some materials such as silica that are not 18 reactive, and therefore when limestone is consumed by 19 reaction with acid, there is something left which would be 20 finely divided solids. It's my opinion that this is the 21 solids that that refers to. 22 Q So it's possible that Pcts or Pcb's would have

Page 537 1 become somewhat fixed or associated with those solids? 2 A It's possible. 3 Q Do you recall if Anniston plant personnel, and 4 perhaps more specifically Mr. Gene Coley, did testing of 5 Snow Creek to see if they could find globules of Aroclor in 6 the water? 7 A He may have but I don't know that he did. 8 Q Now, sir, I believe you had mentioned that 9 several of the items we were mentioning in the Aroclor 10 department were being hauled off. Do you recall where they 11 were being hauled off to? 12 A No. 13 Q But to your recollection it was a shipping 14 department that was doing the hauling? 15 A Yes. 16 Q Do you recall who the supervisor of the shipping 17 department was? 18 A There was a gentleman called Pap Gray, H. L. Gray, 19 who was in charge of shipping, and then there were one or 20 two foremen that reported to him. I don't remember their 21 names. 22 Q Sir, could you describe for me how the biological	Page 539 1 The secondary settler, solids would settle out, 2 and in this particular plant as I recall it, all of the 3 solid was pumped back to the aeration basin because the 4 solids represented the carrier for biological organisms 5 that actually carried out treatment. Under a microscope, 6 you could examine the sludge and see that particularly when 7 treatment was going very well, a variety of different small 8 living organisms, and those organisms somehow consumed the 9 various organic materials present and metabolize them. 10 Q Including Pnp? 11 A Yes, Pnp was a very sensitive indicator since it 12 just takes a couple of parts per million of Pnp to be 13 visible as a yellow color and waste. We could tell very 14 well when the treatment plant was working well because the 15 feed would be bright yellow or perhaps so yellow it would 16 look brown, and the effluent would be substantially 17 clearer. 18 Q Sir, I believe you testified earlier this morning 19 that you recalled a letter that was sent to the editor of 20 the Anniston newspaper that amused you because someone was 21 commenting that her husband was able to fish in Snow 22 Creek.
Page 538 1 treatment facility at Anniston as it was designed back when 2 you were there would have turned Pnp from, I guess, a toxic 3 substance into something relatively benign? 4 A Well, it was a biological treatment. The main 5 components of the process were the aeration basins and, as 6 I recall, one secondary settler, although there may have 7 been more than one. It was called secondary because in a 8 large municipal treatment plant handling domestic waste, 9 there's also a primary settler that goes upstream. We 10 didn't have one of those. We had only the secondary 11 settler. 12 Waste would, after possibly some pretreatment 13 such as ph adjustment, go into -- be fed to the aeration 14 basins through weirs along the side that would distribute 15 the waste uniformly. The aeration basins, as the term 16 implies, had air spargers arrayed across the bottom of the 17 basins, and a large quantity of air was pumped through so 18 that the basins were vigorously agitated by the air bubbles 19 and -- could be seen, the liquid could be seen to be 20 rolling over in the basins and full of air bubbles. The 21 liquid would overflow another weir at the end of the basin 22 and go into the secondary settler.	Page 540 1 A It was her father or grandfather as I recall. 2 Mr. Burnett: Grandfather. 3 By Mr. Meyer: 4 Q And I believe it was your testimony that Snow 5 Creek would not have existed but for the Monsanto plant. 6 A It appeared to me to be an intermittent creek 7 because in dry weather, upstream of the Monsanto outfall 8 there would be no flow. 9 Q Sir, I'd like to direct your attention to the 10 exhibit that we saw earlier this morning that related to 11 Monsanto's description of what it seeks with respect to the 12 Anniston plant. I'm not sure I have the number. It's 13 got -- 14 Mr. Burnett: 108. 15 Mr. Meyer: 108. Thank you very much. 16 By Mr. Meyer: 17 Q And sir, I wanted to direct your attention to the 18 second page under the category li, " Snow Creek. " Are you 19 with me? 20 A Yes. 21 Q There's a discussion there that not only were 22 Aroclor Pcb's found in sediments of Snow Creek but also a

Page 541 1 related drainage ditch downstream of the Monsanto plant. 2 Could you shed some light on the distinction between Snow 3 Creek and the related drainage ditch that's described 4 there? 5 A No, I don't know what it refers to. 6 Mr. Meyer: I'd like to have marked and 7 introduced as our next numbered exhibits sequentially, 8 first a Monsanto memorandum dated January 9, I believe 1959 9 from a Mr. Boucher to a Mr. Green. 10 The Witness: Could I take a coffee break? 11 Mr. Meyer: I'm sorry. Absolutely, yes. 12 (Recess.) 13 Mr. Meyer: I'd like to have introduced as our 14 next numbered exhibit, 115, a Monsanto memorandum dated 15 January 9, 1959 from a Mr. Boucher to a Mr. Green, and its 16 general subject matter is disposal of Aroclor still residue 17 bottoms. 18 (Savage Exhibit 115 identified.) 19 Mr. Meyer: Followed by a Monsanto memorandum 20 dated February 11, 1959 from a Mr. Boucher to a Mr. Pohl, 21 P-o-h-l, and its subject matter is " Meeting to discuss 22 overall plan for Aroclor department. "	Page 543 1 handwritten notes bearing a date Thursday November 14, 2 1963. It was produced to us out of the headquarters of 3 Monsanto, so we know somehow or another it's not a Monsanto 4 document, but it does not show, at least on its face, an 5 author or the circumstances that led to its creation. 6 (Savage Exhibit 120 identified.) 7 By Mr. Meyer: 8 Q Mr. Savage, I would like for you to take a few 9 moments to study this welter and profusion of documents 10 that I've thrown at you and when you're ready, let me 11 know. 12 (Witness reviewed the document.) 13 Yes, I was going to direct your attention, sir, 14 on the longer handwritten one. The page I'm most 15 interested in is the third page starting with " ventilation 16 and residue handling. " 17 A Okay. 18 Q Have you had a chance to review these various 19 exhibits, sir? 20 A Yes. 21 Q Sir, could you tell me who Mr. Boucher was at the 22 Anniston plant?
Page 542 1 (Savage Exhibit 116 identified.) 2 Mr. Meyer: Followed by number 117, which is a 3 Monsanto memorandum out of Anniston dated July 19, 1962 to 4 a Mr. V. R. Haupt, H-a-u-p-t, from a Mr. W. L. Smull and its 5 general subject matter is " Aroclor disposal of still 6 residues. " 7 (Savage Exhibit 117 identified.) 8 Mr. Meyer: For the record, the copy quality on 9 117 is not very good. 10 Mr. Burnett: 115 is not that great either. 11 Mr. Meyer: Wait until you see 117. 12 Followed by 118, which is a December 14, 1962 13 Monsanto memorandum from a Burns O. Severson to an 14 H. L. Gray relating, again, to the disposal of liquid-solid 15 Aroclor trappings. 16 (Savage Exhibit 118 identified.) 17 Mr. Meyer: Followed by Exhibit 119 dated January 18 4, 1963, Monsanto memorandum out of Anniston from a 19 Mr. E. W. Schramm to Burns O. Severson. Again, the subject 20 matter, " disposal of liquid-solid Aroclor trappings. " 21 (Savage Exhibit 119 identified.) 22 Mr. Meyer: And finally 120, which is a series of	Page 544 1 A Ken Boucher was an engineer in the Anniston 2 technical service department. 3 Q So when you joined the plant, he would have been 4 in the same department as you? 5 A When I joined the plant, he was not there yet. 6 He came a year or two after me. He transferred from the 7 Queeny plant. 8 Q Do you recall, sir, who Mr. R. J. Green, the 9 recipient of Exhibit 115, is? 10 A No, I don't recognize that name. 11 Q Sir, I would like to direct your attention to 12 Exhibit 116. Are you with me? 13 A Yes. 14 Q And specifically the discussion in subparagraph 15 A, " disposal of still residue "? 16 A Yes. 17 Q I was wondering, sir, if in 1959 you recall 18 whether or not the disposal of still residue in the Aroclor 19 department took up, as the author describes it, much of the 20 available material handling space in the department? 21 A No, 1959, I didn't have anything to do with this 22 area of the plant.

Page 545 1 Q So you never visited it at that point? 2 A I'm sure I visited it, but I don't recall 3 anything specific about that period of time. 4 Q Well let's move on then, sir to Exhibit 118, 5 which I believe you are shown as having received a copy of, 6 and it's dated 1962. 7 A Yes. 8 Q Now, could you shed some light, sir, on what 9 Aroclor liquid-solid trappings means? 10 A The term is familiar to me but I can't place 11 where such material arose in the process. 12 Q Would that have been another name for the still 13 bottoms? 14 A No. 15 Q Could the trappings have been something that was 16 being collected? 17 A Well, the term implies that, and if you'll see in 18 the second paragraph, it's described as a flammable 19 biphenyl material. The implication there is that it arose 20 fairly early in the process, perhaps in the off-gas and 21 from the chlorinators. But I'm constructing that from this 22 sentence, not from recollection.	Page 547 1 some extent the same work force and overlapping in a lot of 2 ways, and so we had reached an agreement on what things he 3 would look after and what things I would look after. So in 4 some ways, I was not doing all of the things that a 5 production supervisor might do in that part of the plant. 6 Q Well, would that have included not keeping track 7 of costs? 8 A It would certainly have included keeping track of 9 costs, but a few scrap drums would not have been a very big 10 item. 11 Q So you don't recall, sir, in your production work 12 in Aroclor, seeing collected pallets containing drums that 13 from time to time were retrieved by the shipping 14 department, loaded onto a truck with a fork load -- 15 forklift, excuse me? 16 A Oh, I can remember the image that you're 17 picturing, yes. 18 Q Could you describe that for me. How often, did 19 that occur once a day? 20 A I don't know. It would have been a fairly 21 routine thing. 22 Q Where would the drums have been stored pending
Page 546 1 Q So you don't recall, sir, whether or not in this 2 period of time the Aroclor department needed approximately 3 60 to 80 drums to collect these liquids? 4 A No, I don't remember that. 5 Q What position, again, would you have held in 1962 6 at the plant? 7 A I was the production supervisor at that time. 8 Q For Aroclor biphenyl? 9 A Well, I had become chlorine supervisor in, I 10 think 1961, and at some point the liquid Aroclor, solid 11 Aroclor, Hb-40 area was added to my responsibility. Prior 12 to that time Burns Severson had responsibility for the 13 entire biphenyl Aroclor area, and at some point his 14 responsibility was divided in two and part of it added to 15 mine. But I don't know for sure whether that had already 16 occurred on the date of this memo or not. The fact that 17 I'm copied on the memo suggests that it had. 18 Q Well, as the supervisor, sir, would you have been 19 responsible for keeping track of expense items within the 20 department? 21 A As a general rule, yes, but Burns and I had a 22 somewhat awkward situation where we were supervising to	Page 548 1 their pickup by the shipping department? 2 A I don't know. 3 Q Was there a platform at ground level outside of 4 the Aroclor department building? 5 A I don't remember. 6 Q To your knowledge, sir, would most of the drums 7 that you just visualized, would they have been labeled in 8 any way? 9 A I don't know. 10 Q Would any effort have been made to put tops on 11 the barrels? 12 A I don't know. 13 Q Who within the department would have been 14 responsible for monitoring the flow of such barrels and 15 asking for shipping to get them? 16 A One of the foremen. 17 Q So they would have communicated directly with the 18 shipping department? 19 A Yes. 20 Q Now, sir, in the summary of this memorandum, 21 Exhibit 118, there is the reference that the liquid-solid 22 trappings, whatever they were, that were being put into

Page 549 1 these used drums were, quote, going to be thrown " into the 2 dump. " Could you shed some light, sir, on what the author 3 might have meant by a dump? 4 A In general terms, that would refer to a rather 5 casual version of what we would now call landfill. 6 Q Now, earlier this morning you testified to two 7 landfills at the plant. One was on a site which we later 8 on pinned down to be Cleghorn's Lake and the other one was 9 across Alabama Highway 202. Could you identify which dump 10 you think the author intended in this particular 11 memorandum? 12 A No, I have no idea. 13 Q Let me ask you, do you ever recall seeing drums 14 in Cleghorn's Lake? 15 A I don't remember. I don't remember that there 16 weren't. I just don't remember. 17 Q I understand. Well it's been about 30 years. 18 Let me ask you, sir, in your visits to the area across the 19 road where you believed at one time maybe dumping 20 operations occurred and you did some shooting, do you 21 recall that area having an incinerator to burn trash? 22 A I didn't see it.	Page 551 1 shed some light on the quantities that are shown under 2 subparagraph 4, ventilation and residue handling. What 3 does 180,000 pound symbol/year mean, to your knowledge? 4 A It implies that that's how much was sold in that 5 form, 180,000 pounds per year. 6 Q So the pounds symbol means pounds? 7 A Yes. 8 Q Now, over to the right -- and the author has 9 collected those three subcategories of residue together -- 10 there is the phrase " one half to one " and then capital 11 letter with a bar over it M and then, again, the pound 12 symbol and again, slash, year. Could you shed some light 13 on what Monsanto meant by a capital M with a bar over it? 14 A The nomenclature has changed since that time, but 15 at that time, the M with the bar over it referred to 16 million. So this would be one half to 1 million pounds per 17 year. 18 Q And what is the nomenclature today? 19 A Today, we would use a simple capital M for 20 million and a K for thousand. In these days, we used an M 21 without the bar for thousand and with the bar for million. 22 Q Sir, below that there is a description of a
Page 550 1 Q How often, sir, would you say during your tenure 2 at Anniston did you visit that facility across the road? 3 A I think it was just during the first year or two 4 that I was there, and perhaps five times. 5 Q And the purpose, again, for all those visits was 6 related to shooting? 7 A Yes. 8 Q So -- 9 A It was not authorized. 10 Q I see. 11 A I just did it. 12 Q Well, we won't tell anyone and I guess you're 13 retired now so it doesn't matter. So none of your job 14 duties would have taken you up to that area? 15 A No. 16 Q Sir, I wanted to turn your attention to the 17 Exhibit Number 120, the handwritten one, and to 18 specifically that page number 3. 19 A Yes. 20 Q Now, again, we suffer under the disability that 21 we don't know who authored this or what the purpose of its 22 preparation was, but I was wondering, sir, if you could	Page 552 1 disposal method which I assumed relates to the distillers 2 in the Aroclor department. Would I be correct in that 3 assumption? 4 A Yes. 5 Q So do you recall, sir, a procedure whereby at the 6 end of a distillation run in the Aroclor department a drum 7 was placed under a ventilating hood and something known as 8 a drain valve was opened up? 9 A This doesn't fit with my recollection for this 10 particular time. This is late 1963, which would be -- have 11 been sometime around the end of my tenure at Anniston. 12 Probably a bit after I left. It was my recollection at 13 this time that we were using the skip method that I 14 mentioned earlier rather than using drums. 15 Q And that, again, was for the bottoms or still 16 residue? 17 A Yes. I believe I left Anniston in September ' 63. 18 Q Sir, I wanted to direct your attention again to 19 Exhibit 116. It's in that mass that I gave you all at 20 once. It's the February 11, 1959 memo to Mr. Pohl. 21 A 116 did you say? 22 Q Yes, sir. Do you have it?

Page 553 1 A Yes. 2 Q Sir, in the paragraph B, there's a discussion of 3 how apparently in 1959 solid Aroclors were poured into 4 drums and allowed to solidify, and then later on, it was 5 necessary to break up the Aroclor with a sledgehammer. 6 When you became associated with Aroclor production, is that 7 your recollection of how certain solid Aroclors were 8 retrieved and made useful? 9 A I remember the sledgehammer operation, but at 10 some point we installed a flaker which was intended to 11 eliminate that primitive kind of operation. Whether it had 12 been completely eliminated at the time that I was 13 production supervisor, I don't recall. I believe that it 14 had been eliminated when I was production supervisor but 15 I'm not sure. 16 Q Well, now, sir, what would the distinction have 17 been between liquid and solid Aroclor that made one solid 18 and the other one stay liquid? 19 A Two different distinctions. As a convention, any 20 Aroclor derived from biphenyl was part of the liquid 21 Aroclor line and any Aroclor derived from terphenyl 22 Santowax was considered to be part of the liquid Aroclor	Page 555 1 Q Now, I'm envisioning people getting big steel 2 drums and just banging them with sledgehammers. Is that an 3 accurate envisioning? 4 A It's close. 5 Q Now did -- 6 A My recollection is that they were drums that had 7 been split lengthwise and it was a matter of really of 8 casting material, pouring liquid material in there to cast 9 a chunk, then this wet drum would be turned upside down and 10 hit with a hammer to cause the material to drop out, and 11 then the drum would be taken away and the block of Aroclor 12 beaten to pieces with a hammer. 13 Q Now, to your knowledge, sir, was that splitting 14 and sledgehammer operation ever done with any of the 15 Montars? 16 A I don't recall it. It could have been. 17 Q Sir, were you familiar in this period of time 18 with whether or not Monsanto had a standard for worker 19 exposure to Aroclor in the ambient air of 1 milligram per 20 cubic meter of air? 21 A I don't remember that. 22 Q Do you recall any ambient air standard for worker
Page 554 1 line. But as a matter of -- 2 Q Excuse me, that was two liquids? 3 A Excuse me, a solid liquid -- solid Aroclor line. 4 Q The one associated with Santowax was solid? 5 A That's right. That was a conventional 6 nomenclature, but on the other hand, if biphenyl is 7 chlorinated sufficiently, it becomes physically a solid. 8 For instance Aroclor 1268 was nominally part of the liquid 9 Aroclor line but in fact it was a crystalline solid. 10 Q So would it be your testimony, in addition to the 11 feedstock Santowax versus biphenyl, in addition, the 12 quantity of chlorination would also determine whether or 13 not the end Aroclor product would be a liquid or a solid? 14 A That's right. 15 Q Since you mentioned 1268 in Exhibit 116, that is 16 one of the solid Aroclors that would have been produced 17 from biphenyl but chlorinated to 68 percent? 18 A That's right. 19 Q And that was a solid Aroclor which was going 20 through this sledgehammer process? 21 A Originally, yes. It was a very high-melting 22 solid.	Page 556 1 exposure to Aroclor fumes? 2 A I don't remember a quantitative measure. 3 Q Do you remember any measure? 4 A No. As in any operation, there was an intention, 5 at least, to avoid exposure to fumes just as a general 6 precaution, but I don't recall a quantitative standard at 7 that time. 8 Q Who would have been responsible for setting such 9 a standard, if one existed? 10 A The medical department in St. Louis that handled 11 toxicology work. 12 Q Are you familiar with what function the Kettering 13 Lab in Cincinnati might have performed from time to time 14 for Monsanto? 15 A No, I don't remember it. We employed a number of 16 outside laboratories. 17 Q Sir, during your tenure in the chlorine 18 department, do you recall any effort made to monitor 19 mercury levels in the ambient air? 20 A No, I don't remember that. Let me correct that. 21 I remember very vaguely some work with sampling tubes but I 22 don't remember exactly what we were doing.

Page 557 1 Q Do you think maybe these sampling tubes would 2 have in some way been measuring mercury concentrations? 3 A Yes, I remember it in connection with mercury, 4 but I don't remember whether it was part of some general 5 program or a spot sample or what it was. 6 Q Sir, in later years, if Monsanto had been 7 sampling Snow Creek -- and specifically Mr. Coley -- for 8 mercury concentrations, would there have been any 9 department other than the chlorine department that could 10 have been the source of any alleged mercury in Snow Creek? 11 A Not that I know of. 12 Q Could you shed some light on how you think maybe 13 mercury might have gotten to Snow Creek from the chlorine 14 department? 15 A The plausible path would be the overflow water 16 from the alkaline boxes. 17 Q And those were the alkaline boxes that we saw 18 that went from the muriatic acid department down to the 19 limestone bed? 20 A They entered that same sewer system, yes. 21 Q So the chlorine department had a sewer system 22 that itself eventually connected to the muriatic acid	Page 559 1 used for that purpose. They were called Therminol Fr, and 2 for instance, Therminol Fr1, Fr standard for fire 3 resistant. Fr1 was, in fact, identical to Aroclor 1242, 4 and Fr2 was a higher grade of Aroclor. There was also an 5 Fr3. I don't remember exactly how those corresponded to 6 the number systems. But during the time that I was 7 supervisor of the Aroclor department, as I recall it, we 8 were shipping Therminol fluids, which in fact were Aroclors 9 with the designations of Fr1, Fr2 and so forth. Then later 10 on when we decided to end the sale of Pcb's as heat transfer 11 fluids, the Fr series disappeared but the Therminol product 12 line continued. 13 But even earlier than that, at the time that we 14 were selling products called Fr1 and Fr2 and so forth, we 15 were also selling something called Therminol 66 which was 16 relabeled Hb-40. It was a -- it was not a fire resistant 17 fluid but was a very good heat transfer fluid and still 18 sold for that purpose, and I think with the same name. 19 Q Sir, during that period of time when you were in 20 the Aroclor department and materials were being sold as, I 21 believe it was Fr1 and Fr2, did Monsanto have a policy 22 whereby customers of those products were allowed to return
Page 558 1 department sewer system? 2 A My recollection is that that all came together in 3 a kind of tree configuration. But there might have been 4 some sequential flow from one department to another. 5 Q Sir, I wanted to go back -- oh, strike that. 6 Sir, in the late ' 60s and early ' 70s, do you 7 recall whether or not the organic chemicals division's 8 research department did research into efforts to modify 9 Aroclors from chlorination to the use of either bromine or 10 fluorine as the agent that was being applied to the 11 biphenyl Santowax? 12 A I can remember people talking about such a study 13 in later years but I was not familiar with it at the time. 14 Q Did the Therminol lines of heat exchange fluids 15 in later years replace Aroclor for certain product 16 purposes? 17 A That's not an exact characterization. Aroclors 18 were used for heat transfer fluids from some time before I 19 started with the company. But at some point, a marketing 20 program to promote the use of Aroclors as heat transfer 21 fluid was undertaken, and as part of that, the Therminol 22 product line name was adopted to describe grades of Aroclor	Page 560 1 so-called spent heat exchange fluids and then Monsanto 2 would turn around and send out a new batch that was fresh? 3 A Referring to the time that I was the production 4 supervisor? 5 Q Correct. 6 A I was not aware of it at the time. I believe 7 based on my later position as manufacturing manager that 8 some fluids were being returned by customers for 9 reprocessing but that was, as best I recall, not done at 10 the Anniston plant. 11 Q And that could have been done with some Aroclors 12 from other plants like Krummrich? 13 A Could have been. 14 Q But you're not sure? 15 A Well, we also shipped Aroclor called Therminol 16 Fr1, 2 or 3 from the Krummrich plant. So if Therminol Frs 17 were being returned, they could have come from either 18 place. I don't know when that return program may have 19 begun or ended, but I remember that there was such a 20 practice. 21 Q Sir, when you joined the Anniston plant, to your 22 knowledge was the Aroclor department rated as a " toxic "

Page 561 1 department within Monsanto? 2 A I don't remember such a rating system. 3 Q At the Anniston plant or Monsanto-wide? 4 A I don't recall calling departments toxic 5 departments or departments that weren't toxic. 6 Q In later years did you become familiar with 7 Aroclor production at the Krummrich plant? 8 A Yes. 9 Q Did the Krummrich plant have a policy of 10 providing clean changes of clothes to the workers in the 11 Aroclor department each day to your knowledge? 12 A I don't remember. I have worked at several 13 plants, and I know there are some plants where certain 14 departments are designated as toxic departments and there 15 are additional things provided to workers such as 16 additional changes of clean clothes but having been around 17 for a long time and worked in a lot of places, I don't 18 remember which plant that was. 19 Q Well, sir, going back to the bromine and fluorine 20 uses, to your knowledge did Monsanto ever have even bench 21 or pilot plant production of bromo-aroclor or arobrome? 22 A I remember those terms. In the early ' 70s when	Page 563 1 Aroclor was being removed from the drums? 2 A Well, the step of casting drums was no longer 3 part of the process at that point. A flaker consisted of a 4 rotating drum with cooling water inside it and the rotating 5 drum would rotate through a pan that contained liquid feed 6 of Aroclor 1268 or Aroclor 5460 and the solid material 7 would coat the drum as it rotated out of the liquid. And 8 as the drum rotated it would pass under a blade called a 9 doctor blade which would scrape the flakes off the drum and 10 the flakes would then fall into a hopper so that was a 11 process for one step converting the liquid into a 12 manageable solid. 13 Q Now, sir, would that operation have occurred in a 14 warehouse? 15 A My recollection is that it occurred in the 16 Aroclor department. I think there may have been a part -- 17 a room in the Aroclor department that we may have called 18 the warehouse for some reason. 19 Q Now, would that same room have been used for 20 drumming of liquid Aroclors? 21 A I don't remember. 22 Q Did the Aroclor department have a bagging machine
Page 562 1 we were very aggressively doing things to replace Aroclors 2 from the product line, doing other things to minimize what 3 was then described as the Pcb problem. Materials of that 4 kind were considered and I can recall conversations with 5 research where the term " arobrome " and so forth was used. 6 I believe that some materials like that were synthesized so 7 the properties could be determined. As far as I know we 8 never attempted to develop a process. I don't believe we 9 ever commercialized a product like that. 10 Mr. Meyer: Off the record. 11 (Discussion off the record.) 12 By Mr. Meyer: 13 Q Sir, do you recall in the mid to late ' 50s 14 Monsanto and specifically a Mr. Ellenberg or Mr. Cleghorn 15 looking into the possibility of using Aroclor in paints? 16 A I don't recall those people being involved. 17 Q Do you recall any efforts that were being made at 18 the Anniston plant to use Aroclor in any kind of paints? 19 A No. 20 Q Sir, going back to Exhibit 116 in the solid 21 Aroclor that was being hammered out of these drums, how 22 would the flaking operation have changed how the solid	Page 564 1 for placing solid Aroclor into bags? 2 A Yes, a very simple one. 3 Q Did either the mechanism you just described for 4 flaking as well as the bagging operation have any kind of 5 fume or vent control system? 6 A I believe it did. 7 Q Did that system then also have a scrubber that 8 would take out and entrain solid particles? 9 A I don't remember that. 10 Q Do you recall, sir, if the Aroclor building at 11 Anniston had a trench sewer in the ground floor? 12 A I think it did. 13 Q Would the trench sewer have had gratings so that 14 it could be opened up? 15 A Yes. 16 Q To your knowledge, sir, were there paved running 17 areas or curbs outside of the Aroclor building? 18 A Yes. There were paved areas. I don't remember 19 curbs in those days. 20 Q To your knowledge, sir, and recollection, was the 21 Aroclor building a three-story building in this era? 22 A I think it was.

Page 565 1 Q And was it open on most sides? 2 A Yes. 3 Q And were the chlorinators outside? 4 A Yes. 5 Q And were they on their separate concrete pad? 6 A Yes. 7 Q And was that pad surrounded by a curb? 8 A I don't remember that it was. It's possible. 9 Q Do you recall, sir, where the trench that went 10 through the Aroclor building would have gone in terms of 11 the kind of sewer that it was, if you go back to Exhibit 12 114, which distinguishes between, I guess it was the Niran 13 sewer, the acid sewer as a storm sewers and the sanitary 14 sewers. That was the long progress report, sir. I can 15 show you real fast if counsel has no objections so you 16 don't have to root around. 17 A No, I don't know which sewer that would have gone 18 into. 19 Q So I just wanted to confirm, sir, that the series 20 of memoranda that have been introduced 115 through 120 21 discussing generally the disposal of still bottoms and 22 these trappings and so forth, you have no knowledge of the	Page 567 1 piping in the Aroclor department and I was wondering, sir, 2 if that description is what you recall of the department at 3 that time? 4 A Yes, it seems to be. 5 Q Further on, sir, in paragraph d there's a 6 discussion of the fact that due to the high freezing point 7 of solid Aroclors and the inadequacy of transfer piping 8 that the heating of all lines carrying solid Aroclors was 9 done with natural gas torches. Do you recall that 10 practice, sir, in the department? 11 A Yes, I do. 12 Q Would you agree, sir, with the author's statement 13 that that practice, among other things, caused high 14 maintenance costs in the piping and fitting? 15 A Yes, it did. 16 Q Now, why would that be so? 17 A The heat would, should I say, tort the piping and 18 damage the bolts, damage the gaskets. In the case of 19 threaded pipe which was inappropriate anyway, it would burn 20 out the thread compound leading to leaks. 21 Q While you were still at the Anniston plant, sir, 22 was the Therminol heat transfer system mentioned in that
Page 566 1 dump or place that is referred to in those various 2 memoranda what the authors were talking about? 3 A No. It would be speculation on my part. 4 Mr. Meyer: I'd like to have introduced as our 5 next numbered exhibit, 121, a Monsanto progress report 6 dated as of June 7, 1963 and I apologize, I scribbled on 7 your copy, Jim. And its general subject matter is 8 long-range plans for the Aroclor department. And the 9 witness is shown as having received a copy of it. 10 (Savage Exhibit 121 identified.) 11 (Witness reviewed the document.) 12 The Witness: Okay. 13 By Mr. Meyer: 14 Q Sir, do you generally recall the subject matter 15 of this memorandum? 16 A The title is process improvement program. It was 17 normal to have such a program for each of the departments. 18 It covers fairly typical subject matter of such a plant. 19 Q Sir, I wanted to direct your attention to page 3 20 of the report and specifically subparagraph c. 21 A Yes. 22 Q There is a description in there about the process	Page 568 1 paragraph ever installed? 2 A I don't remember. I remember being strongly in 3 favor of it, but I don't remember whether it was done. 4 Q And to confirm, sir, that would be a Therminol 5 heat exchange system as we were discussing a little while 6 ago? 7 A Yes. The date on this report is near the end of 8 my time at the Anniston plant. 9 Q Yes, I was going to assume that that would have 10 been the case. Sir, did the Aroclor/biphenyl department at 11 this time have its own cooling tower? 12 A I don't remember. Probably so, but I don't 13 remember. 14 Q Sir, were you at all involved in procedures 15 leading to the installation of continuous chlorinators at 16 the Anniston plant for Aroclor? 17 A The installation was completed before I became 18 production supervisor. This did not involve installing new 19 chlorinators. As I recall, the project represented 20 repiping some batch chlorinators so they could be operated 21 in a continuous mode. 22 Q Could those have been chlorinators five through

Page 569 1 eight? 2 A I believe that's right. 3 Q And as part of the continuous chlorination 4 process, did that result in larger quantities of entrained 5 materials in the off gas, the Hcl, to your recollection? 6 A I don't remember that. That equipment was 7 started up before I took over so if there was some change 8 in the nature of the operations, I wouldn't have observed 9 it. 10 Q Would the continuous chlorinators have only been 11 used for Aroclor 1242? 12 A That was true nearly all of the time except that 13 we did one time make a run of a couple weeks in Aroclor 14 1248. 15 Q Sir, do you recall either in this period or later 16 on in your tenure at Monsanto who the single largest 17 customer for Aroclor was? 18 A I presume it was one of the electrical companies. 19 Q Could it have been General Electric? 20 A That seems likely. 21 Q Do you recall, sir, whether or not General 22 Electric had a standing practice where it only wished to	Page 571 1 consistently applied. And they preferred not to take the 2 risk of having a second source. They liked the idea of 3 having a second source from the same point of reliability 4 of supply, but from a quality standpoint they generally 5 preferred to receive Anniston material is my understanding. 6 Q Would you have any knowledge, sir, of whether or 7 not until the very end Aroclor was a profitable item for 8 Monsanto? 9 A I believe it was profitable. 10 Q Would it have been more profitable, say, than 11 parathion? 12 A I doubt it. 13 Q During the period you were at Anniston and later, 14 Monsanto did not have a specific patent protecting Aroclor ; 15 is that true? 16 A That's true. 17 Q But at one time Swan did have a patent, is that 18 also true? 19 A I don't think so. I don't know that for sure 20 because I never studied the question, but it's my 21 understanding that the use of chlorinated biphenyl for 22 capacitors was actually invented by General Electric, so it
Page 570 1 purchase Aroclor from the Anniston plant? 2 A At one time they had expressed a preference for 3 the Anniston plant, but I also think that we did ship 4 General Electric from Krummrich plant on occasion. 5 Q Do you recall why it was that they preferred 6 Anniston Aroclor? 7 A There had been an incident a couple of years 8 earlier before I started with the company. I don't 9 remember exactly when it was, but it was a well-known story 10 that General Electric had received some Aroclor from the 11 Anniston plant, I think, which proved to be unstable. 12 Unstable in that context meant that some of the chlorine in 13 the molecule was present in a different structure than the 14 way it was supposed to be. Now, the result of that was 15 some capacitors that failed prematurely which cost General 16 Electric a lot of money, and this of course led to an 17 investigation conducted by both General Electric and 18 Monsanto which led to some more careful practices on the 19 way catalyst was added to the chlorinators. 20 And it's my understanding that General Electric 21 had expressed a preference to have a single source to try 22 to assure themselves that those new measures would be	Page 572 1 seems to me a bit strange that Swan would have had a patent 2 unless perhaps it was a process patent. 3 Q To your knowledge -- 4 A This is all before I was born, incidentally. 5 Q Fair enough. To your knowledge did any other 6 American companies produce polychlorinated biphenyls? 7 A Not that I know of. 8 Q Did any companies in the rest of the world 9 produce them? 10 A Yes. 11 Q Could you tell me who those companies were? 12 A Rhone-poulenc in France, Bayer in Germany, the 13 Japanese company, I believe it was Kanegafuchi. And I 14 believe that some similar material was made in the Soviet 15 Union. 16 Q Probably still is. 17 A I hope not. 18 Q Sir, was the trench that you were describing 19 earlier today where the bad batches of Niran fell out into, 20 could that have also been known within the plant as a 21 cubical trench? 22 A Yes. Let me correct part of the implication of

Page 573 1 your question. It was not bad batches of Niran. That 2 would imply that it was batches from the condensation 3 reactor literally containing parathion. I don't know of 4 any batches from that reactor that ever were in fact put in 5 the trench. The incidents that I know of involved the 6 intermediate. 7 Q Thank you. Sir, going back to Exhibit 121, the 8 general discussion in the first pages of some problem areas 9 in the Aroclor department. 10 A Yes. 11 Q And I was wondering, sir, if the reference to the 12 below standard process piping would be to your knowledge 13 what we were seeing earlier on page 3 with respect to the 14 irregular piping in the department? 15 A Yes. 16 Q Do you think anything else was meant by the 17 author? 18 A No. 19 Q Do you think, sir, the reference to heating is a 20 reference to the installation later on of a Therminol 21 system as opposed to the open torch system? 22 A I think it probably referred to a little more	Page 575 1 A Dry chlorine is normally handled in carbon 2 steel. Wet chlorine is extremely corrosive. 3 Q Did the chlorine in the chlorinators become wet 4 through the mixing with the Santowax or the biphenyl? 5 A It should not have. 6 Q So would it be your testimony that no special 7 precautions needed to be taken with corrosion in the 8 chlorinators in the Aroclor? 9 A That's generally true. The chlorinators were 10 made of steel, including the chlorine distributor. If 11 there was some error that resulted in moisture getting in 12 the chlorinator, that would be a very serious problem, but 13 it didn't require any remarkable precautions that I 14 remember of that happening. 15 Q Would the same have been true of the chlorinators 16 in the Niran department? 17 A Absolutely not. 18 Q Why was that? What was the difference? 19 A That was a very corrosive environment. Those 20 chlorinators were made of what's called a glass line 21 steel. It's like glass. The internals were metal, 22 expensive alloys like Monel, Hastelloy C and the agitators
Page 574 1 than that. Some of the materials that were handled in that 2 piping had melting points above the condensation 3 temperature of the steam available so while steam tracing 4 was used on those lines it was futile because the steam was 5 not hot enough to actually accomplish the purpose and for 6 those lines a Therminol heating system or an electrical 7 heating system would have been necessary to really make any 8 progress. There were other places in the department where 9 simply upgrading steam jacketing or steam tracing could 10 have been sufficient if it was done correctly. 11 Q Now, the chlorinators were jacketed with steam, 12 weren't they, in the Aroclor department? 13 A No. The process required cooling rather than 14 heating. 15 Q I'm sorry, you're right. 16 A Chlorination. 17 Q So it was cooling water? 18 A It was cooling water. At the moment I'm trying 19 to remember whether there was a cooling coil or cooling 20 jacket. I don't remember which. 21 Q Now, the chlorine would have been a fairly 22 corrosive substance, wouldn't it have?	Page 576 1 were also an expensive alloy. That was a much more 2 aggressive environment. 3 Q And is that because the chlorine that was being 4 used in the Niran chlorinators somehow or another was in a 5 liquid form? 6 A No, it had nothing to do with the form of the 7 chlorine. It was the product itself that was corrosive. 8 Q The thio acid? 9 A Thio acid or intermediate. 10 Q Sir, the reference in g. to residue handling 11 facilities of Exhibit 121, do I think that that most likely 12 is a reference to the same subject that we saw on exhibits 13 115 through 120? 14 A Yes. 15 Q Do you believe the author -- well, what do you 16 believe the author meant by that being a problem area? 17 Mr. Burnett: Object to the form of the question. 18 The Witness: I don't see anything in the details 19 that sheds any light on that question. I can only assume 20 that this means that the problem had not been 21 satisfactorily resolved at this time. 22 By Mr. Meyer:

Page 577 1 Q Sir, going back to Exhibit 108, which was the 2 description by Monsanto of what it seeks in the lawsuit 3 with respect to the Anniston plant. Are you with me, sir? 4 A Yes. 5 Q Sir, at the bottom of the page in the description 6 of the solid waste landfill area the statement is made by 7 Monsanto that " approximately 70 percent of the waste 8 shipped to the landfill originated in the parathion 9 department. " 10 Now, sir, based on your experience at the 11 Anniston plant, could you shed some light on what kinds of 12 waste would have been sent to a dump or landfill type 13 facility? 14 A No, I can't. This document of course originated 15 in 1991. 16 Q Correct. 17 A And I left the Anniston plant in 1963. 18 Q Yes, and my question was more going to be based 19 on your operating experience and your experience in setting 20 up the plant and so forth. It would be my understanding as 21 a lawyer but certainly not as a chemist or a chemical 22 engineer or anyone who knows anything about chemistry that	Page 579 1 A I don't recall this memorandum. 2 Q Do you recall the general subject matter of the 3 memorandum? 4 A Yes. 5 Q Now, do you believe, sir that the limestone pit 6 that is referenced in here would be the limestone bed that 7 was associated with the waste treatment facility at the 8 Niran department? 9 A Yes. 10 Q And that would be distinguishable from the 11 incinerator neutralization scrubber pit? 12 A Yes. 13 Q And still distinguishable yet another time from 14 the biphenyl limestone pit or pits? 15 A Yes. 16 Q Now, what would the phrase " the bypassing " do you 17 think have been intended by you at this time? 18 A I don't remember the problem, but just from the 19 context of this sentence it implies a channel in effect 20 whereby flow might get through without thoroughly 21 contacting the limestone. 22 Q Now, could that be similar to the questioning I
Page 578 1 the whole point of the parathion department was to treat 2 the wastes either in the incinerator or in the biological 3 treatment facility, which is why I'm surprised that the 4 bulk of the waste that apparently later on went to the 5 landfill would have originated in that department. 6 A Yes, I can only suppose that this reflects a 7 change in practice from the time that I was at the Anniston 8 plant. 9 Q Fair enough, sir. Well, sir, I'd like to turn to 10 our next numbered exhibit and again whenever you wish to 11 take a break, please let me know. 12 A Now is a good time. 13 (Recess.) 14 Mr. Meyer: Our next numbered exhibit will be 122 15 which for the record is an October 13, 1960 Monsanto 16 memorandum out of Anniston from the witness to a 17 Mr. Stutz. 18 (Savage Exhibit 122 identified.) 19 (Witness reviewed the document.) 20 The Witness: Okay. 21 By Mr. Meyer: 22 Q Sir, do you recall the memorandum at all?	Page 580 1 had earlier about the channelization of the limestone in 2 beds? 3 A Same issue although I think at that time we were 4 talking about the biphenyl bed. 5 Q Yes, sir. Now, sir, how would the ph level of 6 the effluent going through the limestone pit have been 7 measured in this area? 8 A The measurement of ph is done with a simple 9 electronic instrument either by taking a sample and 10 measuring it with a laboratory type instrument or sometimes 11 a continuous instrument is attached to the process so that 12 there can be a continuous readout. I don't know which this 13 was but the basic principle is the same in either case. 14 Q Sir, do you recall when you first joined the 15 plant there being a dispute or disagreement between the 16 city of Anniston and Monsanto relating to sampling of 17 effluent that was going from the Niran plant to the city 18 waste treatment facility? 19 A No. 20 Q To your knowledge, sir, when the Niran plant was 21 first opened up did the waste effluent from the Niran 22 department go to the city for primary treatment?

Page 581 1 A At the time that I arrived at the plant it had 2 been running for about a month and the waste was going to 3 the city sewer for treatment. That treatment would have 4 been to my knowledge primary and secondary. 5 Q So the Monsanto plant had no facility of its own 6 at that early point in time? 7 A Only the limestone bed to correct ph. 8 Q Do you recall whether cost was a consideration in 9 determining whether Monsanto decided to build a secondary 10 treatment facility of its own as a first step in waste 11 treatment from Niran? 12 A My understanding at the time was that we decided 13 to build our own plant because the capacity of the city 14 plant was at best marginal handling waste from our plant as 15 well as the other wastes they had to receive, and we 16 expected there would be continuing problems if we didn't 17 alleviate that by building our own plant. There was a cost 18 impact in the sense that the bill that we paid to the city 19 was partly based on the Bod loading but on the other hand 20 when we built our own plant, we incurred a lot of new fixed 21 variable costs which I suspect were at least as large. 22 Q So you don't recall circumstances -- any	Page 583 1 arrows how you understood the waste treatment facility 2 worked at the Anniston plant? 3 A In the Niran waste treatment facility? 4 Q Yes, sir. 5 A Yes, that's pretty simple. 6 (Witness complied.) 7 Mr. Meyer: Let the record reflect that the 8 witness has handed me a one-page drawing. 9 By Mr. Meyer: 10 Q Now, sir, in prior testimony today reference was 11 made to something known as either a lagoon or a pond. Does 12 that particular structure appear on this drawing? 13 A No. 14 Q Now, where, once that structure was added in this 15 process, would that have appeared? 16 A It would have been downstream of the limestone 17 bed and I think upstream of the aeration basins. My 18 recollection of the lagoon or the pond was that it was 19 built as a test unit considerably before the waste plant 20 was built and was an experiment intended to find a more 21 economical way of treating and I also remember that it was 22 rebuilt at least once and its operation may have been
Page 582 1 disagreements between Monsanto and the city relating to Bod 2 testing when most of the flow or all of the flow was going 3 to the city treatment facility? 4 A I don't remember a testing issue. That's not 5 necessarily something I would have been involved in any 6 way. 7 Q Sir, I wanted to confirm on Exhibit 122 that the 8 reference to the aeration basin is a reference to that 9 structure that we were discussing earlier where bubbles 10 were basically inserted into the waste? 11 A Right. 12 Q And do you recall, sir, at this time did the 13 plant have more than one aeration basin? 14 A Yes, the original design of the waste treatment 15 plant had two basins side by side. 16 Q In later years did that change at all? 17 A I believe that after I left the plant they added 18 more. 19 Q But you weren't involved in that at all? 20 A No. 21 Q Sir, if I gave you a piece of paper, would it be 22 possible for you to draw me with little boxes and little	Page 584 1 continued as a way of reducing the overall load. But 2 whether it continued during the extended period that the 3 large waste treatment plant was in operation, I don't 4 remember. 5 Q Sir, I would like for you to go back to the 6 various maps that we looked at in Exhibit 114. Exhibit 114 7 was the progress report with the figures and maps that we 8 had looked at earlier. And the maps for your convenience 9 are at the end. Sir, on the various maps I acknowledge 10 that there's difficulty with the copy quality, but if you 11 look at page 20 or figure 5 which has a Bates stamp number 12 1401870? 13 A Yes. 14 Q Now, to orient ourselves, the incinerator 15 scrubber neutralization pit that we saw earlier today is 16 off to the south and in fact is very close to something 17 that's captioned circled numbers indicate priority order. 18 Going from there, yes, would you be able to identify where 19 the aeration basins were or are on this map realizing, of 20 course, that this is a 1971 map and maybe we have more of 21 them to deal with? 22 A I believe the aeration basins kind of run off the

Page 585 1 top of this drawing. 2 Q Where are you? 3 A Up in here. 4 Q I see. So they are not depicted on the map? 5 A Well, there's an outline that I think is part of 6 the aeration basin but I'm not sure. 7 Q How about the lagoon or the pond, is that a 8 configuration that appears on this figure? 9 A Just over, I believe this rectangular structure 10 here is the compressor building and this thing over here, 11 that's a regular object here that appears to be a pond, but 12 that's not what I remember. The test pond that I remember 13 is down here near the holding tanks. I may have just 14 forgotten this. It seems like a rather large thing to 15 forget, but it doesn't ring a bell with me. 16 Q Now, are the holding tanks something that are 17 very visible on this map? 18 A Yes, they're down here. 19 Q Could you do me a favor then, sir. Do you have a 20 pen? I'll hand you my pen. If you could circle the area 21 that you have just identified as the holding tanks. And 22 then off the to the side perhaps write " holding tanks " and	Page 587 1 Q Right, but those parts that do appear? 2 A At the time that I was there, the waste 3 chlorinator was -- call that number one -- was up here in 4 the department. 5 Q Could you do a larger number, sir, on subsequent 6 copies. That's not going to do too well. 7 A The limestone beds we'll call number two, I'll 8 just identify like this. Then the holding tanks number 9 three would be an area. Then, as I recall, there were 10 pumps here to move the effluent over to the aeration basins 11 and it appears roughly the aeration basins are in this 12 position. 13 Q Now, was all the piping, sir, that was 14 transporting what I assume was primarily a liquid waste 15 perhaps with some settled solids in it, were those 16 pipelines aboveground? 17 A I believe they were cast iron lines underground. 18 I'm not sure of that. That would have been normal sewer 19 practice. 20 Q Do you recall, sir, before you left the plant in 21 1963 whether or not that perhaps might have been the acid 22 sewer line in the Niran department had to be replaced
Page 586 1 let the record reflect that that's what the witness is 2 doing. 3 Now, sir, is it possible to identify the 4 limestone bed on this particular map? 5 A Yes, it's the -- I believe it's the curved 6 outline just above, just above the holding tanks. 7 Q So let the record reflect that the witness is 8 identifying the limestone beds on this particular map. 9 Now, was the secondary settler known as something 10 else? 11 A Not that I know of. It might have been just 12 called a settler. Sometimes such a device is called a 13 thickener. 14 Q Now, on this map that you drew me, I don't see 15 the holding tanks. Where would they have been? 16 A They were, I would have -- I didn't show them 17 because they're essentially a wide spot line. They're 18 downstream of the limestone bed. 19 Q So if we go back to that figure, sir, could you 20 draw little numbers to correspond to our little map that 21 we've got here that you've drawn for me? 22 A Well, not everything is on the map.	Page 588 1 because it had been corroded out? 2 A I don't remember that. That's possible. 3 Q I believe you testified earlier today, sir, that 4 the clay pipe or vitrified pipe, was it? 5 A Yes. Or what was a later exhibit called, stone 6 wear? 7 Q Yes. That that was being used with the 8 chlorinators for the waste treatment facility? 9 A No, this is a wet -- the original chlorinator 10 which was put in as an urgent, almost stop-gap project. 11 Q That was the chlorinator for the effluent? 12 A That was the effluent chlorinator which was made 13 of some ceramic material which has been described as stone 14 wear. As I recall it, that was of the construction called 15 Bell & Spigot where there's a wide end on one end of the 16 piece of the pipe and a narrower end on the next piece of 17 pipe and some packing is put in to seal the joint and that 18 was the temporary or expedient chlorinator that was 19 installed soon after start-up. It was later on replaced 20 with something better. 21 Q Sir, I wanted to go back to your testimony 22 earlier today on the design basis for the Niran limestone

Page 589 1 bed. There is some evidence to suggest, sir, as part of 2 some Garrett & Miller studies that were done in the 1980s 3 that Monsanto had two limestone beds for the Niran plant. 4 Do you recall, sir, whether or not the waste treatment 5 facility as it was configured when you were there had one 6 or two limestone pits? 7 A I remember that they had one. 8 Q Do you think, sir, in later years when you had 9 oversight responsibilities -- I realize not so much with 10 Niran or parathion -- do you think that you recall the 11 construction of a second limestone bed for Niran? 12 A No. Perhaps the study referred to the other 13 limestone bed that was used in conjunction with scrubber 14 water as being in general part of the Niran facility, as 15 being a second limestone bed. 16 Q Perhaps. 17 A Let me point out that in the oversight 18 responsibilities I had as manufacturing manager in the 19 early ' 70s, I had no responsibility whatsoever for that 20 side of the plant, so anything I learned about it would 21 only have been a matter of casual personal interest. 22 Q Well, sir, going back to the design basis for the	Page 591 1 limestone pit was in existence when you got to the plant ; 2 is that true? 3 A Yes. 4 Q So you don't recall its design basis? 5 A No. 6 Q Did you ever see any drawings for it? 7 A No. 8 Q Did you have any construction or other 9 supervisory responsibilities when the limestone bed was 10 constructed, the Niran one? 11 A No. 12 Q Do you recall if Monsanto employees did the 13 construction? 14 A Most of the construction of the Niran plant was 15 done by contractors. There may have been certain parts of 16 the plant that were built by Monsanto employees. The Niran 17 plant construction was completed when I arrived at the 18 site, so I didn't witness who did any particular part of 19 it. 20 Q So you couldn't shed some light on who would have 21 been responsible primarily for the construction of a 22 limestone bed?
Page 590 1 Niran limestone bed that was installed, I believe it was 2 your testimony earlier today that you recalled seeing some 3 drawings showing that limestone bed? 4 A Yes. 5 Q Now, was this a facility that was excavated into 6 the ground? 7 A Yes. 8 Q And then was concrete placed into it like we saw 9 with the aeration basins? 10 A No, I don't remember that there was any concrete 11 involved. 12 Q But you recall that there was some sort of liner 13 membrane that was being put into it? 14 A I remember seeing that on the ground. 15 Q Now, how would that have been shown on the 16 drawing? 17 A Just in a cross-section drawing. It would have 18 been shown as a line with some kind of identifying note. 19 Q But you can't shed any light on what you think 20 the liner would have been made from? 21 A No. 22 Q Now, I believe you testified that the biphenyl	Page 592 1 A No. 2 Q Sir, on the construction of the limestone bed for 3 Niran I believe it was your testimony that there would have 4 been the membrane and then the clay as a bed and then 5 finally the limestone was placed on top of that, is that a 6 correct statement? 7 A That's right. That's a standard method of 8 construction. That's what I remember is the way that one 9 was constructed. 10 Q When you say " standard method of construction, " 11 would that be for neutralization pits? 12 A Any time a membrane is used, it's common to place 13 a clay or sand or some material like that on top simply so 14 that stones or sticks or whatever won't puncture the 15 lining. 16 Q Now, was the neutralization scrubber incinerator 17 pit in existence when you arrived at the plant? 18 A No. 19 Q So that was added later? 20 A Yes. 21 Q But during your tenure at the plant? 22 A Yes.

Page 593 1 Q Could you describe for me its construction? 2 A I don't have any recollection at all of how that 3 was constructed. 4 Q You don't recall seeing any drawings similar to 5 the one you saw with the Niran limestone bed? 6 A No. 7 Q Can't shed any light on who would have done the 8 work? 9 A No. 10 Q Do you believe that -- strike that question. 11 Mr. Meyer: I would like to have marked and 12 introduced as our next numbered exhibit a Monsanto 13 memorandum authored by the witness dated June 15, 1959 14 regarding sodium hypochlorite eye irritation. 15 (Savage Exhibit 123 identified.) 16 (Witness reviewed the document.) 17 The Witness: Okay. 18 By Mr. Meyer: 19 Q Sir, first of all do you recall the general 20 subject matter of the memorandum? 21 A Yes, just vaguely. 22 Q Now, do you recall, sir, as part of the operation	Page 595 1 A Just represented in essence a new raw material 2 being used in the area, and it would have been fairly 3 routine to ask whether there was any particular precaution 4 that needed to be taken. 5 Q Now what area? 6 A In the Niran department. 7 Q Well, was this sodium hypochlorite manufactured 8 at the Anniston plant? 9 A There was a sodium hypochlorite by-product stream 10 that existed in the brine area of the chlorine plant. So 11 it's possible that it came from there rather than being 12 purchased, but I can't deduce that from this and I don't 13 remember. 14 Q Do you recall any specific instances where this 15 sodium hypochlorite was tested and workers complained of 16 eye irritation caused by its use? 17 A I don't remember that. 18 Q Do you recall, sir, whether or not in the Niran 19 department perhaps in the manufacture of the thio acid that 20 prolonged contact to that, to those fumes, caused eyeballs 21 to blister? 22 A We had a discussion yesterday about an eye
Page 594 1 of the Monsanto waste disposal facility the spraying of a 2 hypochlorite solution? 3 A I remember considering the possibility. Whether 4 we actually implemented this practice, I don't remember. 5 Q Would that have been as an odor control method? 6 A Yes. What this speaks to is reducing the 7 concentration of sulfur fumes in the air, which would have 8 been an order issue. 9 Q Before you used something like this hypochlorite, 10 you wanted to get the input from the medical department as 11 to its possible harmful effects? 12 A That's what this letter seems to indicate, just 13 asking for advice. 14 Q Do you recall whether or not you got a response 15 from Mr. Wheeler? 16 A Dr. Wheeler, no, I don't know whether I got a 17 response. 18 Q So to your knowledge you don't know if you ever 19 used this sodium hypochlorite for that purpose? 20 A No. 21 Q How did you know to ask Dr. Wheeler about eye 22 irritations caused by this sodium hypochlorite?	Page 596 1 irritant. What I recall is that eye irritant was not the 2 thio acid but rather the ethyl Pct. 3 Q So to your knowledge, sir, you don't recall if 4 this sodium hypochlorite was used as a means of odor 5 control at the waste disposal facility? 6 A No, I don't remember. 7 Mr. Meyer: I'd like to have marked and 8 introduced as our next numbered exhibit what appears to be 9 a telegram sent to Mr. Stutz from the witness. 10 (Savage Exhibit 124 identified.) 11 Mr. Meyer: Its date is April 12, 1960. 12 (Witness reviewed the document.) 13 The Witness: Yes. 14 By Mr. Meyer: 15 Q Well, sir, first of all I was wondering do you 16 recall sending a telegram to Mr. Stutz on data of this 17 kind? 18 A I telexed the people in organic engineering that 19 I was working with very regularly with data, so this would 20 be part of a normal practice. 21 Q Now, why were you telexing the information to 22 St. Louis?

Page 597 1 A Telex was the convenient and rapid method of 2 doing it. Obsolete now but the standard method at that 3 time. 4 Q Now, do you recall, sir, what the wood tank was 5 that's referred to in the text of your telex? 6 A No. 7 Q So you don't recall the waste treatment facility 8 in Niran having a wood tank? 9 A No. I don't remember there ever having been a 10 wood tank that was part of the regular department. I 11 believe there may have been a wood tank that was part of 12 the pilot plant, so this may reflect work that I did for 13 Cliff on the pilot plant. 14 Q Okay, now in April of 1960 was the waste 15 treatment facility at the Anniston facility up and running 16 or was it still in the pilot plant stage? 17 A I don't know. 18 Q Sir, do you recognize the handwriting in the top 19 portion of the telex? 20 A That's mine. 21 Q So you recognize the writing? 22 A Yes, that's my handwriting.	Page 599 1 introduced as our next numbered exhibit a letter to 2 Mr. Ullmer at Dorr-oliver, Incorporated from the witness. 3 I guess that will be 125. 4 (Savage Exhibit 125 identified.) 5 (Witness reviewed the document.) 6 The Witness: Okay. 7 By Mr. Meyer: 8 Q Sir, do you recall Mr. Ullmer at a company called 9 Dorr-oliver? 10 A I'm familiar with the Dorr-oliver Company. They 11 make waste treatment equipment. 12 Q Do you believe, sir, that the correspondence you 13 were directing to Mr. Ullmer would have been related to the 14 waste treatment facility at Anniston then? 15 A The text refers to a water trench which runs 16 under a group of reactors, so I presume that's what we've 17 been calling the cubical trench. 18 Q I believe it was your testimony this morning, 19 sir, that that trench always had water in it? 20 A Yes. 21 Q And if there was a bad batch that would just be 22 simply released into the cubical trench, was that true?
Page 598 1 Q And would I be accurate in assuming that the 2 reference to 1/8 Gpm is one eighth of a gallon per minute? 3 A That's right. 4 Q Sir, could you shed some light on what you might 5 have meant? And I know it's been a few years, but when you 6 said, " Dump everything, four drums, no more " -- 7 A " Nutrient " is the word. 8 Q Nutrient? 9 A Well, I don't know what dump everything four 10 drums meant. But 1/8 gallon per minute feed certainly is 11 consistent with the idea that this is pilot plant data. 12 And also -- or at one time we were also testing a trickling 13 filter which was a pilot plant as well, but that was an 14 alternate treatment plan. 15 Q That's the one we saw with Nitro earlier today? 16 A Same kind of device, that's right. And in some 17 of the pilot plant studies I don't know whether it was the 18 activated sludge or the trickling filter nutrient which is 19 really just fertilizer was added to support the biological 20 life. So this is all consistent with being some kind of 21 pilot plant operation. 22 Mr. Meyer: I'd like to have marked and	Page 600 1 A If the bad batch reached the point that there was 2 a rupture disk relieved, then the batch would without any 3 particular human intervention blow into the trench. 4 Q But was it your testimony that the trench was an 5 enclosed area earlier today? 6 A Yes. 7 Q So it wasn't running anywhere? 8 A That's what I remember. 9 Q Now, further in the letter in the first paragraph 10 it mentions that the trench, which I assume again is a 11 cubical trench, was drained and cleaned by hand. Do you 12 recall, sir, how the drain mechanism in the cubical trench 13 would have operated? 14 A What I remember was that there was a pump which 15 could be used to pump the water out, but it would not -- 16 did not have any provision for handling the solid material. 17 Q Now, do you recall, sir, where the material that 18 was in aqueous form would have been pumped to? 19 A I believe it was pumped to the sewer. 20 Q And would that have been the acid sewer? 21 A It would have been the Niran sewer, whatever 22 sewer was nearest, I should think.

Page 601 1 Q Now, am I reading this correctly, sir, that you 2 were asking the Dorr-oliver Company to devise some method 3 where you could remove the solids from the cubical trench? 4 A That's how I interpret this letter. 5 Q Now, were relationships such that Dorr-oliver 6 would have provided technical support to Monsanto in 7 designing a feature like this as part of a waste treatment 8 facility? 9 A They were just an ordinary vendor. I was trying 10 to see if I could get some help of that sort. 11 Q Now, other than Mr. Stutz, was there anybody else 12 at Monsanto you could call upon who had design basis 13 experience in waste treatment facilities at this time? 14 A Not that I knew of. There may have been. 15 Q Now, to confirm, the Niran plant at Nitro did not 16 use a system like this? 17 A That's right. 18 Q Sir, I wanted to go back to your testimony on the 19 chlorine plant. And it's my understanding that two kinds 20 of brine were used, Koh and Naoh ; is that correct? 21 A Well, there are two kinds of brine. One was -- 22 Q Kcl?	Page 603 1 A No, I don't remember being involved at the time 2 of this report, Exhibit 114. I was manufacturing manager 3 based in St. Louis, and I would have been part of the 4 approval chain for them to get the money to do whatever 5 they did. So they may have made some presentation to me on 6 what they were designing, but I don't remember what it was. 7 Q Who within Monsanto would have had the most 8 expertise on a sanitary landfill in 1971? 9 A I don't know. 10 Q So as compared to Mr. Stutz who was a readily 11 identifiable expert within Monsanto on waste treatment 12 facilities, you don't recall in 1971 whether Monsanto had 13 an analog person on sanitary landfills? 14 A No. 15 (Recess.) 16 Mr. Meyer: Back on the record. And I think I've 17 only got about 10 more minutes of Anniston stuff. I'd like 18 to have marked and introduced as our next numbered exhibit 19 a memorandum authored by Mr. Coley who we've seen earlier 20 today and it went to a Mr. Leisy, L-e-i-s-y, dated April 21 20, 1966 and its subject matter is " Streams Leaving the 22 Anniston Plant. "
Page 602 1 A Kcl, muriatic potash, and salt. 2 Q So that's true? 3 A Yes. 4 Q When you provided your estimate of the quantity 5 of mercury that was being used, was that an estimate for 6 the entire chlorine plant running both kinds of brine feed 7 or would you have distinguished between brine feed based on 8 potassium versus sodium? 9 A There would be no reason why I should distinguish 10 between the two. 11 Q Sir, in going back to Exhibit 114 which you 12 recall was the 1971 progress report? 13 A 117 you said? 14 Q 114, sir. 15 A Okay. 16 Q You'll recall that there was a reference in there 17 to the creation of a cost center for the landfill, which at 18 this point was now designated as a sanitary landfill, do 19 you recall that? 20 A Yes. 21 Q Sir, were you involved at all in the design basis 22 for what was now becoming known as a sanitary landfill?	Page 604 1 Now, the witness obviously had left Anniston by 2 that time and was not even a recipient of the memo, but 3 we'll see where it goes. 4 (Savage Exhibit 126 identified.) 5 (Witness reviewed the document.) 6 The Witness: Okay. 7 By Mr. Meyer: 8 Q Sir, do you recall who Mr. Leisy was in 9 connection with the Anniston plant? 10 A Art Leisy was a production superintendent. Art 11 came to the Anniston plant I think as parathion supervisor, 12 but I believe he became superintendent during the time he 13 was there. That's what I remember anyway. 14 Q Sir, I would like to direct your attention to the 15 second page and specifically paragraph number 5, " Stream 16 from Plant Dump. " 17 A Yes. 18 Q Now, I believe you testified earlier today, sir, 19 that Pnp was an indicator waste because of its yellowish 20 color ; is that true? 21 A Yes. 22 Q Given the description, sir, in the paragraph that

Page 605 1 this particular stream coming from the plant dump could at 2 times be quite yellow, I was wondering, sir, if you recall 3 during your tenure at Anniston seeing such a stream? 4 A No. But since he describes it as only existing 5 after heavy rain, it would have been somewhat accidental if 6 I'd seen it. 7 Q Let me ask you, sir. I infer from that 8 description that the Pnp would have originated at the plant 9 dump. Am I missing something in my reading of his 10 statement? 11 Mr. Burnett: Object to the form of the 12 question. Lack of foundation. But I'm not directing you 13 not to answer. 14 The Witness: I think you have to just reach a 15 conclusion from the paragraph on the basis of what it says. 16 By Mr. Meyer: 17 Q Well, let me ask you, sir, is the landfill area 18 that you identified as being off-site across the highway, 19 was that physically fairly close or was it closer to the 20 biphenyl limestone pit than the Niran limestone pit? 21 A Oh, yes. 22 Q Significantly closer?	Page 607 1 it predated him. 2 A Could be. 3 Q On the other hand, I've run into no other Sweets 4 so I think you probably are right. 5 A Because it was a small plant he had 6 responsibility for things other than just personnel, and I 7 think things like yards were his responsibility in those 8 early days and that's how he somehow had his name attached 9 to that. 10 Q Sir, when you first joined the plant what was it 11 in 1957? 12 A '58. 13 Q Do you recall there being a refuse area on the 14 plant property itself where there might have been as much 15 as 10 or 12 feet high just with general rubbish? 16 A You're connecting this with Sweets Valley? 17 Q No. 18 A It's possible, but I don't remember. 19 Q Do you recall an area in the plant known as Junk 20 Hollow? 21 A No. 22 Q Do you recall an area at the plant known as High
Page 606 1 A That's the way I remember it. 2 Q Could you provide an estimate of how far you 3 think the area was where you recalled seeing the pits and 4 maybe some of those drums and you did the shooting and the 5 biphenyl limestone pit? 6 A No, I could only guess. 7 Q If one was walking from one place to the other, 8 would it have taken more than five minutes to walk between 9 the two? 10 A Which two? 11 Q The biphenyl limestone pit and the area across 12 the road where you had done the shooting? 13 A Probably five minutes, yes. 14 Q Sir, do you recall an area at the Anniston plant 15 known as Sweet Valley? 16 A Yes. 17 Q Could you describe for me what you recall of that 18 area? 19 A I remember it as Sweets Valley. I believe it was 20 named after Clarence Sweets who was the superintendent at 21 one time. 22 Q I've asked a few witnesses that and they thought	Page 608 1 Boiler Hill? 2 A No. 3 Q If you fish long enough. Going back, sir, to 4 Sweets Valley, what do you recall of Sweets Valley? 5 A That was a place where used and spare equipment 6 was stored. Some of it was quite orderly and some 7 disorderly. There were drums stored there of obsolete 8 material. 9 Q By its name, would it be fair to say that it was 10 in fact a valley or a depression in the land? 11 A It was a low place where there was some old 12 railroad tracks that I think it was actually the location 13 of some buildings that had been torn down a few years 14 earlier. 15 Q Could those buildings have been at one time the 16 furnace department at the Anniston plant? 17 A It's quite likely. 18 Q Sir, if we go back to Exhibit 114 if you'll 19 recall that's the one with the maps? 20 A Yes. 21 Q Choosing whichever map you can make the most 22 sense out of, could you generally identify the area where

Page 609 1 you recalled Sweets Valley as having been. And ideally if 2 you could make it on the same one where we were doing all 3 those other identifications, that would be great? 4 A I remember it as this area down here where the 5 old railroad tracks are. 6 Q Could I do this, could I hand you my pen and have 7 you circle the general area you recall as being 8 Sweets Valley and then writing off to the side that name. 9 And let the record reflect that the witness has done that. 10 Thank you, sir. 11 Now, going to Exhibit 126 which is the 12 Coley/leisy memo, sir, I believe you've got it right 13 there. Why don't you leave the map out. Do you recall the 14 stream that Mr. Coley was describing in paragraph 3 of 15 " Stream Located in Sweet Valley "? 16 A No. He refers to water from the nitrophenol 17 cooling system, for instance, which are facilities that as 18 far as I know did not exist at any time that I was around 19 the plant. 20 Q Would cleaning of intermediate cars have been 21 done when you were at the plant? 22 A We began selling intermediate near the end of the	Page 611 1 might have meant by the phraseology " wash water from the 2 Santowax-hb-40 areas "? And perhaps I can phrase it so that 3 it has more meaning. Did you ever have any production 4 responsibilities in Santowax Hb-40? 5 A Hb-40, yes. 6 Q Do you recall whether or not as part of 7 housekeeping or ordinary day-to-day operations the Hb-40 8 autoclaves would have been washed down? 9 A I don't recall that as a daily operation. We 10 cleaned up the area from time to time and would probably 11 have done so with a hose. I don't know the frequency. 12 Q Sir, finally on the second page, paragraph 4 a 13 stream west of the Niran department in shipping warehouse. 14 A Yes. 15 Q Do you recall, sir, whether or not the waste 16 treatment air blowers -- and I assume those would have been 17 associated with the aeration basins ; am I correct? 18 A Yes. 19 Q Do you recall whether or not that particular 20 facility required cooling water? 21 A I don't remember cooling water on the blowers. I 22 don't find that particularly surprising understanding big
Page 610 1 time that I worked in the Niran department. In fact, I 2 think that was the last significant project that I worked 3 on was some facilities so that we could sell intermediate 4 as a finished product. And that operation then began just 5 about the time that I transferred into production. So such 6 a thing may have gone on while I was still at the Anniston 7 plant, but it would have been after I had any association 8 with that department. 9 Q Sir, turning to paragraph 2 of Exhibit 126, 10 captioned " Effluent to Snow Creek from the Biphenyl 11 Limestone Pit Area, " I believe it was your testimony 12 earlier today that no waste associated with parathion or 13 Niran department went down through the biphenyl limestone 14 pit? 15 A Yes, but in some subsequent discussion I was 16 reminded of the scrubber waste that went through an upper 17 limestone pit and that would have then gone to the biphenyl 18 limestone pit area. 19 Q So would you like to amend your prior testimony 20 of today to make -- 21 A Yes. 22 Q Sir, could you shed some light on what the author	Page 612 1 blowers like that, but I don't remember that there were 2 coolers. 3 Q Sir, wouldn't it have been a standard practice to 4 send cooling water back to a cooling tower for recooling 5 after it had served its purpose to cool a particular 6 process? 7 A That was the general practice. Sometimes where 8 cooling was required at an isolated place it was easier to 9 use city or wellwater on a once-through basis. It was 10 normally only done if it was a small stream in a remote 11 place. 12 Q Was, in fact, the biological treatment facility a 13 fairly remote place to the cooling water areas? 14 A The compressors were somewhat remote from the 15 rest of the operating area. 16 Q What about something known as Niran warm room, 17 particularly condensation, do you recall what the author 18 might have had in mind there? 19 A There was a warehouse building next to the Niran 20 plant where parathion was stored after it was made before 21 it was shipped. Not Niran itself, which was the trade name 22 for ethyl parathion, but methyl parathion was subject to

Page 613 1 separation in cold weather. Methyl parathion was diluted 2 with xylene to 80 percent so as to depress its freezing 3 point because otherwise it would crystallize under ambient 4 conditions. But in extremely cold weather the xylene would 5 separate into a separate layer which caused a problem for 6 customers. And we eventually put in a warm room which was 7 simply a warmed-up area of the warehouse to let that 8 happen. 9 Q Sir, maybe you went through this before and if 10 you did, please let me know, but could you shed some light 11 on the difference between Bod and Cod? 12 A Bod is a very conventional way of measuring waste 13 loads, particularly for domestic sewage, human waste and 14 the like. It means -- it stands for, I think I may have 15 said earlier Biological Oxygen Demand, but perhaps the word 16 is Biochemical Oxygen Demand. 17 At any rate, it's a measure of the organic 18 content of the stream and is usually measured in the 19 presence of biological organisms and the depletion of 20 oxygen is measured so as to determine how much oxygen is 21 consumed by the organism in oxidizing the waste. Chemical 22 oxygen demand is a somewhat simpler test that doesn't	Page 615 1 Q And once I had finished measuring it, would I 2 then have a zero reading for both of those if it was 3 completely neutralized? 4 A If you would analyze it again? 5 Q Yes. 6 A I don't know. 7 Q Maybe it's a meaningless question. 8 A It's not a logical question in terms of the way 9 the test is run. 10 Mr. Meyer: All right. Well, sir, I believe that 11 does it for our Anniston-related questions. Do we want to 12 go off the record for a moment. 13 (Discussion off the record.) 14 (Savage Exhibits 127 through 129 15 identified.) 16 Mr. Brock: I've marked three documents for the 17 record. The first is dated December 21, 1965 and the Bates 18 numbers are Wgk 2048923 and there's an attachment with a 19 Bates number 2042409. 20 By Mr. Brock: 21 Q Mr. Savage, is Exhibit 127 -- or it seems to be 22 two copies of the same memorandum to you dated December 21,
Page 614 1 involve biological organisms and measures materials that 2 are readily oxidized by oxygen in the absence of living 3 organisms. Either test is used for chemical wastes for 4 various reasons and gives somewhat different results. 5 Q Which would be the one, if any, that would be 6 most associated with toxicity problems? 7 A I wouldn't expect a direct correlation with 8 either one because it depends on how toxic something is and 9 the toxicity of something is not directly related to its 10 oxygen demand. 11 Q Now, just so I understand, when we were 12 discussing how Pnp would be broken down through some 13 application of bacteria? 14 A Well, there were microorganisms, whether there 15 was bacteria is another question. 16 Q Through some application of microorganisms if Pnp 17 was being broken down so it was no longer toxic? 18 A That's right. And if the flow was going in that 19 was measuring Pnp, would the Pnp have had a Bod and a Cod 20 measurement? 21 A You could make both measurements on such a 22 stream, that's right.	Page 616 1 1965 from Clarence Buckley. Is that accurate, Exhibit 127? 2 A Yes. But I only see one copy. 3 Mr. Burnett: You just had an extra one stapled 4 there, I guess. 5 By Mr. Brock: 6 Q For the record, Exhibit 127 is only -- the first 7 copy of the memo Wgk 2048923? 8 A Yes. 9 Q Is that a copy of a memorandum that Clarence 10 Buckley sent to you on December 21 of 1965? 11 A Yes. 12 Q There's a reference in the middle paragraph. It 13 states " I believe that we could avoid the formidable task 14 of cleaning out toxic sludge from underground tanks if we 15 built new crude Ncb storage tanks aboveground. " Do you see 16 that? 17 A Yes. 18 Q In or about the 1965 time frame was Monsanto 19 facing a situation at the Krummrich plant of a possible 20 need to clean out toxic sludge from underground tanks? 21 A The context of this letter or this memo fits an 22 expansion that was going on at that time, and I think the

Page 617 1 issue that Clarey is addressing in this memo is what kind 2 of storage tanks would be put in as part of the expansion. 3 I don't think that he's reflecting any new requirement to 4 clean out sludge from the tanks. 5 Q Can you describe for me what the expansion was 6 that was going on? 7 A No, I don't remember exactly what it was. We 8 increased the capacity of that department several stages at 9 about that time. 10 Q That was the nitrochlorobenzene department? 11 A That's right. Mr. Buckley was production 12 supervisor at that time. 13 Q That was before he took on his pollution control 14 responsibilities? 15 A That's right. 16 Q Do you recall whether there had been any 17 instances when Monsanto had to clean out toxic sludge from 18 underground tanks associated with that department? 19 A I don't remember such an incident. I was not 20 involved in production so I wouldn't necessarily be dealing 21 with such a problem. 22 Q Let's go to Exhibit 128. First of all, do you	Page 619 1 A I believe it was a pipeline transfer, but I'm not 2 sure. 3 Q This makes a reference, it says " As we've 4 previously discussed, with the justification for a solids 5 elimination system gone, efforts would be concentrated on 6 ways to clean the crude storage tanks. " Do you see that? 7 A Yes. 8 Q Do you know what the reference means to 9 " justification for a solids elimination system gone "? 10 A No. We had just made a significant process 11 change which may have changed composition of the crude 12 stream. But I don't remember this particular situation. 13 Q Do you recall what the change in the crude stream 14 was? 15 A Yes. We had at about this time or perhaps just 16 before this time installed a stripping still to remove 17 unreacted monochlorobenzene. That had changed the nature 18 of the operation in several useful ways. The crude stream 19 was cleaner and easier to handle. 20 Q Do you know when that change was instituted, the 21 stripping still? 22 A No. From the context it was prior to this memo.
Page 618 1 recognize whose handwriting this is on the first page? 2 A The memo is from Bob Fields, who worked for me at 3 the time, to Clarey Buckley. 4 Q And what was Mr. Fields, what was his job at that 5 time? 6 A He was an engineer working for me. 7 Q Did he have an area of specialty? 8 A Most of the time that he worked for me he worked 9 in the nitroanilines area, but this memo refers to the 10 nitrochlorobenzene department. They were somewhat related 11 departments. 12 Q In what sense were the Ona and the 13 nitrochlorobenzene departments related? 14 A Nitrochlorobenzenes were the raw materials for 15 making nitroanilines. 16 Q How did the Ncb reach the Ona department? Am I 17 correct in saying the Ona department? 18 A There's two. There's Pncb and Oncb are raw 19 materials or Ona and Pna which are made in the same 20 building considered to be separate departments. 21 Q How did the raw material from the Ncb department 22 reach those departments?	Page 620 1 Q Where did that crude stream go? 2 A That was part of what was changing at the time. 3 This flow sheet was rearranged several times and at one 4 time the first step after — the first step of refining 5 after crude was made was what was called a crude 6 crystallization which was simply a crystallization step and 7 after that various fractionations. 8 At around this time we were changing things 9 around and I believe that we ended up changing so the first 10 step would be distillation rather than crystallization and 11 the requirements on a feed stream changed just because the 12 separation method was changing. 13 Q The Mr. Fields handwritten memo continues " The 14 sludge which builds up in these tanks is mostly Ncb. " Do 15 you see that reference? 16 A Yes. 17 Q Does that refresh your recollection as to there 18 being a situation involving a buildup of sludge around 19 tanks associated with the Ncb storage department — or the 20 Ncb department? 21 A No. 22 Q There's a handwritten note up above that says

Page 621 1 " still a problem " with a question mark. Do you see that? 2 A Yes. 3 Q Do you know whose handwriting that is? 4 A No, it's not mine. 5 Q Can I ask you to turn to the last couple of pages 6 that has Bates numbers 212 and 213. If you look at the 7 last page it appears to be a signature of C. F. Buckley, do 8 you see that? 9 A Yes. 10 Q Do you recognize his handwriting? 11 A Yes, this appears to be Clarey Buckley's 12 handwriting. 13 Q And on the second to last page, the page with 14 Bates number 412, there's a reference to your name up in 15 the top right-hand column. Do you see that? 16 A Yes. 17 Q And the re: line is " Cleaning Underground Tanks, " 18 do you see that? 19 A Yes. 20 Q Does this refresh your recollection at all as to 21 being involved in any projects involving cleaning of solids 22 from underground tanks associated with the Ncb department	Page 623 1 presumably this refers to the crude storage tanks. 2 Q Where were those crude storage tanks located? 3 A In that department, but I can't tell you exactly 4 where. 5 Q Do you have any knowledge about what they 6 consisted of? 7 A They're horizontal steel tanks. 8 Q Again, Clarence Buckley's handwritten memo at the 9 end of this exhibit refers to underground tanks. Do you 10 recall those tanks being underground? 11 A I remember we had quite a few underground tanks 12 in that department. I suppose that the crude tanks were 13 underground. 14 Q Do you know whether they were encased in 15 anything? 16 A I don't remember that. Underground storage at 17 one time was a very conventional standard way of doing 18 chemical storage just as gasoline stations had underground 19 tanks and so forth. Practice these days is generally 20 discontinued. 21 Q When was the practice generally discontinued, to 22 your understanding?
Page 622 1 around the mid -' 60s? 2 A No, I don't remember this. 3 Q Do you recall there being underground storage 4 tanks associated with the Ncb department around this time 5 frame? 6 A Yes, I remember there were some. 7 Q Do you recall how many there were? 8 A No. 9 Q What went into those storage tanks? 10 A I think some of them were used for crude Ncb and 11 some for finished product. Some were used for what were 12 called fractions, meaning materials that had been partly 13 resolved into their components but not completely. The 14 mined operation that makes nitrochlorobenzenes, 15 orthonitrochlorobenzene and paranitrochlorobenzene is one 16 of the most complicated I've ever seen and there are lots 17 of tanks. 18 Q On the first page of the exhibit the reference to 19 " The sludge which builds up in these tanks is mostly Ncb, " 20 do you have an understanding as to what those tanks refers 21 to? 22 A The title of this is " Solids and Ncb crude " so	Page 624 1 A I think probably the beginning or late ' 60s. 2 Q Why was the practice discontinued as a general 3 matter in the late ' 60s? 4 A It was found that in many materials, including 5 gasoline at gas stations and so forth that it was not 6 uncommon to have a leak in such a tank which might just be 7 from external corrosion rusting from groundwater. It was 8 often difficult to detect such a leak and the ground would 9 be contaminated from a leak like that. So it was decided 10 that it was a troublesome practice that should be 11 discontinued. I think there are now some Epa standards for 12 underground tanks requiring double walls and so forth which 13 of course did not exist at that time. 14 Q Do you know whether the storage tanks, the 15 underground storage tanks associated with the Ncb 16 department had double walls at that time? 17 A No, I don't know. 18 Q Did Monsanto at the Krummrich plant undertake an 19 overall program or project at some point of discontinuing 20 storage in underground tanks? 21 A I think we changed our standard such that, such 22 that new tanks would not be put underground. I don't

Page 625 1 remember if we've had a campaign to eliminate underground 2 tanks or not. I have not worked in a plant for 15 years so 3 there may be such a program, but I don't know about it. 4 Q When you say you believe that Monsanto changed 5 its standards, changed its standards in what way? 6 A In terms of the way a new department would be 7 built or the way a new storage tank would be designed. 8 Q Do you recall specific changes in standards that 9 were implemented? 10 A No. 11 Q Do you recall approximately when those changes in 12 standards were implemented by Monsanto? 13 A No. 14 Q Let's go to Exhibit 129. First of all, do you 15 see your name listed as a copy recipient up on the top 16 right-hand corner? 17 A Yes. 18 Q What is this exhibit? 19 A This is a work proposal. It was a standard form 20 that was filled out to request work from the plant, 21 research and development laboratory. 22 Q What was your role in this type of work proposal	Page 627 1 A Oh, yes. 2 Q Were those storage tanks in different areas? 3 A I don't know. 4 Q Do you recall ever hearing or learning that any 5 Mcb storage tanks had been leaking? 6 A No. 7 Q Was Mcb, is that a corrosive material? 8 A No. Mcb is an article of commerce that's shipped 9 in steel tank cars. 10 Q Are you aware of any projects associated with the 11 nitrochlorobenzene operations at the Krummrich plant to 12 determine whether leakage from storage tanks was a problem? 13 A I remember that some of the underground storage 14 tanks in this department had to be replaced due to 15 corrosion, but I don't know the circumstances of the 16 corrosion. 17 Q Do you recall when that was? 18 A No. It was during my time at the Krummrich 19 plant. 20 Q Was that during the time you were a Tsd group 21 leader at the Krummrich plant? 22 A Yes. I just remember hearing about projects to
Page 626 1 in the 1965 time frame? 2 A I didn't have any direct, any direct role to 3 initiate or approve such a proposal. The fact that I am 4 included in the distribution indicates that somebody 5 thought I might be interested in the results. 6 Q The first sentence reads " The Ncb storage tank in 7 department F221 is leaking. " Do you see that? 8 A I think it's Mcb, which would stand for 9 monochlorobenzene. 10 Q I was just -- I agree that does sort of look like 11 an M. If you look up at the top it says, " Product, crude 12 nitrochlorobenzene, " do you see that? 13 A That's right. 14 Q Would your testimony still be that down below 15 refers to monochlorobenzene? 16 A Monochlorobenzene was a raw material to make 17 crude nitrochlorobenzene so it's plausible that there would 18 be an Mcb storage tank in that department. I don't 19 remember as a fact that there was. 20 Q Were there separate storage tanks to your 21 knowledge for nitrochlorobenzene and monochlorobenzene and 22 what was the other one, paronitrochlorobenzene?	Page 628 1 replace underground storage tanks. 2 Q Do you know who worked on those projects? 3 A Ordinarily that would be the maintenance 4 engineering department doing simple replacements. 5 Q Do you know who if anybody from Tsd was involved 6 in that? 7 A No, I wouldn't anticipate that a Tsd engineer 8 would be involved in a tank replacement, not unless the 9 design was being changed for some reason. 10 Q Were those underground storage tanks that were 11 being replaced? 12 A Yes. 13 Q Were they being replaced with other underground 14 storage tanks? 15 A At that time I believe they were. 16 Q Was there a decision made to replace them with 17 underground storage tanks rather than aboveground tanks? 18 And I ask that because there's a reference in Exhibit 127 19 to the possibility of using aboveground storage tanks 20 rather than underground storage tanks. 21 A I don't remember any specific decision about 22 that.

Page 629 1 Q Do you recall which tanks the departments were 2 associated with that had to be replaced? 3 A No. 4 Mr. Brock: Off the record. 5 (Discussion off the record.) 6 (Savage Exhibits 130 through 132 7 identified.) 8 Mr. Brock: I've marked three new exhibits for 9 the record. Exhibit 130 has Bates numbers Wgk 2042381 10 through 382. Mr. Savage, could you let me know when you've 11 had a chance to look through that. That's dated January 12 25, 1965. 13 (Witness reviewed the document.) 14 By Mr. Brock: 15 Q Just for the record, I note that you're referring 16 to a previous exhibit. What exhibit are you referring to? 17 A I'm looking at Exhibit 127 which seems to be a 18 memo on the same subject nearly a year later than 130. I 19 was just trying to make the connection. 20 Q Good point. What is the significance to you of 21 the timing of the two memos? 22 A Simply that in Exhibit 130 Clarey Buckley is	Page 631 1 project involving the installation of aboveground storage 2 tanks for crude Ncb? 3 A Well, I would have been somewhat connected with 4 the project. At the time we were doing various expansion 5 projects and it related to this department and the large 6 projects were being handled by some people from organic 7 engineering. Certain smaller projects were being handled 8 by a couple of my people. And I really don't know whether 9 we did this piece or not. 10 Q Who is J. K. , and I hope I don't mispronounce the 11 name, Rodell, R-o-e-d-e-l? 12 A John Roedel was a chemical engineer who was 13 working for me at the time. He's now a patent attorney and 14 a partner in a firm in St. Louis. 15 Q I don't know whether that's a step up or down. 16 A I thought it was down at the time. 17 Q Did he have any responsibilities regarding 18 underground or aboveground storage tanks at that time? 19 A Not specifically. He was the process engineer 20 that I had assigned to work in this area. 21 Q Was there anybody at the Krummrich plant within 22 the Tsd department who specialized in underground storage
Page 630 1 writing to me posing the problems of solids and crude Ncb 2 and suggesting several possible solutions and Exhibit 127 3 which we looked at before he seems to have come to some 4 conclusion about it. 5 Q Do you know whether the proposal embodied in 6 Exhibit 127 which is making the use of aboveground storage 7 tanks for crude Ncb, do you know whether that was ever 8 implemented? 9 A I believe it was. 10 Q Was that around the time of this memo, Exhibit 11 127? 12 A Obviously, it would have been after that. It is 13 approaching a time that I left the Krummrich plant. So 14 whether it was done when I was still there, I don't know. 15 Q It was done approaching the time that you left 16 the Krummrich plant? 17 A This memo, Exhibit 127 is December 1965. If I 18 remember exactly I guess it was 1967 when I left the 19 Krummrich plant so perhaps this had been implemented by the 20 time I left. I recall that it was implemented, but I don't 21 remember when. 22 Q You didn't have any responsibilities regarding a	Page 632 1 tank matters? 2 A We would not have been that specialized. We did 3 have some mechanical engineers in the department who were 4 competent in the area of storage tank design whether 5 underground or not. 6 Q And who were they? 7 A Mechanical engineer reporting to me named 8 McConnell Magnetti. There was an unusual gentleman who was 9 a registered professional engineer who had never been to 10 college and acquired registration as a professional 11 engineer through his experience. Excellent engineer. 12 Q Do you know whether he's still alive? 13 A No, I haven't heard of him in a long time. He 14 would be, I think, over 80 years old now. 15 Q Let's go back to Exhibit 130. It starts " Our 16 present method of washing Crude Ncb results in the 17 precipitation of calcium and magnesium carbonates from city 18 water together with oxides of iron from the iron salts 19 present in the nitration process. This is carried forward 20 with the streams leaving the process and settles as a 21 sludge in storage tanks. " 22 What were the streams leaving the process that

Page 633 1 would carry that -- those chemicals forward? 2 A Nitration of monochlorobenzene to make crude 3 nitrochlorobenzene is done with a mixed acid of sulfuric 4 and nitric acids. And after the nitration is completed 5 there was a separation made simply by differences in 6 specific gravity to separate the spent acid from the crude 7 nitrochlorobenzene. That's not a perfect separation so 8 there's some acid material in the crude nitrochlorobenzene 9 that's removed in a washing step where alkaline wash water 10 is contacted with the crude. What leaves the washing step 11 is spent wash water and crude nitrochlorobenzene. The 12 crude nitrochlorobenzene is wet. To my recollection 13 there's a dehydration step after that, but I'm not sure. 14 Q Where did that stream go? 15 A Which one? 16 Q Okay, I thought you said there was a stream 17 involving spent wash water and crude Ncb? 18 A No, two different streams leaving the wash step. 19 One is crude Ncb and the other one is spent wash water. 20 Q Where did the crude Ncb stream go? 21 A It's my recollection that it went through a 22 dehydration still which simply was a vacuum treatment to	Page 635 1 A Yes. 2 Q Okay. Do you recall that the presence of a 3 sludge presenting an almost unsurmountable problem for 4 removal from an underground tank associated with that 5 department? 6 A Just from this description it sounds very 7 difficult. I don't remember this particular problem. 8 Q Do you remember there being difficulty in 9 removing sludge -- when it says " removal from an 10 underground tank, " does that refer to removing it from the 11 inside of the storage tank? 12 A Yes. 13 Q Do you recall that being a problem sometimes? 14 A Well, it certainly would be -- Ncb, the Ncbs are 15 toxic materials. The only way to remove such a material 16 probably is to put a person inside that tank and the 17 precautions in doing that are quite complex and time 18 consuming. 19 Q Why would that be the only way to remove that 20 from the tank? 21 A Well, I think that's what Mr. Buckley is 22 reflecting, at the present he has no other way and later on
Page 634 1 remove water and then to the still that I mentioned earlier 2 called an Mcb stripper which removed a few percents of 3 unreacted monochlorobenzene. The result of that was called 4 crude Ncb which went to storage tanks. 5 Q And the spent wash water, did that go to the 6 sewers? 7 A Yes. 8 Q Would there be other -- what, if any, other 9 chemicals would be in that spent wash water other than just 10 water? 11 A I don't remember the details of that process 12 well. There would be some sodium sulfate and some sodium 13 nitrate representing the neutralization products of the 14 acids that are present. Probably are some other things, 15 but I don't remember the details of that process. 16 Q There's a reference or a sentence in the memo 17 which reads, " When saturated with crude Ncb, as this is, it 18 presents an almost insurmountable problem in removal from 19 an underground tank. " 20 The reference to when it says, " When saturated 21 with crude Ncb, as this is, " the reference to " this, " would 22 it be your understanding that that refers to the sludge?	Page 636 1 in this memo he presents some other ways. 2 Q When did you first come to have the understanding 3 that Ncbs were toxic materials? 4 A When I was first introduced to the department. 5 Q Was that when you joined the -- when you came 6 into the Tsd department at the Krummrich plant or sometime 7 before that? 8 A Actually, before that because when I was at the 9 Queeny plant right after I joined the company one of the 10 projects that I worked with involved the use of 11 paranitrochlorobenzene as a raw material. So as part of my 12 indoctrination into that operation, I learned about what we 13 knew about toxicity. 14 Q How did you come to learn that Ncbs were toxic 15 materials? 16 A I think it was part of the instruction I received 17 from my boss at the time that I began working in that 18 department. 19 Q Do you recall any occasions on which the sludge 20 simply couldn't be removed from storage tanks associated 21 with the Ncb operations at the Krummrich plant? 22 A No.

Page 637 1 Q Do you recall any occasions on which somebody 2 went into those tanks to remove the sludge and suffered 3 some sort of ill effects? 4 A No. 5 Q There's a reference down below in the next 6 paragraph to the sludge collecting in still bottoms and 7 eventually leaving the system as still residues. Do you 8 see that in the next paragraph of Exhibit 130? 9 A Yes. 10 Q The reference to leaving the system as still 11 residues, what does that process refer to, what is that 12 process? 13 A This refers to this whole complex. I think much 14 earlier when we talked about the Queeny plant we talked 15 about operations at the Queeny plant that involved 16 materials that had come from Krummrich and went back again 17 and so forth. The whole complex for sorting out the 18 isomers of nitrochlorobenzene involved crystallization and 19 distillations at both the Krummrich plant and at the Queeny 20 plant. And for those big systems to reach equilibrium 21 might take a couple months as materials were moved back and 22 forth.	Page 639 1 the Krummrich plant ; correct? 2 A Yes. 3 Q Do you recall there being projects going on to 4 eliminate solids from crude Ncb in or around the 1965 time 5 frame? 6 A No. 7 Q Do you recall there being efforts to eliminate 8 the necessity of cleanouts of the tanks associated with 9 that department? 10 A No. This doesn't ring any bell with me. 11 Q I thought you had mentioned earlier that Clarence 12 Buckley was trying to address the situation of somebody 13 needing to go down into the tanks? 14 A I think that was my interpretation of his memo of 15 January ' 65, but I don't recall specifically working on 16 that problem. 17 Q Let me ask you to turn to Exhibit 132. 18 I believe you talked about working on accident 19 investigation committees earlier. If you look at the last 20 page of this there's a reference to " J. R. Savage, 21 Chairman, " do you see that? 22 A Yes.
Page 638 1 Q The reference to still residues, where did those 2 go? 3 A Where did they go? 4 Q Right. 5 A I don't know. 6 Q I thought you mentioned that this involved a -- 7 A Fractions were shipped back and forth between the 8 plants. The final distillation at either plant would 9 eventually create a still residue which presumably was 10 disposed of. 11 Q Would that be the materials that were taken off 12 by shipping? 13 A Yes, I suppose so. 14 Q Or do you know how that was disposed of? 15 A No. I was not ever in operations at the 16 Krummrich plant. That's not something that I would have 17 been involved in. 18 Q Let's go to Exhibit 131. You're listed as a copy 19 recipient up in the top right-hand corner of this ; is that 20 correct? 21 A Yes. 22 Q Okay, and this is a work proposal associated with	Page 640 1 Q What did it mean to be a chairman of an 2 investigation -- accident investigation committee? 3 A Well, obviously, I was a member of the committee 4 and in being named chairman that meant it was my 5 responsibility to author the report and to call meetings 6 and so forth. 7 Q What separated a major accident from a minor 8 accident at the Krummrich plant in this time frame, meaning 9 October of 1965? 10 A I'm not very clear on that. But it's pretty 11 definite that if anyone was hurt, that would be considered 12 a major accident. 13 Q Are you familiar with William Fultz, F-u-l-t-z? 14 A No, I don't remember him. 15 Q Let me ask you to take a look, just glance 16 briefly through the second page of the document and read 17 through the bottom paragraph on that page and let me know 18 when you've had a chance to do that. 19 (Witness reviewed the document.) 20 A Okay. 21 Q Do you recall the general subject matter of any 22 workers at the Krummrich plant suffering injuries as a

Page 641 1 result of exposure to nitrochlorobenzene? 2 A I had forgotten about this incident, but I 3 vaguely remember having seen this report. 4 Q What was the crude distillation column? 5 A That was the name given to a very large 6 distillation column which was one of the first steps in 7 separating the isomers. 8 Q Can you describe for me the work that was going 9 on in the column at the time of this injury? 10 A I can't add anything to what the -- to what's in 11 the document. They were making repairs that were necessary 12 because of failure of a packing support. 13 Q Did you draft this accident report? 14 A Since I was a chairman I would assume I did, 15 although I don't remember writing it. 16 Q The words near the bottom of the second page, and 17 this is the next to last sentence, " A blood test confirmed 18 that he had been exposed to a toxic material such as 19 nitrochlorobenzene. " 20 A Yes. 21 Q Those would have been your words? 22 A I think so.	Page 643 1 A I think so. 2 Q Do you recall who that worker was? 3 A No. 4 Q When you said " operator, " was that in a 5 nitroanilines department? 6 A Yes. 7 Q At that time did you regard nitroanilines and 8 their derivatives to be toxic chemicals? 9 A Yes. 10 Q When did you first come to have that 11 understanding? 12 A As soon as I began any kind of work with 13 nitroanilines. During my time with Monsanto in 14 manufacturing I was involved with numerous different 15 operating units and my practice, which I think was general 16 in the company, was that one of the first things I would do 17 in beginning work with a different operation was to learn 18 about the materials being handled, any hazards that might 19 have been associated with them. 20 Q When you say during your time with manufacturing, 21 are you referring to the early time when you were at the 22 Queeny plant?
Page 642 1 Q Do you recall any other incidents of people at 2 the Krummrich plant suffering any injuries as a result of 3 exposure to toxic chemicals such as nitrochlorobenzene? 4 A Yes. 5 Q What are the other incidents that you recall? 6 A First of all, this is not necessarily incidents 7 that I had any direct or immediate knowledge of. 8 Obviously, this one where I had written up an accident 9 report was someone that I had understood in some detail. I 10 remember one other accident where I believe I was on the 11 accident investigation committee, I don't know if I was 12 chairman or not. It occurred in the building that we 13 called the nitroanilines building in which an operator was 14 sprayed with a mixture of some similar material that I 15 believe it was nitrochlorobenzene or one of the 16 derivatives. And it's my recollection that he also got 17 sick, although he was also burned by the hot material. 18 Q Do you recall approximately when that took place? 19 A It would have been during the time I was at the 20 Krummrich plant, but I can't be any more precise than that. 21 Q Do you know whether that was during the time you 22 were a Tsd group leader?	Page 644 1 A No. Any of my time in the first 15 or 20 years 2 with Monsanto. 3 Q Do you recall when it was that you first had 4 occasion to learn about the toxicity of nitroaniline 5 compounds and their derivatives? 6 A It would have been at the Krummrich plant. I had 7 not had any previous experience with nitroanilines. 8 Q Do you recall any other incidents of worker 9 exposure to toxic chemicals at the Krummrich plant 10 resulting in injuries? 11 A I remember an incident in which a production 12 supervisor went into a piece of equipment and sustained 13 some kind of injury, either lung irritation or something. 14 I had no involvement in that. Whenever there was an 15 accident that was investigated, it was a routine practice 16 to post and circulate the investigation reports so everyone 17 would read them. 18 Q Do you know what chemical or chemicals had caused 19 that lung irritation? 20 A It was in the sulfuric acid department, but I 21 don't know specifically what he was exposed to. 22 Q Do you recall who that production supervisor was?

1 A That was Jim Duggan, D-u-g-g-a-n.
2 Q D-u-g-g-a-n?
3 A Yes.
4 Q Do you know whether he's still alive?
5 A I think so.
6 Q Does he still work for Monsanto?
7 A I think he retired very recently.
8 Q Do you know where he resides?
9 A No.
10 Q Was he still at the Krummrich plant when he
11 retired?
12 A I don't think so.
13 Q Do you know where he was employed by Monsanto?
14 A No.
15 Mr. Brock: All right. Off the record.
16 (Whereupon, at 6: 20 p. m. , the deposition was
17 adjourned, to reconvene at 9: 15 a. m. , on Friday, May 21,
18 1993.)
19 _____
20 James R. Savage

Transcript Word Index

[& - 1993]

&	109	1248	180,000
&	407:14 469:12,13 473:20	569:14	551:3,5
405:9 406:2,15 488:20	11	125	19
588:15 589:2	415:16 541:20 552:20	407:30 599:3,4	411:21 413:19 542:3
0	11/14/63	126	19103
	407:25	407:31 604:4 609:11 610:9	406:12
041	110	1268	1950s
411:10	407:15 473:16,19,21	554:8,15 563:6	457:17 480:22 483:3
1	111	127	495:20 517:14
	407:15 473:16,20 479:4	407:32 615:14,21 616:1,6	1957
448:1 449:1,7 487:2 488:1	112	628:18 629:17 630:2,6,11	432:20 461:21 607:11
503:3 506:15 511:11	407:17 482:13,14	630:17	1958
514:22 515:17 551:16	1120	128	411:22 413:8 415:16,21
555:19	406:17	407:32 617:22	456:18
1/27/59	113	129	1959
407:17	407:18 489:5 497:4	407:32 615:14 625:14	420:12 456:18 479:7 541:8
1/4/63	114	13	541:15,20 544:17,21
407:24	407:19 505:12 565:12	578:15	552:20 553:3 593:13
1/8	584:6,6 602:11,14 603:2	130	1960
598:2,10	608:18	629:6,9,18,22 632:15 637:8	431:1,13 578:15 596:11
1/9/59	115	131	597:14
407:20	407:20 541:14,18 542:10	638:18	1960s
10	544:9 565:20 576:13	132	495:21
523:11 603:17 607:15	116	629:6 639:17	1961
10/13/60	407:21 542:1 544:12	14	442:20 469:14 470:7
407:27	552:19,21 554:15 562:20	489:4 542:12 543:1	546:10
10/15/59	117	1401854	1962
407:30	407:22 542:2,7,9,11 602:13	507:16	542:3,12 545:6 546:5
10/2/72	118	1401857	1963
407:7	407:23 542:12,16 545:4	508:19	542:18 543:2 552:10 566:6
10/27/61	548:21	1401866	577:17 587:21
407:12	118-1	511:12	1965
100	405:8	1401870	615:17 616:1,10,18 626:1
407:7 409:14,16 444:19	119	584:12	629:12 630:17 639:4 640:9
445:9 454:15 520:10	407:24 542:17,21	1401890	1966
100,000	12	430:11	489:4 603:21
431:5	487:1 514:4 596:11 607:15	1402440	1967
101	12/14/62	442:12	630:18
407:8 411:5,9,9	407:23	1461	1969
102	120	408:13	506:19
407:8 411:5 415:12	407:25 542:22 543:6	15	1970
103	550:17 565:20 576:13	514:5 535:19 593:13 625:2	536:12
407:8 411:5,9,20 413:19	121	644:1 645:17	1971
414:7	407:26 566:5,10 573:7	1539040	505:9 506:1 509:1 516:3
104	576:11	411:10	527:7 535:4,19 584:20
407:9 420:7,8,11	122	1539264	602:12 603:8,12
105	407:27 578:14,18 582:7	482:15	1972
407:9 420:7,8 425:4	1220	1539644	409:17
106	405:18	469:15	19801
407:11 430:9,10	123	1539917	406:5
107	407:28 593:15	473:20	1980s
407:12 442:10,11	124	1540107	589:2
108	407:29 596:10	473:19	1991
407:13 448:21,22 457:22	1242	17	577:15
463:12 467:20 540:14,15	559:3 569:11	420:11	1993
577:1			405:15 645:18

[2 - abatement]

2	382	50,000	66
2	629:10	431:7	559:15
409:17 431:21 436:20,21	4	505	663
491:9 494:4 503:3 560:16	4	407:19	469:16
610:9	422:6 445:21 523:6 542:18	50s	68
2/11/59	551:2 611:12	453:15 562:13	554:17
407:21	4/20/59	541	7
2/8/60	407:10	407:20	7
407:11	4/20/66	542	508:18 566:6
20	407:31	407:21,22,23,24	7/14/66
405:15 519:19 584:11	40	543	407:18
603:21 644:1 645:16	431:7 451:4,8 452:18	407:25	7/19/62
2000	498:20 514:1 546:11	5460	407:22
480:20 526:10	559:16 611:2,4,5,7	563:6	70
20036	40,000	566	522:20 577:7
406:19	448:10	407:26	70s
2005	408	578	455:5 558:6 561:22 589:19
406:11	407:4	407:27	75
202	409	58	454:15
498:14,17,21 549:9	407:7	607:12	76
2042381	411	593	523:2
629:9	407:8	407:28	7710
2042409	412	596	478:3
615:19	621:14	407:29	8
2048923	420	599	8
615:18 616:7	407:9	407:30	414:16,17 479:7 534:18
21	430	6	80
469:14 615:17,22 616:10	407:11	645:16	460:5 546:3 613:2 632:14
645:17	442	6/15/59	858
212	407:12	407:28	534:19
621:6	443	6/17/59	88c
213	446:16	407:9	405:8
621:6	445	6/23/59	891
25	442:12	407:16	431:21
629:12	448	6/7/63	892
2500	407:13	407:26	436:13
421:17	45	6/8/59	897
266	488:1	407:15	437:11
482:15	46	60	898
3	450:12,17 451:2,14	514:9 546:3	430:11 437:11
3	469	600	9
405:13 422:6 512:21	407:14	523:6	9
516:15 550:18 560:16	473	604	405:19 541:8,15 645:17
566:19 573:13 609:14	407:15	407:31	9/21/61
30	482	60s	407:14
457:11,16 487:2 505:9	407:17	558:6 622:1 624:1,3	9/30/71
514:1,7,13 549:17	489	615	407:19
30,000	407:18	407:32	90
448:8,8	5	63	460:5
300	427:7,8 584:11 604:15	552:17	902
406:18	50	65	406:4
35	405:19 409:6 437:9 438:10	639:15	a
487:1	514:9	655	abatement
350		469:21 470:16	481:9
406:3			

Savage, James (Aroclor Dept employee) in AETNA (3)

[able - analyzed]

able 417:13 448:16 488:15 519:3 539:21 584:18	acid (cont.) 476:6,7 508:5,6,7,8 512:6 512:11,15 517:9 518:9,17 519:2,8,21,21 520:1,3,14 521:3 522:9,11 530:2,3 535:6 536:7,19 557:18,22 565:13 576:8,9 587:21 595:19 596:2 600:20 633:3 633:6,8 644:20	adjacent 498:12	alabama 471:3 488:22 495:17 498:21 549:9
aboveground 587:16 616:15 628:17,19 630:6 631:1,18	acidic 512:10	adjourned 645:17	alive 632:12 645:4
absence 614:2	acidity 414:15 458:17,19 529:22	adjustment 538:13	alkaline 458:19 557:16,17 633:9
absolutely 541:11 575:17	acids 518:4 633:4 634:14	adopted 432:16 481:13 482:3 558:22	allegation 472:3
absorbed 428:8 465:17	acknowledge 584:9	advice 594:13	alleged 422:4 470:11 557:10
absorber 465:15 519:21 520:8	acquired 632:10	advocated 524:6	alleging 422:9
accelerates 440:16	acre 457:16	aerated 492:8	alleviate 581:17
acceptable 412:15	acres 449:17 457:11	aeration 491:19,21,22 492:5,22 493:10,13 538:5,13,15 539:3 582:8,13 583:17 584:19,22 585:6 587:10,11 590:9 611:17	allocating 509:20
access 475:14 501:4	action 405:7 441:22 509:14	aerosol 428:2,17	allowed 553:4 559:22
accident 639:18 640:2,7,8,12 641:13 642:8,10,11 644:15	activated 495:8 598:18	aetna 405:9	allows 476:7
accidental 605:5	active 518:3	afternoon 488:1	alloy 576:1
accomplish 574:5	activities 421:5	agent 558:10	alloys 575:22
accomplished 514:11 532:6	actual 490:15	aggressive 576:2	alternate 598:14
accomplishing 513:14	actuality 503:20	aggressively 562:1	alternatives 531:4
account 444:3 507:10	add 475:19 641:10	agin 480:18	amalgam 523:15,18,20 524:9
accounting 509:14	added 437:6 512:13,18 516:8 532:15 546:11,14 570:19 582:17 583:14 592:19 598:19	agitated 538:18	ambient 555:19,22 556:19 613:3
accumulate 476:7 524:11 533:22	addition 554:10,11	agitation 419:6	amend 610:19
accumulated 524:13,18 525:6 527:22	additional 435:7 447:6 530:7 561:15 561:16	agitators 575:22	american 406:20 572:6
accumulating 524:9	additions 490:16	ago 439:11 449:20 535:22 568:6	amount 419:7,11 444:11 521:9 526:22 530:3 533:12 535:12
accurate 451:16,20 478:8 555:3 598:1 616:1	address 408:12 482:4 639:12	agree 479:16,17 567:12 626:10	amounts 410:19
acetone 419:7 433:20 434:11,14,20 434:21 435:1 444:1,2,14,16 444:17,20,21 448:7 476:19	addressing 437:14 469:5 617:1	agreed 488:7	amused 539:20
achieved 419:3	adequate 480:12	agreement 405:17 547:2	analog 603:13
acid 414:21 415:10 426:19 427:19 428:5,6,8,22 432:8 435:4 436:5 445:18 458:13 458:20 459:1,8 464:21 465:4,6,7,10,15,17,18		air 484:12 538:16,17,18,20 555:19,20,22 556:19 594:7 611:16	analysis 446:9 463:13 472:11,14,14
		al 405:10	analytical 443:11 472:16 494:1
			analyze 615:4
			analyzed 427:9

[anderson - attapulugus]

anderson 406:2	apparently 476:13 479:11 553:3 578:4	area (cont.) 483:16 501:18 544:22	art 604:10,10
anecdotal 410:19,21	appear 479:6 583:12 587:1	546:11,13 549:18,21	article 627:8
animal 439:4,7	appearances 406:1	550:14 576:16 577:6 580:7	ash 433:19 434:4,7 476:2
ankeny 506:4	appeared 456:20 540:6 583:15	585:20 587:9 595:2,5,10	aside 472:6
ann 411:10 430:11 442:12 469:15 473:19,20 482:15	appears 442:17 443:10 450:19 585:8,11 587:11 596:8 621:7,11	600:5 605:17 606:3,11,14 606:18 607:13,19,22 608:22 609:4,7 610:11,18 611:10 612:15 613:7 618:7 618:9 631:20 632:4	asked 410:5 421:15 422:11 468:18 533:17 606:22
anniston 412:11 413:9 415:22 416:11 422:9 425:7 432:17 442:16 449:1,11,16 450:18 450:20 451:22 452:15 453:18 455:4 457:17 459:2 461:1 466:20 468:9 469:3 471:3,13,15,20 472:1,9,19 472:21 473:7,11,13 488:22 489:21 494:3 495:17 497:12 498:1,12 505:8 506:7,10 507:8,16,19,21 510:1,6,7,13,19 518:13 526:5 527:7,11 531:17 534:11 537:3 538:1 539:20 540:12 542:3,18 543:22 544:1 550:2 552:11,17 560:10,21 561:3 562:18 564:11 567:21 568:8,16 570:1,3,6,11 571:5,13 577:3,11,17 578:7,16 580:16 583:2 595:8 597:15 599:14 603:17,22 604:1,9 604:11 605:3 606:14 608:16 610:6 615:11	appended 511:10	areas 449:13 450:6,8 475:8 564:17,18 573:8 611:2 612:13 627:2	asking 423:5 472:22 488:21 548:15 594:13 601:2
	application 478:13 614:13,16	arobrome 561:21 562:5	assigned 631:20
	applied 558:10 571:1	aroclor 464:16 465:9,10,16 467:22 468:4 498:9,15 501:16 504:11,14 515:18 516:1,1 518:14 521:6,9,12 522:3 525:14,22 531:7,21 532:3 532:11,22 533:1,20 537:5,9 540:22 541:16,22 542:5,15 542:20 544:18 545:9 546:2 546:8,10,11,13 547:12 548:4 552:2,6 553:5,6,17 553:20,21,21,22 554:3,8,9 554:13,19 555:11,19 556:1 558:15,22 559:3,4,7,20 560:15,22 561:7,11,21 562:15,18,21 563:1,6,6,16 563:17,22 564:1,10,17,21 565:10 566:8 567:1 568:10 568:16 569:11,13,17 570:1 570:6,10 571:7,14 573:9 574:12 575:8	associated 449:10 458:9 511:19 512:1 520:19 537:1 553:6 554:4 579:7 610:12 611:17 614:6 617:18 620:19 621:22 622:4 624:15 627:10 629:2 635:4 636:20 638:22 639:8 643:19
	approaching 630:13,15		association 610:7
	appropriate 439:3		assume 508:14 568:9 576:19 587:14 600:10 611:16 641:14
	appropriation 430:17,22 431:3		assumed 552:1
	approval 466:11 603:4		assuming 513:7 598:1
	approve 626:3		assumption 552:3
	approved 466:10		assurance 406:21
	approximate 513:16		assure 570:22
	approximately 409:4 451:8 457:16 483:6 498:16 523:3,9 546:2 577:7 625:11 642:18	aroclors 452:20 533:15 553:3,7 554:16 558:9,17,20 559:8 560:11 562:1 563:20 567:7 567:8	atmosphere 429:19 438:9
answer 428:9 462:19 467:2 468:19 496:4 529:8 605:13	april 596:11 597:14 603:20	arose 467:14 545:11,19	atmospheric 438:8 444:18 476:15
answered 468:18	aquatic 472:20 473:5,13	arrayed 538:16	attached 498:2 580:11 607:8
anticipate 628:7	aqueous 527:20 528:10,12,14,18 600:18	arrival 461:1	attaches 415:16
anticipated 440:12	arbitrary 523:2	arrived 413:9 491:18 501:17 503:11 581:1 591:17 592:17	attachment 615:18
anybody 601:11 628:5 631:21	arbitration 405:9		attachments 469:15
anymore 455:6	archie 474:10	arrow 420:15	attacked 426:19
anyway 413:15 500:22 522:4 567:19 604:13	area 410:5 449:5 450:15,21 451:17,20,22 453:20 454:4 454:8 456:7,7,9,15 475:2 475:22 478:11 482:8	arrows 583:1	attapulugus 533:16 534:12,14
apart 453:15			
apologize 566:6			

attempt 481:3	back (cont.) 525:19 527:19 531:6	batches 440:4,7 441:13 442:5	believe (cont.) 488:14 494:1 498:17 499:6
attempted 520:1 533:7 562:8	534:17 538:1 539:3 558:5	572:19 573:1,2,4	500:9 501:11 502:1 503:10
attempting 429:1 461:13	561:19 562:20 565:11	batchwise 433:9 437:5	503:22 514:15 516:19
attempts 524:3	573:7 577:1 584:5 586:19	bates 411:9 430:11 431:21	520:17 521:16 531:7
attention 409:21 468:13 472:18	588:21 589:22 601:18	436:13 437:11 442:12	532:16 537:8 539:18 540:4
473:3,4,14 506:14 507:14	602:11 603:16 608:3,18	446:15 469:15,20 470:16	541:8 545:5 552:17 553:13
508:17 511:9 534:18 540:9	612:4 632:15 637:16,21	473:19,20 482:15 507:16	559:21 560:6 562:6,8 564:6
540:17 543:13 544:11	638:7	508:18 511:11 534:19	569:2 571:9 572:13,14
550:16 552:18 566:19	background 494:6 496:22 497:1	584:11 615:17,19 621:6,14	576:15,16 579:5 582:17
604:14	backhoe 511:7	629:9	584:22 585:9 586:5 587:17
attorney 631:13	bacteria 495:5,7,8,10 614:13,15	bayer 572:12	588:3 590:1,22 592:3
attributed 470:13 472:9	bad 572:19 573:1 599:21 600:1	bearing 543:1	593:10 597:11 599:12,18
author 543:5 544:19 549:2,10	bagging 563:22 564:4	bears 508:18 511:11	600:19 604:12,18 606:19
551:8 573:17 576:15,16	bags 434:7,7 476:1 564:1	beaten 555:12	609:12 610:11 615:10
610:22 612:17 640:5	banging 555:2	beater 477:5	616:13 619:1 620:9 625:4
authored 447:21 489:20 550:21	bar 551:11,13,15,21,21	becoming 602:22	628:15 630:9 639:18
593:13 603:19	barrels 531:10,13,15,16 548:11,14	bed 413:4,11,12,14 458:1,4,9	642:10,15
authorized 550:9	based 446:8,10 490:1 510:2 560:7	458:12,16 459:4 460:19,21	believed 549:19
authors 566:2	577:10,18 581:19 602:7	461:4 462:8 463:5,9,16,19	believing 485:19
author's 567:12	603:3	464:5,8,11 465:19 466:3,17	bell 585:15 588:15 639:10
autoclaves 611:8	basement 493:5	467:1,4,16 475:6,7 498:14	bench 561:20
automate 434:9	basic 580:13	520:18 557:19 579:6 580:4	benign 538:3
autothermal 440:13	basically 582:10	581:7 583:17 586:4,18	benzene 453:13
auxiliary 433:17	basin 490:19 538:21 539:3 582:8	589:1,11,13,15 590:1,3	best 560:9 581:14
available 441:6 461:10 544:20 574:3	582:13 585:6	591:9,22 592:2,4 593:5	better 588:20
avoid 488:11,12 520:2,3 556:5	basins 491:19,21,22 492:6,22	beds 458:7 580:2 586:8 587:7	beyond 496:8
616:13	493:10,13 538:5,14,15,17	589:3	bicarbonate 444:10 459:10
aware 416:15 449:13 463:8 464:7	538:18,20 582:15 583:17	began 423:5 452:12 455:4 457:17	big 409:4 454:13 457:10
466:21 467:10,13 468:16	584:19,22 587:10,11 590:9	609:22 610:4 636:17	484:20 485:2 513:21 547:9
486:18 560:6 627:10	611:17	643:12	555:1 611:22 637:20
awkward 546:22	basis 423:10 484:15 493:9	beginning 408:10 532:16,16 624:1	bigger 431:7 484:6
	495:22 517:13 527:10,20	643:17	biggest 453:5
	588:22 589:22 591:4	begins 506:16	bill 431:15 443:7,16 447:21
	601:12 602:21 605:15	begun 560:19	462:3 506:7 511:6 581:18
	612:9	behalf 405:20 406:6,13,20	bins 475:22 476:4
b	batch 433:11 440:21 526:11	behest 422:19	biochemical 613:16
back 416:21 441:11 455:13	532:16 560:2 568:20	believe 421:21 422:2 439:20	biological 495:3 537:22 538:4 539:4
492:11 501:21 508:22	599:21 600:1,2	469:19 475:4 477:14	578:2 598:19 612:12
514:21 516:15 523:4			

[biological - care]

biological (cont.) 613:15,19 614:1	bottom 409:21 419:20 454:18 460:22 504:3 525:7 538:16 577:5 640:17 641:16	bubble 484:12	c
biphenyl 452:7,12 498:9 501:19 514:17 516:21 518:8 527:12 528:9 529:15,21 530:10 536:12 545:19 546:8,13 553:20 554:6,11 554:17 558:11 568:10 571:21 575:4 579:14 580:4 590:22 605:20 606:5,11 610:10,13,17	bottoms 502:10,11 504:10,14 541:17 545:13 552:15 565:21 637:6	bubbles 538:18,20 582:9	calcium 434:15,19 518:3 523:20 632:17
biphenyls 572:6	boucher 541:9,15,20 543:21 544:1	buckley 616:1,10 617:11 618:3 621:7 629:22 635:21 639:12	call 420:18,22 549:5 587:3,7 601:12 640:5
birmingham 406:21	bound 424:9	buckley's 621:11 623:8	called 405:16 418:8 420:5 436:20 436:22 440:13 452:8,14,20 453:3,4 456:8 461:2 462:7 499:21 501:9 502:10 504:12 508:8 520:7 522:22 524:14 525:18 526:9 527:12 533:18 534:10,11 534:14 537:18 538:7 559:1 559:14,15 560:1,15 563:8 563:17 575:20 586:12,12 588:5,14 599:8 620:5 622:12 634:2,3 642:13
bit 447:12 451:2 552:12 572:1	box 425:10 515:17 524:14,16	build 426:5 486:5 581:9,13	calling 561:4 599:17
blade 563:8,9	boxes 557:16,17 582:22	building 406:3 451:3,11 548:4 564:10,17,21,21 565:10 581:17 585:10 612:19 618:20 642:12,13	calls 421:1,4,6,9
blister 595:21	break 486:22 492:12 541:10 553:5 578:11	buildings 608:13,15	campaign 625:1
block 450:22 456:9 499:10 555:11	breakdowns 480:5	builds 620:14 622:19	campaigns 507:3
blood 641:17	briefly 408:19 640:16	buildup 620:18	campbell 406:15 488:20
blow 534:3 600:3	bright 539:15	built 453:18 461:1 462:13 464:10 475:5 486:10 491:22 492:2 493:3,6 517:4 581:20 583:19,20 591:16 616:15 625:7	canada 453:18
blowers 429:5 611:16,21 612:1	brine 595:10 601:20,21 602:6,7	bulk 444:3 578:4	cans 500:12
bluff 408:13	bring 525:17	bulletin 432:22	capacities 431:16
board 432:22	brink 427:5	bunch 453:12	capacitors 570:15 571:22
bob 618:2	broad 510:17	burn 435:7 549:21 567:19	capacity 437:9 480:12 494:10 581:13 617:8
bod 445:5 581:19 582:1 613:11 613:12 614:19	broadly 502:8	burned 435:18 642:17	capital 466:11 551:10,13,19
body 484:10	brock 406:7 407:4 408:7 409:15 411:7 420:8,10 430:10,12 434:1,3 442:11,13 448:22 449:2 463:2 466:14 468:21 469:13,17 473:18 482:14 482:16 485:11,12 486:21 488:6,17 615:16,20 616:5 629:4,8,14 645:15	burnett 406:1 408:22 462:18 466:13 468:18 485:10 488:13 500:2 529:7 540:2 540:14 542:10 576:17 605:11 616:3	captioned 584:17 610:10
boiler 608:1	broken 614:12,17	burning 435:12	carbide 531:15,17
bolts 567:18	bromine 558:9 561:19	burns 542:13,19 546:12,21	carbon 465:18 575:1
born 572:4	bromo 561:21	busy 536:3	carbonate 518:3,4
borne 521:21 522:1	brought 468:12 472:18 473:2,4,14 490:9 516:12 530:7	butter 523:14,17,19 524:1,4,9,19 525:1,3,7	carbonates 632:17
boss 443:10 474:12 506:8 636:17	brown 539:16	bypassing 579:16	care 419:14
bottlenecks 431:18			

[careful - clear]

careful 570:18	central 450:22,22 451:3,17	charles 406:14 488:20	chocolocco 470:7 496:3
carefully 509:4,17	centre 406:16	charlie 488:7	chocolocco 473:2
carried 539:5 632:19	ceramic 478:9 588:13	cheaper 481:21	choosing 608:21
carrier 539:4	certain 427:20 428:12,18 433:17 497:21 502:7 507:1 509:18 521:12 530:3 553:7 558:15 561:13 591:15 631:7	checked 410:15 418:22	chunk 555:9
carry 413:15 633:1	certainly 412:20 446:4 447:11 459:8 480:3 488:9,11 495:18 524:2 527:6 547:8 577:21 598:10 635:14	chemical 459:6,7 471:2,2 501:8,10 517:10 577:21 613:21 614:3 623:18 631:12 644:18	cincinnati 556:13
carrying 567:8	chain 603:4	chemicals 438:3 463:5 486:16 558:7 633:1 634:9 642:3 643:8 644:9,18	circle 585:20 609:7
cars 609:20 627:9	chains 525:19	chemist 443:13 577:21	circled 584:17
cartridges 429:15,17,17 436:6	chairman 639:21 640:1,4 641:14 642:12	chemistry 418:7 444:7 446:8,11 577:22	circles 513:19 514:3
case 405:10 408:20 441:6 458:21 463:1 479:20,21 509:22 567:18 568:10 580:13	challenge 447:12	chemists 417:8	circulate 644:16
cast 555:8 587:17	chance 430:14 449:5 469:21 482:18 489:11 543:18 629:11 640:18	chief 443:13	circumstances 543:5 581:22 627:15
casting 555:8 563:2	change 441:7 466:18 569:7 578:7 582:16 619:11,13,20	chilled 476:18	city 412:16,16 413:5,5 422:3 424:19 475:14 512:3 580:16,17,22 581:3,13,18 582:1,3 612:9 632:17
castle 405:3	changed 441:9 453:21 551:14 562:22 619:11,17 620:11 624:21 625:4,5 628:9	chloride 434:15,19 459:9 532:17	civil 405:7
casual 549:5 589:21	changes 419:5 476:10 561:10,16 625:8,11	chlorides 427:9,15,16,18,21 428:10 428:17	claimed 473:8
casually 453:4	changing 620:2,8,9,12	chlorinated 491:3 554:7,17 571:21	claims 473:1
casualty 405:9	channel 414:11 467:7 579:19	chlorination 436:19 479:13 480:2 490:18,21 520:22 526:8 527:4 554:12 558:9 569:3 574:16	clarence 606:20 616:1,9 623:8 639:11
catalyst 570:19	channelization 528:18 580:1	chlorinator 421:13 423:6,9 436:15 437:4,6,8 478:1 575:12 587:3 588:9,11,12,18	clarey 617:1 618:3 621:11 629:22
categories 507:21 508:1	characteristic 512:10	chlorinators 432:9 437:4 442:7 515:13 521:13,18,22 522:3,5 545:21 565:3 568:15,19,20 568:22 569:10 570:19 574:11 575:3,8,9,15,20 576:4 588:8	class 417:3
category 508:19 509:10 540:18	characterization 558:17	chlorine 522:13 523:5,8 546:9 556:17 557:9,13,21 570:12 574:21 575:1,2,3,10 576:3 576:7 595:10 601:19 602:6	clay 423:10,16,22 461:5 467:7 478:8 533:18,22 534:4,6 588:4 592:4,13
cause 410:10 419:9 421:8 555:10	characterize 467:5		clean 561:10,16 616:20 617:4,17 619:6
caused 567:13 594:22 595:16,20 613:5 644:18	characterized 417:7		cleaned 436:5 600:11 611:10
causes 443:20	charge 528:10 530:9 537:19		cleaner 619:19
causing 472:19			cleaning 609:20 616:14 621:17,21
caustic 478:12,16			cleanouts 639:8
cell 524:17			clear 640:10
cells 523:13 524:12,19			
center 509:11,13,15 602:17			

[clearer - considerably]

clearer 539:17	college 632:10	completed 568:17 591:17 633:4	concrete 475:13 493:2,5,16 510:6 565:5 590:8,10
clearly 482:6 504:6	color 415:6,7 539:13 604:20	completely 553:12 615:3 622:13	condensate 477:21
cleghorn 501:15 562:14	column 425:9 434:18 445:17 448:7 460:4,11,15 478:2 479:9 480:16,17 481:12 482:7 621:15 641:4,6,9	completion 445:10	condensation 417:21 418:6,8 419:5,8,9 432:11 444:8,16,17 459:18 459:19 460:10 476:14,15 476:20,21 573:2 574:2 612:17
cleghorn's 501:13,22 503:9,17,19 504:21 505:1 513:10 549:8 549:14	columns 480:12	complex 635:17 637:13,17	condense 476:19
cliff 411:21 415:21 479:6 493:14 597:13	comfortably 488:15	complicated 529:3 622:16	condenser 476:21
cliff's 416:6	coming 429:22 436:5 477:19 520:21 522:8 536:6 605:1	complied 583:6	condensor 476:18
close 495:14 555:4 584:16 605:19	commenting 539:21	component 444:1 445:3 452:11	conditions 445:12 476:16 613:4
closer 605:19,22	comments 482:1	components 442:19 445:22 446:5,7 453:5 459:6,7 490:15 518:1 538:5 622:13	conducted 443:12 570:17
closing 422:11	commerce 406:9 440:2 522:22 627:8	composition 518:7 619:11	confident 414:2
clothes 561:10,16	commercial 529:10	compound 567:20	configuration 501:22 558:3 585:8
cloud 505:2	commercialized 562:9	compounds 417:3 453:6 459:11,14 460:2 644:5	configured 589:5
coat 563:7	committee 640:2,3 642:11	comprehensive 504:9	confirm 565:19 568:4 582:7 601:15
cod 613:11 614:19	committees 639:19	compressor 484:11 585:10	confirmed 514:21 641:17
coffee 541:10	common 417:15 431:6 495:4 592:12	compressors 612:14	conform 536:13
coil 574:19	communicated 548:17	concentrated 619:5	conjunction 589:13
coke 520:4,7	companies 569:18 572:6,8,11	concentration 594:7	connect 443:20
cold 499:13 613:1,4	company 405:5,9 406:6,13,21,22,23 406:24,26,27 471:3 501:10 510:11,18 534:15 558:19 570:8 572:13 599:8,10 601:2 636:9 643:16	concentrations 557:2,8	connected 521:2 557:22 631:3
coley 489:4 493:18,20,21 496:21 537:4 557:7 603:19 609:12 609:14	compared 513:19 603:10	concept 517:8	connecting 607:16
coley's 494:6	compartment 524:16	concern 429:8 467:11,12 472:18 481:5 482:9	connection 413:18,22 425:20 430:18 437:15 442:15 471:7,22 472:2 557:3 604:9 629:19
colleagues 409:9	competent 632:4	concerning 416:16 420:19 421:1,22 422:19 449:1 470:20 471:8 471:14,20 474:1	conscious 481:1
collect 428:6 524:4 546:3	compiled 439:17	concerns 421:6 438:11 466:21 473:12	consequence 435:18
collected 426:7,19 427:18,19 465:17 545:16 547:12 551:9	complained 595:15	conclude 488:15	conservative 432:16
collecting 428:2 471:6 637:6	complaints 438:15 477:11,13	conclusion 500:6 605:15 630:4	consider 437:22
collection 414:13	complete 436:14,15 437:2		considerably 450:19 583:19

[consideration - crude]

consideration 581:8	contains 417:18 523:2,20 536:17	cool 612:5	cost 480:20 481:2,10 507:2
considerations 519:5	contaminated 624:9	coolant 453:17	509:11,12,15,20 570:15
considered 423:8 432:6 434:15 448:13 452:9,22 453:2 472:15 497:9 524:2 553:22 562:4 618:20 640:11	contemplated 413:10 437:1 445:22	coolers 612:2	581:8,17 602:17
considering 594:3	content 467:4 468:14 469:1 613:18	cooling 563:4 568:11 574:13,17,18 574:19,19 609:17 611:20 611:21 612:4,4,8,13	costs 507:4 509:16,17 547:7,9 567:14 581:21
consist 427:4 433:6 434:5 435:3 459:4	context 458:7 461:7 536:15 570:12 579:19 616:21 619:22	coosa 470:7 473:2	counsel 405:17 488:7 565:15
consisted 426:21 436:17 454:18 483:13 523:18 563:3 623:6	continue 429:4 484:20	copied 546:17	county 405:3
consistent 598:11,20	continued 405:22 408:6 432:2 559:12 584:1,2	copies 587:6 615:22	couple 408:21 429:3,12 493:22 512:22 539:12 569:13 570:7 621:5 631:8 637:21
consistently 571:1	continues 620:13	copy 409:17 415:13,17 420:11 420:13,16 425:14 430:17 505:11 542:8 545:5 566:7,9 584:10 616:2,7,9 625:15 638:18	course 409:18 414:1 417:21 429:3 438:7 439:16 468:15 508:9 508:16 521:5 570:16 577:14 584:20 624:13
constituent 515:5	continuing 581:16	corner 625:16 638:19	court 405:1,20
constituting 442:5	continuous 568:15,21 569:3,10 580:11 580:12	corporation 501:5	cover 415:13 417:18 437:18
constructed 493:1 591:10 592:9 593:3	continuously 433:11 460:1,4	correct 414:6 415:18 425:18 476:3 488:13 502:2 511:16 514:15 515:2 518:5 521:18 528:4 552:2 556:20 560:5 572:22 577:16 581:7 592:6 601:20 611:17 618:17 638:20 639:1	covered 408:9 517:22
constructing 545:21	contractor 510:6,19 511:1,6	correctly 416:22 460:7 464:15 507:5 574:10 601:1	covers 566:18
construction 492:5,21 493:7 503:9,17 517:6 588:14 589:11 591:8 591:13,14,17,21 592:2,8,10 593:1	contractors 591:15	correlation 410:16 417:19 443:20 614:7	cracks 480:7
consumed 529:22 530:6 533:11,12 536:18 539:8 613:21	contribution 446:1	correspond 586:20	crash 423:10
consuming 635:18	control 440:11 442:1 475:22 476:4 477:22 478:10 481:4 505:10 506:12 507:9 564:5 594:5 596:5 617:13	corresponded 559:5	create 638:9
contact 422:16,18 434:14 480:12 490:19 492:13 517:20 595:20	convenience 584:8	correspondence 407:8,32 599:12	created 444:14 523:15
contacted 633:10	convenient 597:1	corroded 588:1	creates 415:6
contacting 579:21	convention 553:19	corroon 406:2	creation 543:5 602:17
contain 465:6	conventional 554:5 613:12 623:17	corrosion 426:11,13 575:7 624:7 627:15,16	creek 413:18,20 414:6,9,13 415:3 464:14 467:5,6,10,17,20 468:1,5,15,17 469:1 470:7 473:2,9,10 495:17 496:2,3 498:11,13,18 514:19 515:1 516:20 537:5 539:22 540:5 540:6,18,22 541:3 557:7,10 557:13 610:10
contained 563:5	conversation 422:11	convincing 415:5,8	crestview 510:18
container 454:6,7 532:8 534:5	conversations 472:7 562:4		cross 590:17
containing 547:12 573:3	convert 522:9		crude 442:9 444:9,21 445:11 465:17 616:15 619:6,11,13

[crude - desirable]

crude (cont.) 619:18 620:1,5,5 622:10,22 623:1,2,12 626:11,17 630:1 630:7 631:2 632:16 633:2,6 633:8,10,11,12,17,19,20 634:4,17,21 639:4 641:4	dated (cont.) 603:20 615:17,22 629:11	demister 427:6 435:21,22 436:4,6 526:19	depletion 613:19
crushed 528:22 529:10	day 408:22 436:4 487:2 547:19 561:11 611:7,7	denora 523:13 524:12	deposition 405:13,16 407:6 408:20 409:8 487:1 488:15 645:16
crystalline 554:9	days 527:11 551:20 564:19 607:8 623:19	density 505:2	depress 613:2
crystallization 620:6,6,10 637:18	deal 421:5 471:14 584:21	department 425:5 446:2 450:11,16 452:18 454:8 455:20 457:20 458:10 459:3 461:10,17,22 462:2 464:2,8 464:16,20,20,21 465:4,6,10 465:11,14 474:12,13,15 475:21 477:10 490:8,11 491:2,4 494:12,14,14 497:6 497:10,12,19 498:3,5,9,15 501:16 505:8 509:19 511:15 515:18 516:1,1 518:10,18 519:2 520:19 521:2,3,6,13,17 522:8,13 522:17 525:15,16,21 530:22 531:5,5,6,22 532:11 535:7 536:7 537:10,14,17 541:22 544:2,4,19,20 546:2 546:20 547:14 548:1,4,13 548:18 552:2,6 556:10,18 557:9,9,14,18,21 558:1,4,8 559:7,20 560:22 561:1,11 563:16,17,22 566:8 567:1,2 567:10 568:10 573:9,14 574:8,12 575:16 577:9 578:1,5 579:8 580:22 587:4 587:22 594:10 595:6,19 597:10 608:16 610:1,8,13 611:13 617:8,10,18 618:10 618:16,17,21 620:19,20 621:22 622:4 623:3,12 624:16 625:6 626:7,18 627:14 628:4 631:5,22 632:3 635:5 636:4,6,18 639:9 643:5 644:20	depression 608:10
crystallize 613:3	dealing 433:3 470:19 480:21 617:20	depicted 585:4	dept 432:2
cubic 555:20	dealings 416:18		depth 528:13
cubical 572:21 599:17,22 600:11 600:12 601:3	dealt 431:18 440:12		derivatives 642:16 643:8 644:5
cubicles 432:12	debottlenecking 435:9		derived 553:20,21
culminated 535:14	december 542:12 615:17,22 616:10 630:17		describe 408:19 412:5,9 441:15 478:6 519:11 523:17 525:14 531:12 537:22 547:18 558:22 593:1 606:17 617:5 641:8
curb 565:7	decided 509:15 559:10 581:9,12 624:9		described 423:1 441:18 501:4 502:1 509:1,5 527:6 541:3 545:18 562:3 564:3 588:13
curbs 564:17,19	decision 519:5 529:5 535:15 628:16 628:21		describes 426:15 544:19 605:4
curved 586:5	decisions 431:17		describing 501:12 572:18 609:14
custodian 461:10	decomposition 440:13,14,15		description 449:4,14 478:9 485:8 489:22 501:21 507:19 509:6 540:11 551:22 566:22 567:2 577:2,5 604:22 605:8 635:6
customer 519:4 520:13 569:17	deduce 595:12		design 411:16 413:3 426:4 432:1 432:16 434:6 435:4 437:3 440:18 460:20 461:3,7,9 466:18 486:6 493:9,16 495:22 517:12 518:6 527:19 582:14 588:22 589:22 591:4 601:12 602:21 628:9 632:4
customers 518:18 559:22 560:8 613:6	deemed 522:10		designated 561:14 602:18
cut 431:6	defendants 405:11		designations 559:9
cv 405:8	deferral 507:4		designed 461:20 538:1 625:7
d	deferred 507:1,10		designing 493:12 495:19 601:7 603:6
daily 611:9	definite 640:11		desirable 509:17
damage 421:22 567:18,18	degree 410:11		
data 407:29 411:17 414:8,13 426:4,7 431:15 439:5,22 443:20 470:22 596:16,19 598:11	dehydration 633:13,22		
date 475:4 543:1 546:16 568:7 596:11	delaware 405:2,14 406:3,5		
dated 411:21 455:14 489:4 505:9 535:19 541:8,14,20 542:3 542:17 545:6 566:6 593:13	delegate 536:3		
	deliberately 452:13		
	demand 519:4 613:15,16,22 614:10		

[detail - dr]

detail 441:22 642:9	dimensions 513:17	discussions 535:14	distribution 626:4
detailed 441:20 493:16	direct 409:21 438:13 506:14	disk 600:2	distributor 575:10
details 576:18 634:11,15	507:14 508:17 534:18	disorderly 608:7	ditch 414:16 468:2 469:8,10,11
detect 624:8	540:9,17 543:13 544:11	dispersed 526:14	518:15 541:1,3
deterioration 429:14	552:18 566:19 604:14	disposal 415:22 416:19 433:21,22	divert 518:13
determine 554:12 613:20 627:12	614:7 626:2,2 642:7	435:2 440:4 475:2,7 478:11	divided 498:22 536:20 546:14
determined 415:9 562:7	directing 599:13 605:12	480:22 481:4,8 541:16	division's 558:7
determining 581:9	direction 416:7 462:5 464:21,22	542:5,14,20 544:15,18	doctor 563:9
develop 411:16 431:15 562:8	514:9	552:1 565:21 594:1 596:5	document 407:18,25 411:11 430:15
developed 425:17 452:10	directional 513:8	disposed 435:10 440:19 451:21	431:21 448:2 469:22 470:1
developer 501:6	directly 422:16 518:15 548:17	453:20 454:3 455:10,17	470:3 482:14,18,19 489:2
developing 431:11	614:9	638:10,14	489:16,18 491:10 505:11
development 625:21	dirt 454:22	disposing 455:14	505:14,17 507:15 508:18
device 475:10 586:12 598:16	disability 550:20	dispute 580:15	511:10 512:22 535:2,4,8
devise 601:2	disagreement 580:15	dissolve 530:3	543:4,12 566:11 577:14
diagram 448:6 514:14 516:3	disagreements 582:1	distance 527:13	578:19 593:16 596:12
diameter 514:4	disappeared 559:11	distill 453:9	599:5 604:5 629:13 640:16
diatomaceous 533:19 534:6	discharge 438:8 441:6 512:4	distillation 433:7 533:11,19 552:6	640:19 641:11
difference 496:7 512:2 575:18 613:11	discharged 412:15 413:2 438:16	620:10 638:8 641:4,6	documents 409:1,2,6 412:2 502:17
differences 633:5	464:14	distillations 637:19	543:9 615:16
different 413:20 414:3 452:12	discolored 422:5	distilled 436:21 444:18 453:21	doing 416:8 418:18,19 419:15
453:12,15,19,20 458:6	discontinued 623:20,21 624:2,11	distillers 552:1	421:7 422:22 423:14
485:17 517:3 519:21 539:7	discontinuing 624:19	distilling 526:13 532:11	434:16 443:1,2 471:12
553:19 570:13 614:4 627:2	discovered 424:8	distinct 503:20	472:2,13 517:19 525:12
633:18 643:14,17	discriminate 533:2	distinction 541:2 553:16	537:14 547:4 556:22 562:1
difficult 519:22 624:8 635:7	discuss 541:21	distinctions 553:19	562:2 586:2 597:2 609:2
difficulty 584:10 635:8	discussed 418:10 619:4	distinguish 509:3 602:9	623:17 628:4 631:4 635:17
digging 511:7	discussing 495:20 565:21 568:5 582:9	distinguishable 579:10,13	domestic 496:17 538:8 613:13
dilute 459:8 465:6 512:5	614:12	distinguished 602:7	dorr 599:2,9,10 601:2,5
diluted 613:1	discussion 414:9 423:6 434:2 436:13	distinguishes 565:12	dotted 513:18
	458:1 470:17 472:12	distribute 529:2 538:14	double 624:12,16
	540:21 544:14 553:2		doubt 571:12
	562:11 567:6 573:8 595:22		dove 424:18
	610:15 615:13 629:5		downstream 468:2 469:8 541:1 583:16
			586:18
			downward 530:5
			dr 470:17,19 594:16,21

[draft - enter]

draft 641:13	dump 549:2,3,9 566:1 577:12 598:6,9 604:16 605:1,9	effective 428:19 429:9 435:6 481:6 524:5	eliminator 425:5,15,21 426:3,17 427:2 427:6,9,19,21 428:1,5,9,10 428:13,19,22 429:8,12,14 429:18,22 430:2,7
drafted 473:22	dumped 434:8 476:2 530:8	effectively 484:18	ellenberg 562:14
draftsman 462:4	dumping 529:1 549:19	effects 416:10 443:21 594:11 637:3	embodied 497:3 630:5
drain 525:20 552:8 600:12	dumpster 525:18	efficiency 426:9 429:13,15,18 433:19	emission 477:20
drainage 468:1 469:8,10 541:1,3	dunlap 443:6,7,12	efficient 434:16 444:20 485:20	emitted 476:22 477:4
drained 600:11	duplicative 488:10	effluent 411:17,22 412:6,12 413:1 413:10,12 420:2 421:13 477:5 484:1 495:22 539:16 580:6,17,21 587:10 588:11 588:12 610:10	employed 556:15 645:13
draw 582:22 586:20	durable 423:14	effluents 469:1	employees 591:12,16
drawing 583:8,12 585:1 590:16,17	duties 550:14	effort 488:9,12 492:6 504:2 522:7 523:22 548:10 556:18	employment 409:19 430:19 442:15 463:22
drawings 460:20 461:8,9,11,12,15 462:4,13 486:6,8 590:3 591:6 593:4	duty 524:22	efforts 558:8 562:17 619:5 639:7	emptied 476:1,5
drawn 450:19 586:21	earlier 424:5 448:2 456:19 466:5 478:7 483:22 499:1,6 501:11 511:14 520:17 521:16 536:2 539:18 540:10 549:6 552:14 559:13 570:8 572:19 573:13 580:1 582:9 584:8 584:15 588:3,22 590:2 598:15 600:5 603:19 604:18 608:14 610:12 613:15 634:1 637:14 639:11,19	eight 521:13,22 569:1	emptying 454:11
drew 586:14	early 424:2,4 455:5 495:20 545:20 558:6 561:22 581:6 589:19 607:8 643:21	eighth 598:2	enactment 507:6
drop 429:3,6 555:10	earth 533:16,19 534:7,9,12	either 422:12,13 429:16 440:9 461:2 466:19 509:15 510:6 542:10 558:9 560:17 564:3 569:15 578:2 580:9,13 583:11 614:3,8 638:8 644:13	encased 623:14
droplets 428:5,6	earthen 460:21	elaboration 442:1	enclosed 600:5
dropped 534:5	easier 612:8 619:19	electric 569:19,22 570:4,10,16,17 570:20 571:22	encourage 525:9
drum 552:6 555:9,11 563:4,5,7,8 563:9	easy 435:6 518:2	electrical 532:19,21 533:3,5,8 569:18 574:6	ended 515:6 560:19 620:9
drumming 563:20	economical 412:14 583:21	electronic 580:9	ends 436:12 446:15 469:20
drums 457:3,6,6 500:17 546:3 547:9,12,22 548:6 549:1,13 552:14 553:4 555:2,6 562:21 563:1,2 598:6,10 606:4 608:7	ed 510:7,9	elimination 619:5,9	engineer 443:7 462:3 471:2,4 474:11 474:16,17,18 493:14 494:11,14,16 544:1 577:22 618:6 628:7 631:12,19 632:7,9,11,11
dry 434:19 454:1 540:7 575:1	edelblut 420:12		engineering 425:4 431:8 461:11,16 462:2 494:12,14,17 522:5 596:18 628:4 631:7
drying 419:7 433:19 434:11,14,18	editor 473:6 539:19		engineers 462:5 632:3
dual 480:11	effect 410:10 421:9 579:19		enlarge 466:3
due 429:13 567:6 627:14			enlarged 484:3
dug 452:4 453:21			entail 434:5,12
duggan 645:1			enter 467:5
duly 408:4 488:4			

[entered - extracted]

entered 463:14,19 464:5 475:14 557:20	estate 449:21	excluded 467:9	expansion 431:12,19 434:17,17 437:16,22 616:22 617:2,5 631:4
entering 458:14 467:1	estimate 513:16 528:13 530:14 602:4,5 606:2	excuse 416:12 436:19 524:15 547:15 554:2,3	expect 465:16 517:16 614:7
entire 413:15 492:9 501:18 546:13 602:6	et 405:10	executive 506:15 507:7	expected 427:18 581:16
entirely 504:8 530:2	ethyl 436:20 442:9 445:8 526:9 596:2 612:22	exhibit 407:7,11,12,13,14,17,18,19 407:20,21,22,23,24,25,26 407:27,28,29,30,31 409:14 409:16 411:9,20 413:19 414:6 415:12 416:13 419:18 420:11 425:4 430:9 430:10 442:10,11 448:21 448:22 450:12,17 451:2,14 457:22 463:12,15 467:19 469:12,13 473:19,21 479:4 482:13,14 485:6 489:1,5 497:4 505:7,12 515:17 534:17 540:10 541:14,18 542:1,7,16,17,21 543:6 544:9,12 545:4 548:21 550:17 552:19 554:15 562:20 565:11 566:5,10 573:7 576:11 577:1 578:10 578:14,18 582:7 584:6,6 588:5 593:12,15 596:8,10 599:1,4 602:11 603:2,18 604:4 608:18 609:11 610:9 615:21 616:1,6 617:22 622:18 623:9 625:14,18 628:18 629:9,16,16,17,22 630:2,6,10,17 632:15 637:8 638:18 639:17	expects 529:2
entirety 462:12	evening 424:17		expedient 588:18
entrain 564:8	event 472:15 526:17		expense 523:7 546:19
entrained 465:9 520:5 536:8,9 569:4	events 510:2 521:5		expenses 507:4
entrance 479:1 481:18 530:5	eventually 436:6 452:9,11 465:20,22 501:10 511:21 515:1 526:20 527:22 557:22 613:6 637:7 638:9		expensive 481:4 510:3 575:22 576:1
entries 491:10	evidence 410:10,19,21 500:18 589:1		experience 490:2 496:14 520:2 522:12 577:10,19,19 601:13 632:11 644:7
entry 467:19,20	evident 515:11		experiences 422:13
environment 436:9 575:19 576:2	exact 477:15 558:17		experiment 483:3 583:20
environmental 505:10 506:12	exactly 427:3 431:14 449:15 454:15 471:18 523:12 556:22 559:5 570:9 617:7 623:3 630:18		experimental 482:21
envisioning 555:1,3	examination 405:17 407:2 408:6 489:6		expert 511:7 603:11
epa 624:11	examine 539:6	exhibits 407:8,9,15,32 411:5,8,9 420:7,8 473:16 483:22 489:8 541:7 543:19 576:12 615:14 629:6,8	expertise 496:9 603:8
equilibrium 637:20	examined 408:5 488:5	exist 490:8,20 497:4 609:18 624:13	explain 410:6 411:10 480:13
equipment 425:17 426:18,20,22 427:3 431:17 436:21 441:19 462:20 480:7 481:18 482:11 522:4 527:13 569:6 599:11 608:5 644:12	example 417:12 424:12 428:17 448:1,7 454:20 473:4	existed 430:7 451:19 490:12 503:11 507:22 540:5 556:9 595:10	explosion 432:14,18,21 433:3
era 495:20 498:6 517:13 564:21	excavated 493:4 530:11 590:5	existence 491:14 496:11 503:14 591:1 592:17	exposed 641:18 644:21
error 440:10 575:11	excavation 461:3 529:20	existing 431:16 478:2,5,12 517:5 605:4	exposure 555:19 556:1,5 641:1 642:3 644:9
esq 406:1,7,14	excavations 500:1	expand 437:6	expressed 421:6 429:8 438:11 466:22 467:11 570:2,21
essence 595:1	exceed 461:4		extended 484:16,22 584:2
essentially 434:9 480:15 586:17	excellent 632:11		extent 429:21 448:18 512:4 518:6 547:1
establish 509:15	excessive 446:18,21,22,22 447:2,9,18 448:13,15,19		external 624:7
established 438:21 509:11	exchange 558:14 560:1 568:5		extra 480:20 519:18 616:3
establishing 509:12			extracted 444:22 445:12

[extremely - floor]

extremely 432:15 438:6 536:2 575:2 613:4	fairly (cont.) 595:2 605:19 612:13	fertilizer 598:19	firm 488:20 631:14
eye 593:14 594:21 595:16,22 596:1	fall 563:10	fiber 429:14	first 409:22 413:14 415:12 416:21 419:19 423:9 429:11 432:7,8 435:5 439:1 444:18 449:3 465:15 468:22 475:2 481:5 491:3 491:10,22 494:16 541:8 550:3 573:8 580:14,21 581:10 593:19 596:15 600:9 607:10 615:17 616:6 617:22 618:1 620:4,4,9 622:18 625:14 626:6 636:2 636:4 641:6 642:6 643:10 643:16 644:1,3
eyeballs 595:20	familiar 449:10 450:1 456:4 457:16 457:19 490:1,3,11 508:3 517:15,17 527:18 545:10 555:17 556:12 558:13 561:6 599:10 640:13	fiberglass 427:1	
f	familiarize 505:15	fields 618:2,4 620:13	
f221 626:7	far 413:21 455:13 484:17 498:16 562:7 606:2 609:18	fifth 405:19	
face 415:8 543:4	fashion 452:13	fighths 594:7	
facilities 419:7 481:6 576:11 601:13 603:12 609:17 610:3	fast 565:15	figure 448:9 511:11 512:21 513:9 514:22 515:17 516:15 584:11 585:8 586:19	
facility 463:15 488:22 491:5,21 494:3,18,19,21,22 495:13 495:19 496:1 497:4,7 509:4 509:18 538:1 550:2 577:13 578:3 579:7 580:18 581:5 581:10 582:3 583:1,3 588:8 589:5,14 590:5 594:1 596:5 597:7,15,15 599:14 601:8 611:20 612:12	father 473:8 540:1	figures 448:11,13,15 584:7	
facing 616:19	favor 568:3 585:19	filed 422:8	fish 470:6,11,12,20 471:8 472:3 472:8,16 473:1,4 539:21 608:3
fact 411:2 419:1 420:15 427:16 452:3,15 453:4 462:10 470:11 472:8 481:12 486:12 509:10 511:15 546:16 554:9 559:3,8 567:6 573:4 584:16 608:10 610:1 612:12 626:3,19	feature 499:7,16 503:10 601:7	filled 411:13 625:20	fished 473:9
factor 410:1 480:21	features 490:4,6	filter 494:20 495:1,3,10 533:20 533:21 534:3 598:13,18	fit 552:9
factoring 519:5	february 431:1,12 541:20 552:20	filtered 533:15,20	fits 616:21
factors 480:20 481:10 522:5	fed 433:8 528:3 538:13	filtering 495:6	fitting 567:14
failed 570:15	federal 501:9	filters 533:17	five 449:17 453:13 510:15 523:11 550:4 568:22 606:8 606:13
failure 440:10 441:19,20 519:2 641:12	feed 433:13 515:8 516:12 518:7 539:15 563:5 598:10 602:6 602:7 620:11	filtration 531:22 532:6 534:1	fixed 537:1 581:20
failures 480:6	feedstock 554:11	final 428:9 461:4 532:18 533:3 638:8	flaker 553:10 563:3
fair 438:4 467:9 491:11 513:7 535:8 572:5 578:9 608:9	feel 489:11	finally 491:19 508:14 532:10 533:14 542:22 592:5 611:12	flakes 526:14 563:9,10
fairly 415:8 430:6 486:4,9 512:5 523:1 529:3 532:17 545:20 547:20 566:18 574:21	feet 454:15 498:20 514:1,4,8,9 607:15	find 443:20 465:11 537:5 583:20 611:22	flaking 562:22 564:4
	fell 429:13,18 572:19	finding 415:2	flammable 545:18
	felt 437:7	findings 472:3	flare 435:11
	fence 414:16	finely 536:20	flask 522:22 523:6
	fencing 509:7	finished 439:4 534:2 610:4 615:1 622:11	flasks 523:9
	fenner 426:10,11	fire 406:22,27 559:2,16	flat 456:6,9
	ferromanganese 499:21 500:3 501:2	firebox 435:6,8,12,14,17,20	flexibility 435:9
			floating 524:19
			floor 405:19 406:10 476:7

[floor - glance]

floor (cont.) 564:11	forth 419:11 441:8 444:10 471:17 559:9,14 562:5 565:22 577:20 623:19 624:5,12 637:17,22 638:7 640:6	fresh 560:2	gas (cont.) 438:10,16 465:14 518:14 518:20 519:3 520:6,21 521:7,20 522:8 534:2 545:20 567:9 569:5 624:5
flow 410:1,14 413:15,20 414:8 414:13 424:18 445:4 448:2 448:3,5 459:3 465:5,15 473:10,10 475:11 491:6 492:9 514:22 515:4 522:4 527:20 528:10,12,14,16,18 529:2 536:6 540:8 548:14 558:4 579:20 582:2,2 614:18 620:3	forward 632:19 633:1	friday 645:17	gaskets 567:18
flowed 491:4 535:13	found 418:13 427:14 429:11 430:3 439:15 468:1,5,17 469:7,9 524:19 528:7 540:22 624:4	fritz 418:10,18 462:2	gasoline 623:18 624:5
flows 414:1,11 424:18 465:14	foundation 462:18 529:7 605:12	frogs 441:8	gauge 531:18
fluid 532:19 558:21 559:17,17	four 413:9 449:17 507:21 598:6 598:9	front 464:13 483:7 498:14	gene 489:4 493:18 537:4
fluids 558:14,18 559:8,11 560:1,8	fourth 507:15	frs 560:16	general 410:5 419:13 438:2 441:18 442:22 446:8,10 462:20 482:8 505:21 507:18 508:19 511:1 517:22 541:16 542:5 546:21 549:4 556:5 557:4 566:7 569:19 569:21 570:4,10,15,17,20 571:22 573:8 579:2 589:14 593:19 607:15 609:7 612:7 624:2 640:21 643:15
fluorine 558:10 561:19	fr 559:1,2,11	full 411:17 426:5,17 441:5 494:21 538:20	generally 431:4 452:8,14 453:22 490:3 501:13 505:19 512:17 517:10 565:21 566:14 571:4 575:9 608:22 623:19,21
followed 541:19 542:2,12,17	fr1 559:2,3,9,14,21 560:16	fuller's 533:15 534:9	generate 426:4 429:5 433:10 443:19
follows 408:5 488:5	fr2 559:4,9,14,21	fultz 640:13	generated 433:7 461:15,16,18,19
force 547:1	fr3 559:5	fume 564:5	generates 440:14
forces 528:18	fractionations 620:7	fumes 556:1,5 595:20	gentleman 537:18 632:8
foremen 537:20 548:16	fractions 452:2,6 453:18,22 455:11 455:14,18 502:1 622:12 638:7	function 458:11,13 506:9 532:13 556:12	geographical 499:7
forget 585:15	frame 415:21 417:6 419:13 422:15 442:20,21 456:17 472:4 497:11 533:21 616:18 622:5 626:1 639:5 640:8	functionally 497:14	georgia 534:13
forgotten 585:14 641:2	frames 533:22	funnel 504:3	germany 572:12
fork 547:14	france 572:12	funlow 405:18	getting 532:20 555:1 575:11
forklift 547:15	free 534:3	furnace 608:16	give 441:20 443:18 513:20 529:8
form 411:12 445:16 453:22 504:22 526:14,18 551:5 576:5,6,17 600:18 605:11 625:19	freezing 567:6 613:2	furnaces 452:12	given 502:21 604:22 641:5
formal 497:17	frequency 611:11	further 405:16 408:5 442:1 453:9 488:5 514:21 567:5 600:9	gives 614:4
formed 435:20 525:7 527:2,4	frequent 417:11	 futile 574:4	glance 430:14 469:19 482:18 640:15
former 409:9	frequently 424:10 430:1 459:21 475:17,18	g	
formidable 616:13		gain 501:1	
forms 411:14 493:4		gallon 598:2,10	
		gallons 445:4	
		gap 588:10	
		garlette 431:15 462:3,6	
		garrett 471:14,16 589:2	
		gas 433:20 435:2,10,14,14	

[glass - horizontal]

glass 429:14 575:20,21	gravity 633:6	handwriting (cont.) 621:12	heard (cont.) 632:13
globules 537:5	gray 537:18,18 542:14	handwritten 407:25 543:1,14 550:17 620:13,22 623:8	hearing 463:7,20 469:9 472:5 627:4 627:22
go 413:4,11,13 415:12 416:21 425:4 436:10,12 440:11 441:3,4,11 445:9 450:12 457:22 470:16 475:1 478:10 479:4 488:7 492:11 514:12,21 516:15 527:19 534:17 538:13,22 558:5 565:11 580:22 584:5 586:19 588:21 601:18 608:18 615:12 617:22 620:1 625:14 632:15 633:14,20 634:5 638:2,3,18 639:13	great 441:22 526:8 542:10 609:3	happen 435:22 515:11 613:8	heat 440:14 558:14,18,20 559:10,17 560:1 567:17,22 568:5
gobs 526:14	green 541:9,15 544:8	happened 430:1 440:17 441:1 460:12 460:15 505:5 528:6 533:10	heating 510:18 567:8 573:19 574:6 574:7,14
goes 496:8 538:9 604:3	ground 410:2,8,13,13,17 411:3 456:1 457:7,8 475:22 493:3 493:4,5 500:1,15 548:3 564:11 590:6,14 624:8	harm 472:19 473:12	heavy 524:20,20 605:5
going 409:13 419:8,8,11 445:4 465:2,10 468:15 484:19 501:21 514:14 520:18 527:20 528:10,12,16 531:6 535:6 539:7 543:13 549:1 554:19 561:19 562:20 568:9 573:7 577:1,18 580:6 580:17 581:2 582:2 584:18 587:6 589:22 602:11 608:3 609:11 614:18 616:22 617:6 639:3 641:8	groundwater 463:14,19 464:5 467:1,6,8 467:16 624:7	harmful 594:11	hedworth 443:8
good 408:8 511:3 529:17 532:20 542:9 559:17 578:12 629:20	group 443:1 452:14 497:13 599:16 627:20 642:22	harms 473:4	hedworth's 425:13
gotten 557:13	grsenda 470:17,19	hastelloy 575:22	held 546:5
gpm 598:2	guess 436:19 475:12 478:8 536:8 538:2 550:12 565:12 599:3 606:6 616:4 630:18	hailed 532:9 537:10,11	help 512:19 601:10
grade 503:4 519:8,9,12,14,17 520:3,12 532:21 533:3,4,5 533:8 559:4	guidance 443:18	hauling 537:14	high 417:22 418:13,15 429:1 465:1 519:13,15 554:21 567:6,13 607:15,22
grades 502:8 520:1 529:10 558:22	h	haupt 542:4	higher 453:8 559:4
grandfather 473:8 540:1,2	h2s 433:20 435:2,4,10,13,14,16 435:18 438:10,16	haveg 478:3	highway 449:18,22 450:8 456:5,7 498:13,21 549:9 605:18
granite 406:22	half 422:5 461:21 551:10,16	hazard 439:22	hill 608:1
graphical 448:5	hall 511:6	hazardous 432:2,5,13	history 453:1,14 499:20 501:3
gratings 564:13	hammer 555:10,12	hazards 438:20 439:18 643:18	hit 555:10
	hammered 562:21	hb 451:4,8 452:18 546:11 559:16 611:2,4,5,7	hold 433:12 440:21 479:12,22 481:19 482:5 491:14,16
	hand 425:9 479:9 554:6 581:19 585:20 600:11 607:3 609:6 621:15 625:16 638:19	hcl 458:21 459:8 465:6,9,16 518:2,9,14,17 519:19 520:5 520:18,21 521:7,8,20 522:8 569:5	holding 475:13 483:17 585:13,16 585:21,22 586:6,15 587:8
	handed 583:8	head 442:2 443:8	hollow 607:20
	handle 619:19	header 477:7,8	home 406:20
	handled 431:4,8 440:8 556:10 574:1 575:1 631:6,7 643:18	heading 437:11 438:19 446:16 463:16	hood 552:7
	handling 433:19 434:4 440:18 492:9 538:8 543:16 544:20 551:2 576:10 581:14 600:16	headquarters 494:10 543:2	hope 572:17 631:10
	handwriting 597:18,22 618:1 621:3,10	hear 463:3,18 464:4 470:12 472:6,8 486:15	hopper 563:10
		heard 470:8,9,10,14,15 472:7	horizontal 623:7

[horse - installed]

horse 456:9 499:10	identified (cont.) 469:12 473:16 477:18	improvement 419:6 505:10,21 506:11,19	indicating 489:14
horseshoe 499:8	482:13 489:5 505:12	507:1,10 566:16	indication 427:17
hose 611:11	541:18 542:1,7,16,21 543:6	improvements 421:13 466:12,15 481:16	indicator 539:11 604:19
hot 504:22 574:5 642:17	566:10 578:18 585:21	impurity 453:11 532:18	individual 421:17
hours 408:21 429:3	593:15 596:10 599:4 604:4	inadequacy 567:7	indoctrination 636:12
house 493:5	605:18 615:15 629:7	inappropriate 567:19	industrial 416:10
housekeeping 611:7	identify 442:18,21 445:22 477:19	incident 447:4 570:7 617:19 641:2	industry 517:10
houses 421:22 422:4	490:6 549:9 584:18 586:3	644:11	infer 605:7
human 600:3 613:13	587:8 608:22	incidentally 572:4	inference 507:12
humorous 473:7,9	identifying 586:8 590:18	incidents 435:16 440:18 441:12	inferring 491:11
hundred 449:17	ii 467:19 540:18	573:5 642:1,5,6 644:8	information 407:13 430:18 431:11
hurt 532:19 640:11	image 547:16	incinerated 435:15 440:21	439:17 471:7,9 596:21
husband 539:21	immediate 642:7	incineration 438:9 513:9	initial 472:6
hydrochloride 482:10	immediately 454:9 498:11	incinerator 425:6,16,19 433:8,11,13,15	initially 492:12
hydrogen 435:7	impact 581:18	435:5 436:3 511:16,18,20	initiate 626:3
hydrolysis 446:12 459:11,18	impervious 528:17,21	515:9,16 516:16 526:15,18	injuries 640:22 642:2 644:10
hypochloride 478:13 481:17	impetus 412:5,9 414:4,12 466:6	527:2,8 549:21 578:2	injury 641:9 644:13
hypochlorite 593:14 594:2,9,19,22 595:7	474:3	579:11 584:14 592:16	input 474:19 594:10
595:9,15 596:4	implement 481:3	include 439:21	inserted 582:10
hypothesis 418:21	implemented 594:4 625:9,12 630:8,19,20	included 502:4 511:4 547:6,8 626:4	inserting 495:5
	implication 545:19 572:22	including 444:9 501:19 539:10	inside 450:11,16 491:1 563:4
i	implies 523:19 538:16 545:17	575:10 624:4	635:11,16
idea 412:13 424:14 446:8,10	551:4 579:19	incomplete 459:17 460:9	insoluble 436:11
448:14 454:19 455:9	imply 573:2	incorporated 599:2	inspections 462:14,16,20
513:20 549:12 571:2	importance 447:5	increase 438:10,12,14 452:13	install 481:17
598:11	important 440:17	increased 428:18 438:16 617:8	installation 426:6 491:17 492:14
ideally 609:1	impose 447:7	increment 433:10	511:22 524:6 568:15,17
identical 559:3	impoundments 503:21 504:4	incurred 581:20	573:20 631:1
identifiable 603:11	improbable 515:8	indicate 450:16 489:12 535:5	installations 491:12
identifications 609:3	improper 526:17	584:17 594:12	installed 423:9 424:1 427:3 430:2,8
identified 407:6 409:14 411:6 420:7	improve 419:1,4 423:5 426:8 433:18	indicated 463:13	
430:9 442:10 446:5 448:21	435:9 466:2,6 509:6	indicates 420:15 626:4	

[installed - kind]

installed (cont.) 434:19 462:11 479:1 482:7 482:11 484:11 512:9 553:10 568:1 588:19 590:1 619:16	interpret 601:4 interpretation 639:14 interrupt 447:15 intervals 430:4 intervention 600:3 introduced 489:1 505:7 515:10 541:7 541:13 565:20 566:4 593:12 596:8 599:1 603:18 636:4 introducing 489:9 invented 571:22 inventory 533:9 investigate 471:11 investigated 474:8 644:15 investigation 411:1 415:1 471:8 474:4 570:17 639:19 640:2,2 642:11 644:16 investigations 467:14 474:1 486:18 involve 568:18 614:1 involved 426:13 427:12,13 438:3 441:19 495:7 506:13 507:4 509:16 510:22 511:2 536:4 536:4 562:16 568:14 573:5 582:5,19 590:11 602:21 603:1 617:20 621:21 628:5 628:8 636:10 637:15,18 638:6,17 643:14 involvement 416:3 443:15 466:9 496:12 510:8 644:14 involving 441:13 620:18 621:21 631:1 633:17 ionizable 532:18 iron 499:19 587:17 632:18,18 irregular 529:1 573:14 irregularly 454:17	irrelevant 522:2 irritant 596:1,1 irritation 593:14 595:16 644:13,19 irritations 594:22 isolate 453:10 isolated 432:12 612:8 isolation 432:1 isomer 453:19 isomers 453:7,12,16 637:18 641:7 issue 580:3 582:4 594:8 617:1 item 427:8 449:7 523:7 547:10 571:7 items 440:1 537:9 546:19 j ja 405:8 jack 471:14 jacket 574:20 jacketed 574:11 jacketing 574:9 jackson 406:15 488:20 jaffee 416:10,16 james 405:13,16 406:1 407:3 408:3 488:3 645:20 january 541:8,15 542:17 629:11 639:15 japanese 572:13 jet 477:5 jets 477:20 jim 418:2 420:18 422:12 424:16,17 474:11 566:7 645:1	job 550:13 618:4 john 420:12 422:21 631:12 johnson 474:10,11 johnson's 474:14 joined 544:3,5 560:21 580:14 607:10 636:5,9 joining 494:7 joint 462:21 588:17 july 413:8 489:4 542:3 june 420:11 479:7 566:6 593:13 junk 607:19 justification 619:4,9 k kanawha 495:15 kanegafuchi 572:13 karl 420:12 katzenstein 405:18 kcl 601:22 602:1 keep 465:2 504:4 522:16 533:8 keeping 546:19 547:6,8 ken 544:1 kettering 556:12 kill 471:8 472:3,8 473:1 kills 470:6,11,12,20 473:4 kind 411:13 414:18 417:10 445:15 454:6,7 457:2 461:13 473:5,7 494:22 495:3,11 505:22 517:12 524:3 529:6 532:8 534:2,5 553:11 558:3 562:4,18 564:4 565:11 584:22 590:18 596:17 598:16,20 617:1 643:12 644:13
---	---	---	--

[kinds - level]

kinds 507:19 518:4 577:11 601:19,21 602:6	known (cont.) 508:5,11 510:6,18 514:17 515:17 516:2,20 518:15 519:8 523:14 531:15,17 532:18 533:15 534:9,12 552:7 570:9 572:20 583:11 586:9 602:22 606:15 607:19,22 612:16	landfill 449:4,10,14 450:7,15 451:10,14,21 454:3,11,13 455:2,8,11,14,18 456:1,5,5 456:13,14,19,20,22 457:10 457:10,11,14,17,19 498:22 500:17 501:12 502:12 509:1,7,11,13 510:1,8 525:11 527:17 549:5 577:6 577:8,12 578:5 602:17,18 602:22 603:8 605:17	leader 462:3 627:21 642:22
kirkwood 408:11 471:22	knows 577:22	landfills 450:2 549:7 603:13	leading 567:20 568:15
knew 421:8 494:1 601:14 636:13	koh 601:20	lane 408:13	leads 486:3
know 410:15 412:18 413:2,21 414:16,19,21 415:9 416:1 417:8 421:3 423:22 430:13 432:5,18 433:14 439:7,9,12 447:21,22 449:5,15 454:18 454:20 455:1,13,16,19,21 456:2,21 457:12,13 459:21 460:17 461:15,18 462:7,10 462:15 463:1 464:18 465:19,21 466:2,5,18 468:20 469:11,21 470:15 471:17,18 474:5,16,19,21 479:19 482:10,17 483:15 485:21 486:2,12 493:17 494:22 496:10 497:1 498:19 499:16 500:21 503:8,13,16 519:11 520:11 528:20 529:9,10 530:16,19 531:3 534:10 537:7 541:5 543:3,11 546:15 547:20 548:2,9,12 550:21 557:11 560:18 561:13 562:7 565:17 571:19 572:7 573:3 573:5 578:11 580:12 586:11 594:16,18,21 597:17 598:5,9,17 603:9 609:18 611:11 613:10 615:6 619:8,20 621:3 623:14 624:14,17 625:3 627:3,15 628:2,5 629:10 630:5,7,14 631:8,15 632:12 638:5,14 640:17 642:11,21 644:18,21 645:4,8,13	kristine 405:19	large 414:11,21 454:14 465:5 495:14 509:16 514:2 538:8 538:17 581:21 584:3 585:14 631:5 641:5	leak 423:12 424:9,10 486:11 624:6,8,9
	krumrich 411:3 506:8 560:12,16 561:7,9 570:4 616:19 624:18 627:11,18,21 630:13,16,19 631:21 636:6 636:21 637:16,19 638:16 639:1 640:8,22 642:2,20 644:6,9 645:10	larger 414:1 423:15 435:17 449:21 495:16 499:16 569:4 587:5	leakage 476:6 627:12
	I	largest 445:3 569:16	leaking 423:12 626:7 627:5
	lab 416:6 472:16 494:1 556:13	larkin 443:6,8	leaks 424:12 480:7 486:16 567:20
	labeled 513:1,18 548:7	late 480:22 483:3 495:20 517:13 552:10 558:6 562:13 624:1,3	learn 432:21 463:3,18 464:4 486:15 636:14 643:17 644:4
	labor 434:10	law 405:17 488:20	learned 453:9 589:20 636:12
	laboratories 556:16	laws 507:6	learning 463:20 469:9 470:6 627:4
	laboratory 472:13 580:10 625:21	lawsuit 577:2	leave 609:13
	lack 462:18 529:7 605:12	lawsuits 421:15,19,21 422:8	leaves 633:10
	lafayette 406:16	lawyer 577:21	leaving 418:16 445:17 467:4 476:17,19 603:21 632:20 632:22 633:18 637:7,10
	lagoon 420:5 483:18,19,20 484:4,9 484:9,12,15 485:7,11,14,15 485:18,21 486:7,10,12,16 489:3 490:1 491:7,10 492:8 492:9,12,17 583:11,18 585:7	layer 461:5 525:7 613:5	led 543:5 570:16,18
	lagooning 482:22	laying 457:7	left 444:20 453:19 461:11 464:10 479:9 489:21 493:1 513:9 536:19 552:12,17 577:17 582:17 587:20 604:1 630:13,15,18,20
	lagoons 419:21 483:13 485:8,10,13	leached 410:2,14	leisy 603:20 604:8,10 609:12
	lake 501:13,22 503:9,17,19 504:21 505:1 513:10 549:8 549:14	leaching 410:7,16 455:22 460:18 463:4 467:15	lengthwise 555:7
	land 450:2 499:8 500:5 503:19 608:10	lead 410:7 493:14	lesser 429:21
knowledge 470:4 494:13 495:13,16 497:2 498:11 501:1 504:9 514:11 522:7 524:8 525:10 527:7 530:9 532:5 548:6 551:3 555:13 560:22 561:11,20 564:16,20 565:22 571:6 572:3,5 573:12 580:20 581:4 594:18 596:3 623:5 626:21 642:7			letter 407:30 436:13 473:6 502:20 539:19 551:11 594:12 599:1 600:9 601:4 616:21
known 439:11 440:16 471:10 476:2 489:2 499:13 501:13 502:4 504:11,15,18 506:18			level 412:15 417:20 418:13,15 427:15,20 428:12,17,18 429:16 475:22 493:3 497:15,21 548:3 580:5

[levels - marketed]

levels 556:19	lining 426:18,21 461:2,4 466:4,5	long 449:19 485:1 488:9 494:13	making 418:7 450:4 468:6 520:2
lexington 406:25	466:12,16,17 478:14,19	494:15 496:10,15 513:22	618:15 630:6 641:11
liaison 426:5	486:10,13 592:15	535:22 561:17 565:14	manageable 563:12
liberty 406:13	liquid 438:9,16 454:9,10 504:11	566:8 608:3 632:13	manager 452:16 466:2,21 467:3
life 426:20 472:20 473:5,13	504:22 514:11 532:3,4	longer 419:3 458:22 505:14	468:10 469:2 560:7 589:18
598:20	533:1 534:3 536:8,8,9	543:14 563:2 614:17	603:2
light 506:20 541:2 545:8 549:2	538:19,21 542:14,20 545:9	look 411:20 418:2 425:9,12	manager's 497:15
551:1,12 557:12 576:19	546:10 548:21 553:17,18	443:19 451:2 456:22	managing 530:18
577:11 590:19 591:20	553:20,22 554:3,8,13 555:8	463:12 467:19 469:22	manganese 501:5
593:7 598:4 610:22 613:10	563:5,7,11,20 576:5 587:14	485:6 489:12 514:6 539:16	manifested 429:2
liked 571:2	liquids 546:3 554:2	547:3,3 584:11 621:6	manta 406:8
lime 532:11,13,15,17 533:10	listed 415:17 477:5,12,12 625:15	626:10,11 629:11 639:19	manual 489:2 497:3
limestone 413:4,11,12,13 441:11	638:18	640:15	manually 434:8
458:1,4,6,9,12,15,20 459:4	lists 475:1	looked 409:2 500:17,19,22 503:20	manufacture 595:19
460:19,21 462:8 463:5,9,16	literally 573:3	584:6,8 630:3	manufactured 595:7
463:19 464:5,8,11 465:19	literature 517:12,15,16	looking 418:3 562:15 629:17	manufacturing 439:21 452:16 466:1,20
466:3 467:1,4,16 475:6,7	little 408:21 450:4 451:2 456:6	lot 459:9 527:5 528:5 547:1	467:3 468:10 469:2 506:2
479:1,12,22 481:18 482:4	476:4 515:17 525:18 568:5	561:17 570:16 581:20	560:7 589:18 603:2 643:14
483:16 491:11 498:14	573:22 582:22,22 586:20	lots 622:16	643:20
513:14 514:17 516:21	586:20	louis 461:17,22 494:12 556:10	map 414:18 450:12,19 451:13
517:4,8,13,19 518:2,3,9,15	lived 510:10	596:22 603:3 631:14	451:14,19 483:17 516:16
518:20,22 520:18 527:20	living 421:16 539:8 614:2	low 522:11 608:11	584:19,20 585:4,17 586:4,8
527:21 528:1,3,7,9,13,17	load 412:15 435:8,13,16 444:3	lower 447:5	586:14,20,22 608:21
528:17,21,22 529:6,10,14	446:2,7 447:2,7,12 448:17	lunch 486:22 492:12	609:13
529:15,21,21,22 530:4,4,6	547:14 584:1	lung 644:13,19	maps 508:4 511:10 584:6,7,8,9
530:7,10,10 536:12,16,16	loaded 547:14	m	608:19
536:18 557:19 579:5,6,14	loading 483:8,11 581:19	machine 563:22	marginal 581:14
579:21 580:1,6 581:7	loads 446:18,21,22,22 447:9,18	magnesium 518:4 632:17	mark 414:9 483:20 621:1
583:16 586:4,8,18 587:7	530:7 613:13	magnetti 632:8	marked 409:16 411:8 420:8 430:10
588:22 589:3,6,11,13,15	located 512:19 513:5 609:15 623:2	magnitude 521:10 523:11	442:11 448:22 450:22
590:1,3 591:1,9,22 592:2,5	locating 442:20 446:1	main 449:18,22 452:11 498:22	451:17 469:13 482:14
593:5 605:20,20 606:5,11	location 451:7 608:12	538:4	483:17,18 489:1 505:6
610:11,13,17,18	locations 422:6	maintenance 462:22 474:13,14 497:13	541:6 593:11 596:7 598:22
line 452:10 476:17 511:7	log 498:1	497:16,17,18,19 498:2	603:18 615:16 629:8
513:18 553:21 554:1,3,9	logical 471:11 486:21 615:8	529:20 530:22 531:4	market 405:18 406:4,11
558:22 559:12 562:2		567:14 628:3	marketed 453:16
575:20 586:17 587:22		major 442:19 444:1 640:7,12	
590:18 621:17			
lined 426:22 454:21 465:19			
485:21 486:1,3			
liner 590:12,20			
lines 424:22 473:3 511:4 558:14			
567:8 574:4,6 587:17			

marketing 558:19	meaningful 512:12	memoranda 565:20 566:2	meyer (cont.) 540:3,15,16 541:6,11,13,19
mass 444:9,21 445:11 552:19	meaningless 615:7	memorandum 407:7,9,11,14,16,20,21,22	542:2,8,11,17,22 543:7
massive 447:14	means 440:4 443:9 447:22 458:9	407:23,24,27,28,31 409:17	562:10,12 566:4,13 576:22
material 410:13 415:6 436:20	545:9 551:6 576:20 596:4	411:20 415:14,16 420:12	578:14,21 583:7,9 593:11
439:11,15,22 440:5,7,19	613:14 619:8	469:14 505:20 541:8,14,19	593:18 596:7,11,14 598:22
442:4,5,8 444:11 445:16	meant 431:5 549:3 551:13 570:12	542:3,13,18 548:20 549:11	599:7 603:16 604:7 605:16
452:20,21 453:11 454:8	573:16 576:16 598:5,10	566:15 578:16,22 579:1,3	615:10
458:20 459:12 465:11	611:1 640:4	593:13,20 603:19 615:22	microorganisms 614:14,16
478:9 504:8 505:4 514:14	measure 475:10 507:2 556:2,3	616:9	microscope 539:5
536:16 544:20 545:11,19	613:17	memos 629:21	mid 562:13 622:1
555:8,8,10 563:6 571:5	measured 580:7 613:18,20	mentioned 409:12 433:5 434:6 441:21	middle 465:1 616:12
572:14 588:13 592:13	measurement 468:7 580:8 614:20	464:11 469:20 500:16	migrating 467:15
595:1 600:16,17 608:8	measurements 614:21	504:7 510:11 520:17 536:2	migration 455:22 460:18 463:5
618:21 626:16 627:7 633:8	measures 478:11 570:22 614:1	537:8 552:14 554:15	486:16
635:15 636:11 641:18	measuring 414:11 467:3 557:2 580:10	567:22 634:1 638:6 639:11	mile 422:6
642:14,17	613:12 614:19 615:1	mentioning 537:9	miles 422:7
materials 418:12 423:15,20 428:7,13	mechanical 434:9 462:5 474:11,16,17	mentions 458:8 600:10	mill 589:2
438:20 439:6,18,22 440:8	474:18 519:2 632:3,7	mercaptan 416:22 417:1,2,5,9,12	milligram 555:19
441:13 451:21 452:2,14,22	mechanically 423:11	mercaptans 417:3,8	million 415:7 448:9,10 539:12
453:2 455:10,22 457:13	mechanism 509:20 564:3 600:12	mercury 522:17,19,22 523:14,21	551:16,16,20,21
458:16,19 459:19,22	medical 556:10 594:10	524:1,4,7,18,20,21 525:7	mind 462:1 509:6 612:18
460:18 466:22 467:15	meet 483:9,10 533:5	556:19 557:2,3,8,10,13	mine 488:9 546:15 597:20 621:4
485:17 518:5 536:17 539:9	meeting 541:21	602:5	mined 622:14
559:20 562:3,6 569:5 574:1	meetings 640:5	met 408:21 471:17,21 496:13	minimize 424:19 425:1 562:2
614:1 618:14,19 622:12	melting 554:21 574:2	meta 453:7	mining 500:4,20,22
624:4 635:15 636:3,15	member 431:2 640:3	metabolize 539:9	minor 445:22 446:5,7 522:6 640:7
637:16,21 638:11 643:18	membrane 460:21 461:2,5 462:7,10,14	metal 575:21	minute 448:8 598:2,10
matter 452:3 507:18 517:21 529:1	463:4,10 590:13 592:4,12	metals 523:21	minutes 603:17 606:8,13
541:16,21 542:5,20 550:13	memo 413:19 417:18 440:3	meter 555:20	mispronounce 631:10
554:1 555:7 566:7,14,18	535:18 546:16,17 552:20	method 552:1,13 592:7,10 594:5	missing 605:9
579:2 589:21 593:20	604:2 609:12 616:7,21	597:1,2 601:2 620:12	missouri 408:11
603:21 624:3 640:21	617:1 618:2,9 619:22	632:16	mist 425:5,15,21 426:3,17 427:2
mattered 495:22	meaning 419:2 440:13 448:17	methods 481:4	
matters 473:3 632:1	497:14 508:22 611:3	methy 436:21 438:20 442:9 445:8	
mcb 626:8,18 627:5,7,8 634:2	622:12 640:8	526:9 612:22 613:1	
mcconnell 632:8		meyer 406:14 488:7,19,20 489:7	
mcguinness 510:7,9		500:3,7 505:6,13 529:13	
mean 413:11 424:4 443:3 447:18			
447:20 459:5 519:15,18			
528:2 551:3 640:1			

[mist - nitrochlorobenzene]

mist (cont.) 427:6,8,19,21 428:1,5,8,10 428:13,19,22 429:8,12,14 429:18,22 430:2,7	monsanto (cont.) 578:15 580:16 581:5,9 582:1 589:3 591:12,16 593:12 594:1 601:6,12 603:7,11,12 616:18 617:17 624:18 625:4,12 643:13 644:2 645:6,13	names 510:11 537:21	neutralize 458:13 517:20 518:2
mix 453:16 522:8	monsanto's 448:22 480:21 483:10 488:6 540:11	naoh 601:20	neutralized 615:3
mixed 445:18 527:5 533:19 633:3	montar 502:5,6,10,15 503:3,4 504:12,15,21,22 533:13	narrower 588:16	neutralizing 458:19
mixing 575:4	montars 503:2,7 531:14 555:15	national 406:26	new 405:3 411:8 426:21,22 427:3 429:17 432:16 436:14,15 437:2,22 466:17 482:7 530:11 560:2 568:18 570:22 581:20 595:1 616:15 617:3 624:22 625:6 625:7 629:8
mixture 453:4 642:14	month 424:13 523:10 581:2	natural 484:10 567:9	newspaper 473:7 539:20
mode 568:21	months 413:9 417:14 430:4 637:21	naturally 489:13	newspapers 433:1
modification 461:13	morning 408:8 539:18 540:10 549:6 599:18	nature 426:1 569:8 619:17	nine 503:6,7
modifications 484:5,7	mountain 456:8,9 499:14	ncb 616:15 618:16,21 620:14 620:19,20 621:22 622:4,10 622:19,22 624:15 626:6 630:1,7 631:2 632:16 633:17,19,20 634:4,17,21 635:14 636:21 639:4	niran 412:19,20,22 413:3,22 414:22 415:2,22 417:16 419:16,20 424:5,6 425:6,16 430:22 431:12 432:2,15 434:21 437:16 438:3,20 447:9 458:9 461:9 474:1 475:21 482:21 491:1,3,17 494:18 497:8,9 498:5 508:11,12 511:15 520:19 520:22 521:2,8,17,21 526:3 526:6 565:12 572:19 573:1 575:16 576:4 579:8 580:17 580:20,21 581:11 583:3 587:22 588:22 589:3,10,11 589:14 590:1 591:10,14,16 592:3 593:5 595:6,18 597:8 600:21 601:15 605:20 610:1,13 611:13 612:16,19 612:21
modified 484:3	mounted 435:11	ncbs 635:14 636:3,14	nitrate 634:13
modify 558:8	move 545:4 587:10	near 450:11,15 513:19 514:19 516:20 530:5 568:7 585:13 609:22 641:16	nitration 632:19 633:2,4
moisture 575:11	moved 471:21 637:21	nearest 600:22	nitric 633:4
molecule 570:13	mullendore 420:12 422:21	nearly 442:22 482:9 569:12 629:18	nitro 432:15,19 494:19 495:13 495:15 598:15 601:15
moment 469:18 574:18 615:12	municipal 420:19 421:1 496:22 538:8	necessarily 582:5 617:20 642:6	nitroaniline 644:4
moments 534:22 543:9	municipally 496:18	necessary 481:19 532:20 536:3 553:5 574:7 641:11	nitroanilines 618:9,15 642:13 643:5,7,13 644:7
monel 575:22	muriatic 459:8 464:20,20 465:4,5,6 465:10,15,17,18 518:9,17 519:2,8,21 520:14 521:3 522:9,11 535:6 536:7 557:18,22 602:1	need 616:20	nitrochlorobenzene 617:10 618:10,13 626:12
money 481:7 570:16 603:4	mutual 406:13	needed 426:4 463:8 480:17 509:19 517:19 546:2 575:7 595:4	
monitor 556:18	n		
monitoring 446:16 548:14	name 425:9,12,13 431:10 443:9 469:20 488:19 499:10,12 499:15,16 502:7,13,15,21 510:9 523:19 534:16 544:10 545:12 558:22 559:18 607:8 608:9 609:8 612:21 621:14 625:15 631:11 641:5	needing 639:13	
monochlorobenzene 619:17 626:9,15,16,21 633:2 634:3	named 511:6 606:20 632:7 640:4	neighbor 471:17,18	
monsanto 405:5 406:6 408:14,17 409:9,19 422:9 430:19 439:13,13,18 442:16 455:22 463:22 468:2 469:8 470:13,15 471:1,2 481:3 489:2 494:7 496:15 499:8,9 499:18 505:7 506:22 509:12 510:6,19 518:13 540:5,7 541:1,8,14,19 542:3,13,18 543:3,3 551:13 555:18 556:14 557:6 559:21 560:1 561:1,3,20 562:14 566:5 569:16 570:18 571:8,14 577:2,7		neighbors 477:14,14,17	
		neutralization 511:19 512:7,18 513:2,10 513:13,14,19 514:7,10,22 515:7 516:17 517:9 535:7 579:11 584:15 592:11,16 634:13	

[nitrochlorobenzene - ordinary]

nitrochlorobenzene (cont.)	number (cont.)	occurred	open
626:17,21 627:11 633:3,7,8	504:13 507:16 508:18	435:19 440:22 442:3,6	414:11 467:7 565:1 573:21
633:11,12 637:18 641:1,19	511:12 521:22 522:5	452:15 523:14 546:16	opened
642:3,15	534:19 536:11 540:12	549:20 563:13,15 642:12	534:4 552:8 564:14 580:21
nitrochlorobenzenes	542:2 550:17,18 556:15	occurring	operate
618:14 622:14	559:6 584:11 587:3,5,7,8	512:14 520:22	429:1,4 519:22
nitrogen	604:15 615:19 621:14	o'connor	operated
534:2	numbered	405:20	419:6 423:13 426:2 432:12
nitrophenol	489:1 503:6 505:7 541:7,14	october	433:9 437:5 460:4 480:8
609:16	566:5 578:10,14 593:12	409:17 578:15 640:9	485:15,19 497:10 509:4
nomenclature	596:8 599:1 603:18	odor	568:20 600:13
531:20 551:14,18 554:6	numbers	416:22 417:10,20 419:3	operating
nominally	411:9 430:11 437:11	420:19 421:7,12 422:13,15	411:17 426:7 433:18
554:8	442:12 448:18 469:15	424:7,20 425:2 474:1 475:2	447:13 452:12 479:13
non	473:19 482:15 504:13	477:5,9,15,22 480:21 594:5	480:2,4 489:2 497:7,11
405:9	584:17 586:20 615:18	596:4	522:12 525:16 577:19
nonaqueous	621:6 629:9	odorous	612:15 643:15
512:11	numerous	417:4	operation
normal	643:14	odors	432:1 436:3 438:21 440:10
410:1,7,16 423:13 437:18	nutrient	417:5,7,12 421:1 422:9	444:2,6 464:9 484:20 492:8
439:20 440:11 447:5 486:4	598:7,8,18	475:17,18 476:22 477:4,11	500:20,22 509:7 511:7
486:9 521:5 566:17 587:18	o	477:12 479:11,22 482:4	523:13 526:17 527:18
596:20	oak	offices	528:10 535:15 553:9,11
normally	408:13	405:18	555:14 556:4 562:22
441:4,5 448:5 509:14 529:2	object	oh	563:13 564:4 583:22 584:3
575:1 612:10	576:17 585:11 605:11	462:12 480:3 484:8 533:5	593:22 598:21 610:4 611:9
northwest	objection	547:16 558:5 605:21 627:1	619:18 622:14 636:12
451:12	462:18 466:13 529:7	okay	643:17
note	objections	430:16 450:14 479:5	operations
590:18 620:22 629:15	565:15	482:20 489:19 505:18	433:18 435:10 438:3
notes	objective	515:21 534:21 535:3	439:19 445:7 451:7 459:16
479:9 543:1	411:16,18	543:17 566:12 578:20	460:8,14 471:15,20 472:9
notice	objectives	593:17 597:14 599:6	472:19 549:20 569:8 611:7
457:4 490:18	483:9,10	602:15 604:6 633:16 635:2	627:11 636:21 637:15
noticed	observe	638:22 640:20	638:15
475:17,18	450:6	old	operator
notified	observed	435:11 456:6,20 478:19	642:13 643:4
422:14	454:5 505:5 569:8	501:4 531:20 608:11 609:5	operators
notify	obsolete	632:14	525:19
422:12	478:12,17 597:2 608:7	oliver	opinion
notorious	obtained	599:2,9,10 601:2,5	527:3,10 536:14,20
441:17	471:1	omp	opposed
notoriously	obviously	503:1	495:5 573:21
417:4	411:13 475:11 482:1 604:1	ona	opposite
november	630:12 640:3 642:8	618:12,16,17,19	498:13
411:21 413:19 543:1	occasion	oncb	order
nozzles	434:18 474:5 570:4 644:4	618:18	413:8 433:18 521:10 523:6
478:22	occasional	once	523:11 526:10 535:11
nuclear	436:8 526:22	424:12 530:11 547:19	536:12 584:17 594:8
453:17	occasionally	552:20 583:14,22 612:9	orderly
number	441:7 519:20	615:1	608:6
405:7 407:6 427:7,8 431:21	occasions	ones	ordinarily
431:21 436:13 443:17	441:17 442:4 445:2 463:3	442:6 459:12 492:22	440:1 628:3
445:21 446:15 450:2	636:19 637:1	ongoing	ordinary
469:14,21 470:16 473:20	occur	474:7 491:7 529:19	480:16 601:9 611:7
473:20 502:20 503:2	459:13 547:19		

[ore - path]

ore 499:19,21,22	overall 469:4 541:22 584:1 624:19	pages 437:10 512:22 573:8 621:5	part (cont.) 497:9,22 499:20 502:9
organic 431:8 453:17 461:11,16,22 462:2 475:16 483:8,11 494:11,13,16 539:9 558:7 596:18 613:17 631:6	overcome 429:5	paid 581:18	511:18 512:14 513:11 515:4 546:14 547:5 553:20 553:22 554:8 557:4 558:21 563:3,16 566:3 569:3 572:22 585:5 589:1,14 591:18 593:22 596:20 597:10,11 601:7 603:3 611:6 617:2 620:2 636:11 636:16
organics 418:1 520:5,14	overflow 538:21 557:15	paint 421:22	partial 436:2
organism 613:21	overlapping 547:1	paints 562:15,18	partially 483:7
organisms 539:4,8,8 613:19 614:1,3	overload 428:21 447:15	paired 437:4	particle 529:11
organized 497:14	overpressure 440:22	pallets 547:12	particles 428:2,18,20 429:9,19 495:9 527:21,22 528:3 529:1 564:8
orient 584:14	oversight 589:9,17	pan 563:5	particular 410:10 417:9 426:15 453:16 457:4 462:1 463:1 481:11 498:2 503:4 508:22 518:18 519:16 539:2 549:10 552:10 583:12 586:4,8 591:18 595:3 600:3 605:1 611:19 612:5 619:12 635:7
origin 459:5 503:4	owned 496:19 499:8,18 510:7	pap 537:18	particularly 428:21 429:11 508:3 511:2 519:22 524:5 530:5 539:6 611:22 612:17 613:13
original 413:3 426:6,17 431:22 434:6 435:4 437:3 465:20 484:8 491:17 501:5,6,6 511:22 582:14 588:9	owner 501:6,6	paper 532:6 533:20,22 534:1,4 582:21	parties 405:21
originally 452:9 512:1 554:21	oxides 632:18	paragraph 414:3,6,8 418:11,18 421:14 424:15 431:22 443:22 449:1 458:7 481:15 507:7 507:13 509:2,9 535:5,16 545:18 553:2 567:5 568:1 600:9 604:15,22 605:15 609:14 610:9 611:12 616:12 637:6,8 640:17	partition 485:16
originate 415:10 445:6	oxidized 614:2	paranitrochlorobenzene 622:15 636:11	partly 581:19 622:12
originated 536:15 577:8,14 578:5 605:8	oxidizing 613:21	paranitrophenate 418:9 445:9,11,14 459:10 460:6	partner 471:17 631:14
originates 414:22	oxygen 484:9 613:15,16,20,20,22 614:2,10	paranitrophenol 445:13 458:8 463:14 464:1 464:4,7	parts 415:7 424:19 431:16 448:8 448:9,10 518:3 539:12 587:1 591:15
originating 444:2	oxygenate 492:6,13	paraterphenyl 453:6	party 421:17
ortho 453:5	p	parathion 418:7 438:21 439:10 442:19 443:1 444:22 457:20 458:8 459:3,16 460:8,13 463:13,18 511:15 511:19 513:1 515:6,6,16 516:13,16 522:8 571:11 573:3 577:8 578:1 589:10 604:11 610:12 612:20,22 612:22 613:1	pass 563:8
orthonitrochlorobenzene 622:15	p2o5 425:18	paronitrochlorobenzene 626:22	passage 467:10
otto 426:11	p2s5 475:20 476:1,2,3,4,10 516:5	part 410:11 427:18 431:19 449:18,21,22 456:9,14 469:3,4 491:7,17 495:19	patent 571:14,17 572:1,2 631:13
outfall 498:12,17 514:19 515:1 516:20 535:13 540:7	package 523:2		path 467:8 557:15
outlet 475:9,10,11,12 479:2 524:14,16,17	packing 476:7 588:17 641:12		
outline 585:5 586:6	pad 565:5,7		
outside 414:16 422:4 436:7 439:13 516:13 548:3 556:16 564:17 565:3	page 409:22 416:13,21 419:18 419:19 427:7 431:20,21 436:12,12 438:19 445:21 446:15 449:4 457:22 463:15 469:20 470:16,17 475:1 478:10 483:7 485:6 491:9 506:15 507:15 508:18 534:18 540:18 543:14,15 550:18 566:19 573:13 577:5 583:8 584:11 604:15 611:12 618:1 621:7 621:13,13 622:18 639:20 640:16,17 641:16		
ovals 513:8			

[paved - plants]

paved 454:20 564:16,18	personnel 537:3 607:6	pipelines 587:16	plant (cont.) 425:16 426:2,5,12 427:9
paving 510:7	ph 445:13,17 538:13 580:5,8 581:7	pipes 424:9 477:17	430:22 431:4,6,12 432:15 432:17,19 433:1 434:5,21 438:17 442:16 443:14 444:3 447:3,7,10,13,16 449:1,11,16,18,22 450:11 450:13,16,18,20 451:1,6,7 451:15,22 452:15 453:1 454:4 455:5,16,20 457:17 459:2 461:14,20 462:12 464:22 465:1 466:20 468:2 468:9 469:3,8 471:14,15,20 472:9,19,21 473:11,13 474:1 475:5 477:15 483:15 484:18,20 485:3 489:3,21 490:1,2,5,10,13,17,22 491:15,20 492:1,22 493:21 493:22 494:4,18 495:4,8,15 497:3,6,9,12,14,15,22 498:12,22 499:20 501:3,13 501:17 502:9 503:11 505:10,21,21 506:8,10,11 507:8,20,21 508:4,6,9 510:5,14,19 514:15,16 516:5,13 518:13 521:8 523:5 526:5,6 527:8,11 530:17 531:17 534:11 537:3 538:8 539:2,14 540:5 540:12 541:1 543:22 544:3 544:5,7,22 546:6 547:5 549:7 560:10,16,21 561:3,7 561:9,18,21 562:18 566:18 567:21 568:8,16 570:1,3,4 570:11 572:20 577:3,11,17 577:20 578:8 580:15,17,20 581:1,5,13,14,14,17,20 582:13,15,17 583:2,19 584:3 587:20 589:3,20 591:1,14,16,17 592:17,21 595:8,10 597:12,13,16 598:11,13,17,21 601:15,19 602:6 603:22 604:9,11,16 605:1,8 606:14 607:5,10,14 607:19,22 608:16 609:19 609:21 610:7 612:20 616:19 624:18 625:2,20 627:11,19,21 630:13,16,19 631:21 636:6,9,21 637:14 637:15,19,20 638:8,16 639:1 640:8,22 642:2,20 643:22 644:6,9 645:10
pc 436:20,21	phase 495:11	piping 511:2,4 567:1,7,14,17 573:12,14 574:2 587:13	
pcb 410:1,13 467:4,14 468:14 468:22 469:4 562:3	phases 432:3	pit 457:3 458:4 479:1,12,22 481:18 482:4 483:16 491:11 511:19 512:18 513:2,10,11,13,19 514:3,7 514:17 515:1,7 516:17,19 516:21 517:2,4,8 518:9,15 518:21,22 527:21 528:9,14 528:17 529:16,21 530:10 536:12,16 579:5,11,14 580:6 584:15 591:1 592:17 605:20,20 606:5,11 610:11 610:14,17,18	
pcbs 410:2,8,17 411:3 467:22 468:4,17 469:7,9 535:12 536:22 540:22 559:10	philadelphia 406:12	pits 499:19 500:1,2,3,15 501:2 517:13 527:20 535:8,11,13 579:14 589:6 592:11 606:3	
pct 442:9 445:9 526:9,9,13 596:2	philosophy 432:1,16	pittsburgh 406:28	
pcts 536:22	phone 420:22,22 421:4,6,9	place 418:19 421:3 432:18 433:12 451:9 465:1 476:15 480:9 481:9 504:1,9 524:13 524:17 525:5 545:10 560:18 566:1 592:12 606:7 608:5,11 612:8,11,13 642:18	
peculiar 435:19	phosphoric 428:5,6,8,22	placed 502:11 504:21 505:1 529:16 532:8 533:22 552:7 590:8 592:5	
pen 585:20,20 609:6	phosphorus 428:3 459:11,14 460:2 501:10	places 524:13 561:17 574:8	
pending 547:22	phrase 509:1 551:10 579:16 611:2	placing 564:1	
pennsylvania 406:12,25,28	phraseology 611:1	plaintiff 405:6 406:6	
pentoxide 428:3	physically 503:19,20 554:7 605:19	plan 536:13 541:22 598:14	
people 418:19 421:15 422:18 462:1 497:17 555:1 558:12 562:16 596:18 631:6,8 642:1	pick 531:8,10	planned 507:8	
percent 437:9 438:10 444:19 445:9 460:5 519:19 520:10 554:17 577:7 613:2	pickup 548:1	plans 566:8	
percents 634:2	picturing 547:17	plant 410:2 411:3 412:11,17,19 412:20,22 413:6,21 415:22 417:6,12,16 418:17 419:16 419:20 420:20 421:2,16 422:3,5,9 424:5,7,16 425:6	
perfect 633:7	piece 436:21 449:15 582:21 588:16,16 631:9 644:12		
performed 413:17 556:13	pieces 450:2 522:3 533:21 555:12		
period 424:2 429:13 436:4 447:4 484:3,16,22 510:13 520:10 521:12 522:16 523:22 545:3 546:2 555:17 559:19 569:15 571:13 584:2	pilot 411:22 412:6,11 413:1,10 413:12 419:20 420:1 426:2 484:1 494:22 561:21 597:12,13,16 598:11,13,17 598:21		
permanent 484:15	pinned 549:8		
person 471:12 603:13 635:16	pinpoint 477:15		
personal 589:21	pint 522:19,21		
	pipe 423:10,17,22 477:15 478:8 567:19 588:4,4,16,17		
	piped 435:5		
	pipeline 619:1		

[platen - problems]

platen 533:21	polyphenyls 453:8	practice (cont.) 587:19 594:4 596:20 612:3 612:7 623:19,21 624:2,10 643:15 644:15	presume 416:7 458:8 500:5 569:18 599:16
platform 548:3	pond 411:17,22 412:7,12,13 413:1,10,12,14,14 414:1 420:2 484:1,3,12 492:8,8 492:16 583:11,18 585:7,11 585:12	practices 570:18	pretreatment 538:12
plausible 557:15 626:17		precaution 556:6 595:3	pretty 502:8 510:17 515:8 583:5 640:10
please 412:8 490:6 505:14 515:21 535:1 578:11 613:10	ponds 481:19	precautions 575:7,13 635:17	prevent 455:22 460:18
plug 526:18	portion 597:19	precipitation 632:17	prevented 463:4 480:7
pluggage 436:2 527:3	posing 630:1	precise 430:5 642:20	previous 424:17 432:15 466:18 492:11 496:16 629:16 644:7
plugged 435:21 436:1	position 474:14 546:5 560:7 587:12	preclude 489:14	previously 408:4 427:5 434:6 441:21 443:13 488:4 506:8 619:4
plumbing 510:18	possibility 417:19 446:17 466:22 562:15 594:3 628:19	predated 607:1	price 522:11 523:3
plume 425:18 429:22 430:6,7 477:19	possible 440:9,16 515:4 536:22 537:2 565:8 582:22 586:3 588:2 594:11 595:11 607:18 616:19 630:2	predates 455:15	primarily 587:14 591:21
pna 618:19		predominantly 458:21	primary 428:1 538:9 580:22 581:4
pncb 618:18	possibly 459:19 466:3 523:21 528:2 534:9 538:12	preference 570:2,21	primitive 500:11 524:3 553:11
pnf 412:21 415:6,6 417:20,22 418:14,16,16,17 419:11 444:2 445:6,13,15,15,17,19 451:18 490:8,9,10 508:10 515:5,10 516:10 538:2 539:10,11,12 604:19 605:8 614:12,16,19,19	post 644:16	preferred 570:5 571:1,5	principle 426:3 580:13
pohl 541:20 552:20	pot 532:15	prematurely 570:15	prior 490:2 492:5 494:7 496:11 503:9,17 507:6 546:11 583:10 610:19 619:22
point 429:4 430:5 435:10 443:12 455:2 474:8 484:11,13,14 485:16 489:14 515:10,20 517:5 522:6 535:6 545:1 546:10,13 553:10 558:19 563:3 567:6 571:3 578:1 581:6 589:17 600:1 602:18 613:3 624:19 629:20	potash 602:1	premised 518:6	priority 584:17
points 574:2	potassium 602:8	preparation 550:22	probably 410:1 414:22 443:11 451:9 454:14 466:10 471:16 475:6 478:8 486:21 493:15 508:11 510:3,15 512:19 514:7 521:10 522:10 527:3 552:12 568:12 572:16 573:22 606:13 607:4 611:10 624:1 634:14 635:16
policy 559:21 561:9	potent 519:18	prepare 408:20	problem 418:2,3 419:3 421:8 424:7 424:7 425:18 426:16 427:14,17 447:6 482:8 512:15 527:3 562:3 573:8 575:12 576:16,20 579:18 613:5 617:21 621:1 627:12 634:18 635:3,7,13 639:16
pollutants 495:6	potential 447:14	prepared 462:4 489:3	problems 421:12 422:13,15,15 424:19 425:1,1 437:12,15
pollution 437:11,14 438:1,4 481:8 507:9 617:13	potter 406:2	presence 445:15 613:19 635:2	
polychlorinated 572:6	poulenc 572:12	present 405:20 428:7 438:3 444:9 445:19 453:7 458:20 459:8 488:17 490:4,7 518:1 526:12 539:9 570:13 632:16,19 634:14 635:22	
polyester 427:1	pound 551:3,11	presentation 603:5	
	pounds 445:5 522:20 523:2 526:11 551:5,6,6,16	presenting 635:3	
	poured 553:3	presents 634:18 636:1	
	pouring 555:8	press 533:21 534:4	
	practice 413:6 455:13 517:10 518:12,19 560:20 567:10 567:13 569:22 578:7	pressure 429:2,5,6 444:18 476:16	
		presumably 471:22 623:1 638:9	

[problems - ramification]

problems (cont.) 437:22 438:4 447:6 467:14 581:16 614:6 630:1	profusion 543:9	proposed 478:2,22 479:2	q
procedure 506:3 552:5	program 477:22 506:19,20,21 507:11 529:20 557:5	proposing 480:15	quality 519:13,15 532:20 542:8 571:4 584:10
procedures 568:14	558:20 560:18 566:16,17 624:19 625:3	protect 461:6	quantitative 556:2,6
process 407:18 432:9 434:22 436:18 439:21 440:1,9 443:18 444:7,15 462:3 483:2 491:7 493:15 515:10 531:22 533:11 538:5 545:11,20 554:20 562:8 563:3,11 566:16,22 569:4 572:2 573:12 574:13 580:11 583:15 612:6 619:10 631:19 632:19,20 632:22 634:11,15 637:11 637:12	programs 507:1	protecting 571:14	quantities 526:7 527:16 551:1 569:4
processes 471:1,10	progress 407:10,12,15,17,19,26 415:17,18 419:19 425:5 426:15 442:14 447:19 473:22 505:7 565:14 566:5 574:8 584:7 602:12	prove 426:3	quantity 414:21 415:10 520:13,13 521:6 538:17 554:12 602:4
produce 521:5 572:6,9	progressed 530:6	proved 570:11	quart 523:1
produced 452:7 516:5 521:8,9,21 526:6 543:2 554:16	progressing 416:9,15	provide 440:18 480:11 481:6 513:16 530:14 606:2	quaterphenyl 453:8,10
product 438:6 439:4 444:12 452:8,9 452:10 502:22 503:5 526:10 531:16 532:18 533:3 554:13 558:15,22 559:11 562:2,9 576:7 595:9 610:4 622:11 626:11	project 411:14,18 412:3,6,10,10,18 413:1,18 420:1,3 425:21 426:14 431:7 432:3 434:9 434:17,17 436:14 442:18 443:5 463:11 466:6,9,11 474:20,22 505:22 510:16 568:19 588:10 610:2 624:19 631:1,4	provided 426:5 480:13 561:15 601:6 602:4	queenly 426:12 433:1 544:7 636:9 637:14,15,19 643:22
production 438:14 443:3 462:22 470:22 471:7,9 497:15,20 497:21 498:3 504:11,15 518:14 522:14 523:4,8 525:13 526:3 530:20 533:2 546:7 547:5,11 553:6,13,14 560:3 561:7,21 568:18 604:10 610:5 611:3 617:11 617:20 644:11,22	projects 420:4 431:3,5 463:8 466:2 471:19 481:9 506:16 507:1 507:9 510:20 511:2 621:21 627:10,22 628:2 631:5,6,7 636:10 639:3	providing 436:14 471:6 509:18 561:10	quenched 518:14
products 444:8 446:12 459:11 502:19 559:14,22 634:13	prolonged 595:20	provision 440:4 600:16	quenching 512:14
professional 632:9,10	promote 558:20	pump 476:7,12 524:18 600:14,15	question 411:2 428:9 437:21 496:4,8 510:17 571:20 573:1 576:17,19 577:18 593:10 605:12 614:15 615:7,8 621:1
professor 416:10,16	prone 423:12	pumped 440:20 441:10 501:22 538:17 539:3 600:18,19	questioning 488:8,10,10,12 489:13,15 579:22
profit 506:19,22 507:10	pronounce 460:6	pumps 495:10 587:10	questions 410:5 488:21 615:11
profitable 571:7,9,10	pronounced 416:22	puncture 592:14	quickly 423:19 518:5
	properly 440:12 479:13 480:2,4,8	purchase 529:12 570:1	quinquephenyl 453:12
	properties 532:19 562:7	purchased 595:12	quite 424:2,4 435:6 449:19 459:9 467:2 468:14 495:4 605:2 608:6,17 623:11 635:17
	property 449:13,15,16 450:6 498:22 499:18 501:7 607:14	pure 527:1,3,6 536:16	quote 549:1
	proportion 438:13 452:13	purpose 414:10 423:21 428:2 456:11 458:18 476:18 510:1 532:6 550:5,21 559:1 559:18 574:5 594:19 612:5	r
	proposal 478:11 481:17 625:19,22 626:3 630:5 638:22	purposes 413:16 480:16 558:16	railroad 608:12 609:5
		pursuant 405:17	rain 605:5
		put 423:18 429:16 461:5,5 481:9,12 484:21 492:14 493:4 528:19 529:6 548:10 548:22 573:4 588:10,17 590:13 613:6 617:2 624:22 635:16	rains 409:22 410:7
		putting 453:10 466:12,15 485:16	rainwater 410:3,14,16
			ramification 509:12

[ran - reference]

ran 433:11 440:22 484:22	reads 626:6 634:17	recall (cont.) 547:11 549:13,21 552:5	recollection (cont.) 503:12,21 513:4 519:1,13
random 529:1	ready 484:21 489:12 543:10	553:13 555:16,22 556:6,18	520:8 525:17 537:13
range 456:6,10,15 566:8	real 449:21 565:15	558:7 559:7 560:9 561:4	545:22 552:9,12 553:7
rapid 597:1	realize 489:20 589:9	562:4,13,16,17 564:10	555:6 558:2 563:15 564:20
rate 429:1 433:12 449:21 452:18 513:12 613:17	realizing 584:19	565:9 566:14 567:2,9	569:5 583:18 593:2 620:17
rated 560:22	really 423:20 447:14 496:8 529:3 529:9 555:7 574:7 598:19 631:8	568:19 569:15,21 570:5	621:20 633:12,21 642:16
rates 522:4	rearranged 620:3	578:22 579:1,2 580:14	reconstruction 441:20
rating 561:2	reason 437:7 456:2 485:5 519:1 563:18 602:9 628:9	581:8,22 582:12 587:9,20	reconvene 645:17
raw 407:29 418:12 452:20,21 453:2,11 595:1 618:14,18 618:21 626:16 636:11	reasonable 507:12 517:16	588:14 589:4,10 590:12	reconvened 487:2
reach 500:5 533:7 605:14 618:16 618:22 637:20	reasonably 414:2 415:5 439:6 529:3	591:4,12 593:4,19,22	recooling 612:4
reached 429:15 547:2 600:1	reasons 484:4 614:4	594:14 595:14,18 596:1,3	record 409:16 411:8 420:9 430:11 434:1,2 442:12 488:19 489:21 505:9 507:15 514:6 542:8 562:10,11 578:15 583:7 586:1,7 603:16 609:9 615:12,13,17 616:6 629:4,5 629:9,15 645:15
react 458:20 518:4	rebuilt 536:12 583:22	596:16 597:4,7 599:8	recover 524:1,6
reacted 458:22	recall 410:9,21 411:1 413:13,17 414:4,12 415:1,13,13,20 416:3,18 417:5 418:2,13,21 420:22 421:5,19 422:8,14 422:16,18,20 423:3 424:22 425:11,20 426:21 427:5,14 429:7 430:1 431:11 435:13 437:7,14 438:11,15 441:13 441:15 442:6,18 443:5 446:2,20 447:8 449:16 450:20 453:5 454:17 455:3 456:8,15 457:3 468:4,10,12 469:9 470:6,10,19 471:6,19 472:2,10,12,17 473:12 474:3 475:17 476:8,10,22 477:4,11,13,17 478:19 479:2,3 481:8,14 482:3 483:2,5,6 484:5 485:13 492:7,9,21 493:14,18,20 494:6 499:17 500:15 503:2 503:5 504:2,20 505:19 506:4,9 508:11 510:5,18 511:6 512:17 515:22 516:3 519:4,8 523:3,7 525:3 529:14,19 531:21 532:10 535:14,17 536:11 537:3,10 537:16 538:6 539:2 540:1 544:8,17 545:2 546:1	600:12,17 602:12,16,19 603:12 604:8 605:2 606:14 606:17 607:13,19,22 608:4 608:19 609:7,13 611:6,9,15 611:19 612:17 617:16 619:13 622:3,7 623:10 625:8,11 627:4,17 629:1 630:20 635:2,13 636:19 637:1 639:3,7,15 640:21 642:1,5,18 643:2 644:3,8 644:22	recovered 433:20 434:11,20 525:8
reactor 432:11 453:17 476:14,17 476:19,20,21 573:3,4		recalled 539:19 590:2 606:3 609:1	rectangular 585:9
reactors 432:6,8,8 441:1 453:17 599:16		receive 571:5 581:15	recurrence 442:2
read 449:3,9 535:16 640:16 644:17		received 424:18 434:7 505:11 518:9 545:5 566:9 570:10 636:16	recycle 444:18
readily 603:10 614:2		receiving 415:13 495:21 496:2,3,6	recycled 435:1 495:9 512:4
reading 507:5 535:5,8 601:1 605:9 615:2		recess 448:20 473:17 541:12 578:13 603:15	redistilled 452:5
readout 580:12		recessed 487:2	reduce 412:14 419:7 483:11 507:4 535:12
		recipient 415:17 544:9 604:2 625:15 638:19	reduced 419:12 428:13 483:9
		recognition 438:2	reducing 419:10 428:19 446:1 584:1 594:6
		recognize 431:10 448:16,16 508:1 510:9,10 544:10 597:18,21 618:1 621:10	reduction 484:19
		recognized 426:16	refer 414:5 417:2 418:6 420:1 475:3,6 512:21 549:4 635:10 637:11
		recollect 434:16 448:17 452:1 530:1	reference 418:5 421:14,21 427:7 434:20 435:2 440:3 446:17 446:22 447:18,19 448:2 451:11 469:7 475:16 478:5
		recollection 434:13 455:5 466:4 479:20 480:6 481:11 482:8 484:2 484:17,21 490:19 491:16 492:20 494:5,15 498:7	

[reference - require]

reference (cont.) 480:4 490:10 491:6,9 506:18 509:10 531:16 548:21 573:11,19,20 576:10,12 582:8,8 583:10 598:2 602:16 616:12 619:3 619:8 620:15 621:14 622:18 628:18 634:16,20 634:21 637:5,10 638:1 639:20	registration 632:10 regular 585:11 597:10 regularly 596:19 reinforced 427:1 relabeled 559:16 relate 412:2 414:18 related 412:18,20 468:1 522:4 540:10 541:1,3 550:6 599:13 614:9 615:11 618:10,13 631:5 relates 447:6 552:1 relating 488:21 542:14 580:16 582:1 relation 521:6 relationship 421:9 521:20,21 relationships 601:5 relative 418:15 452:13 527:11 relatively 538:3 relatives 408:14,16 released 429:19 599:22 releases 436:8 reliability 426:8 571:3 relieved 600:2 remainder 415:4 remained 528:17 remarkable 575:13 remarkably 423:11 remember 409:6 411:4,12,15 415:11 415:15 416:2,8,17 419:15 421:7 422:10 424:3,11 425:3 430:4 431:14 435:16 437:17 443:16 446:14	remember (cont.) 447:17 449:19 454:6,14,15 457:2,5,9 460:20 461:1 462:9 463:7,11,20 464:15 466:8 467:12,18 468:6 470:5,9 471:12 472:5,13,14 473:6 475:12 476:12,16 477:3,9 478:18 480:10 481:22 482:6,12 484:4,8,12 484:13 485:1 486:8 491:8 497:5 499:10,15,21 500:21 501:14 504:19 505:3,3 506:21 508:2,8 510:16 515:15 517:7 519:6,7,16,20 520:15 523:12 524:4,7,10 525:9,12 526:1 528:15 531:19 535:18 537:20 546:4 547:16 548:5 549:15 549:15,16 553:9 555:21 556:2,3,15,20,21,22 557:3 557:4 558:12 559:5 560:19 561:2,12,18,22 563:21 564:9,18 565:8 568:2,2,3 568:12,13 569:6 570:9 574:19,20 575:14 579:18 582:4 583:21 584:4 585:12 585:12 588:2 589:7 590:10 590:14 592:8 594:3,4 595:13,17 596:6 597:9 600:8,14 603:1,6 604:13 606:1,19 607:18 609:4 611:21 612:1 617:7,19 619:12 622:2,6 623:11,16 625:1 626:19 627:13,22 628:21 630:18,21 634:11 634:15 635:7,8 640:14 641:3,15 642:10 644:11 remembered 504:6 reminded 610:16 remote 432:1 612:10,13,14 remotely 432:12 removal 433:20 634:18 635:4,9 remove 458:16,18 520:5 601:3 619:16 634:1 635:15,19 637:2 removed 458:22 563:1 633:9 634:2 636:20 removing 429:9 635:9,10	repack 429:17 430:3 repair 463:8 510:12 repairs 641:11 repeat 412:8 repetitive 488:10 repiping 568:20 replace 434:19 466:3,7 558:15 562:1 628:1,16 replaced 443:8 478:2 517:4 530:11 587:22 588:19 627:14 628:11,13 629:2 replacement 426:6 510:12 529:21 628:8 replacements 628:4 replacing 423:14 report 407:10,12,15,17,19,26 415:17,18 419:19 425:5 426:15 434:18 437:18,19 442:14 443:10 447:19 473:22 479:7 505:8 565:14 566:5,20 568:7 584:7 602:12 603:2 640:5 641:3 641:13 642:9 reported 497:18 537:20 reporter 405:20 reporting 632:7 reports 644:16 represented 435:7 539:4 568:19 595:1 representing 634:13 represents 414:21 466:18 reprocessing 560:9 request 411:13 430:17 625:20 requests 430:22 431:3 require 575:13
---	--	--	--

[required - savage]

required 426:7 432:7 512:7 529:20 574:13 611:20 612:8	result 417:19,21 436:9 459:15 569:4 570:14 634:3 641:1 642:2	ring 585:15 639:10	run (cont.) 552:6 569:13 584:22 607:3 615:9
requirement 617:3	resulted 422:22 434:17 435:19 575:11	rings 453:13	runaway 440:4,7 441:13 442:5
requirements 620:11	resulting 644:10	rinsed 526:20	running 460:16 564:16 581:2 597:15 600:7 602:6
requiring 624:12	results 614:4 626:5 632:16	rises 440:15	runs 599:15
rereviewing 489:15	resumed 407:3 408:4 488:4	risk 571:2	rupture 600:2
research 558:8,8 562:5 625:21	retired 550:13 645:7,11	river 470:7 473:2 495:14,15,16	russ 474:12
reside 408:10 495:10	retrieved 547:13 553:8	road 498:22 499:8,19 549:19 550:2 606:12	rusting 624:7
resides 645:8	retrieving 525:15	rodell 631:11	s
residue 432:10 433:5,7,10,13,15 434:21 440:21 453:10 502:8,9 525:20 526:12,15 541:16 543:16 544:15,18 551:2,9 552:16 576:10 638:9	return 488:8 559:22 560:18	roedel 631:12	sale 559:10
residues 438:10,16 452:2 503:16 542:6 637:7,11 638:1	returned 560:8,17	role 525:14 625:22 626:2	salt 459:9 602:1
resistant 559:3,16	review 409:1 469:19 489:12 505:15 543:18	rolling 538:20	salts 632:18
resolved 576:21 622:13	reviewed 430:15 470:1 482:19 489:18 505:17 535:2 543:12 566:11 578:19 593:16 596:12 599:5 604:5 629:13 640:19	room 475:20,22 476:1,3,3,4,4,11 476:13 563:17,19 612:16 613:6	sample 557:5 580:9
respect 414:5 431:11 433:2 437:15 463:9 466:22 540:11 573:13 577:3	reviewing 489:10	root 565:16	samples 416:6 426:8 427:13
respective 405:21	revisions 478:1	rosenberg 462:2,6	sampling 556:21 557:1,7 580:16
response 479:7 594:14,17	rhone 572:12	rotate 563:5	sand 592:13
responsibilities 430:21 433:2 464:1 527:12 589:9,18 591:9 611:4 617:14 630:22 631:17	ridge 456:8	rotated 563:7,8	sanitary 471:3 494:11,14 508:15 509:1 565:13 602:18,22 603:8,13
responsibility 431:3 455:19 462:17,21,21 469:3 506:11 546:11,12,14 589:19 607:6,7 640:5	rifle 456:6,10,15 500:11	rotating 563:4,4	santotar 504:18,19
responsible 493:12 497:7,22 530:17 531:1 546:19 548:14 556:8 591:21	right 411:19 425:9 443:4 447:3 459:13 475:6 481:20 483:20 490:14 492:15 495:8 496:10 498:19 512:8 512:16 514:3,6 516:9,11,14 518:16 521:1,11,19 530:5 551:8 554:5,14,18 569:2 574:15 582:11 587:1 592:7 598:3,16 601:17 607:4 609:12 614:18,22 615:10 617:11,15 621:15 625:16 626:13 636:9 638:4,19 645:15	roughly 483:16 587:11	santowax 450:11,15,21 451:4,7,8 452:2,6,8,11,14,19,21 453:3,3 454:8 455:11,14,17 455:20 502:1,10,11,13,20 502:21,22 503:1 504:8,21 505:4 553:22 554:4,11 558:11 575:4 611:2,4
rest 572:8 612:15		round 454:16	satisfaction 489:11
restricting 468:8 472:20		routine 416:6 423:6 437:21 547:21 595:3 644:15	satisfactorily 576:21
		routinely 461:12 467:3	saturated 634:17,20
		rubber 426:18	savage 405:13,16 407:3,6 408:3,8 409:14,17 411:5,10 418:2 420:7,11 422:12 424:16 430:9,13 442:10,14 448:21
		rubbish 607:15	
		rule 546:21	
		run 439:3,4,7,9,12 454:8,10	

Savage, James (Aroclor Dept employee) in AETNA (3)

[savage - side]

savage (cont.) 449:3 469:12,18 471:2 473:16,21 482:13,17 488:3 488:21 489:5,20 505:12 541:18 542:1,7,16,21 543:6 543:8 566:10 578:18 593:15 596:10 599:4 604:4 615:14,21 629:6,10 639:20 645:20	secondhand 470:8,10 section 437:17 508:10 590:17 sediments 468:1,5,17 540:22 seeing 460:20 461:2 470:5 486:8 500:15 505:3 547:12 549:13 573:13 590:2,14 593:4 605:3 606:3 seeks 540:11 577:2 seen 470:3 538:19,19 603:19 605:6 622:16 641:3 segregated 504:5 sell 610:3 selling 559:14,15 609:22 semantics 447:11 semiliquid 526:14 semisolid 523:19 send 433:15 560:2 612:4 sending 596:16 sense 478:16 517:18 581:18 608:22 618:12 sensitive 539:11 sent 409:18 420:16 429:10 430:18 458:16 464:8 485:17 518:20,22 525:10 526:15 527:16 539:19 577:12 596:9 616:10 sentence 415:4 431:22 506:15 545:22 579:19 626:6 634:16 641:17 separate 420:4 422:2 476:3 491:12 565:5 613:5,5 618:20 626:20 633:6 separated 422:6 444:12 640:7 separating 641:7	separation 613:1 620:12 633:5,7 september 409:22 410:7 415:16,21 469:14 505:9 535:19 552:17 sequence 466:11 485:19 sequential 558:4 sequentially 541:7 series 511:10 542:22 559:11 565:19 serious 575:12 served 498:14 509:21 612:5 service 484:21 544:2 services 505:8 509:19 session 488:1 setting 500:12 556:8 577:19 settle 539:1 settled 495:9 587:15 settler 495:9 538:6,9,11,22 539:1 586:9,12 settles 632:20 settling 536:13 seven 421:16 seventh 406:10 severe 426:16 479:12 480:1 severson 542:13,19 546:12 sewage 420:19 421:2 478:1 613:13 sewer 419:11 423:10,16,22 445:20 465:11 475:14 508:2,4,5,6,8,10,11,12 511:4 557:20,21 558:1 564:11,13 565:11,13,13,17 581:3 587:18,22 600:19,20 600:21,22	sewers 412:16 413:5 441:10 445:4 507:19,22 508:7,15 510:12 565:13,14 634:6 shaped 454:17 shed 506:19 541:2 545:8 549:2 551:1,12 557:12 577:11 590:19 591:20 593:7 598:4 610:22 613:10 sheds 576:19 sheet 407:29 439:22 448:2,4,5 620:3 ship 570:3 shipped 457:20 465:18 531:17 560:15 577:8 612:21 627:8 638:7 shipping 525:15,20 531:5,6 537:13 537:16,19 547:13 548:1,15 548:18 559:8 611:13 638:12 shooting 500:9,10,12,12 549:20 550:6 606:4,12 shop 450:22 451:1,3,17 short 426:20 show 417:22 543:4 565:15 586:16 showed 460:21 showing 590:3 shown 451:19 472:15 505:11 516:20 545:5 551:1 566:9 590:15,18 shows 514:14,22 515:3 shuffling 453:19 shut 429:16 sick 642:17 side 413:16,21 417:20 418:5,11 419:2,9 435:19 454:15
--	--	--	--

[side - sources]

side (cont.) 456:8 464:22 465:2 485:17 485:18 498:13 514:15,16 527:12 538:14 582:15,15 585:22 589:20 609:8	sir (cont.) 546:18 547:11 548:6,20 549:2,18 550:1,16,22 551:22 552:5,18,22 553:2 553:16 555:13,17 556:17 557:6 558:5,6 559:19 560:21 561:19 562:13,20 563:13 564:10,16,20 565:9 565:14,19 566:14,19 567:1 567:5,10,12,21 568:4,10,14 569:15,21 571:6 572:18 573:7,11,19 576:10 577:1,3 577:5,10 578:9,9,22 579:5 580:5,5,14,20 582:7,12,21 583:4,10 584:5,9 585:19 586:3,19 587:5,13,20 588:3 588:21 589:1,4,8,22 592:2 593:19,22 595:18 596:3,15 597:4,18 598:4 599:8,12,19 600:12,17 601:1,18 602:11 602:14,21 604:8,14,18,22 605:2,7,17 606:14 607:10 608:3,18 609:10,12 610:9 610:22 611:12,15 612:3 613:9 615:10	slash 425:13 551:12 sledgehammer 553:5,9 554:20 555:14 sledgehammers 555:2 slope 456:7,10 slovensky 422:12,14 424:17 slow 433:12 436:3 sludge 495:8,9,11,12 539:6 598:18 616:14,20 617:4,17 620:14 620:18 622:19 632:21 634:22 635:3,9 636:19 637:2,6 slump 530:5 small 423:18 426:2 428:2,5 431:5 484:17,17 485:7,11 524:6 526:14,22 539:7 607:5 612:10 smaller 522:3 631:7 smell 417:8,13 smith 405:18 smull 542:4 snow 413:17,20 414:5,9,13 415:2 464:14 467:5,6,10,16,20 468:1,5,15,17 469:1 473:9 473:10 495:17 496:2 498:11,13,18 514:19 537:5 539:21 540:4,18,22 541:2 557:7,10,13 610:10 snow's 515:1 516:20 soda 433:19 434:4,7 476:2 sodium 418:9 444:9 445:9,10,14,15 445:17 459:9,10,10 460:6 593:14 594:19,22 595:7,9 595:15 596:4 602:8 634:12 634:12 soil 463:5 467:1,7,15 sold 502:7,19,21,22 503:1 522:11 533:3 551:4 559:18	sold (cont.) 559:20 solid 436:10 444:11 449:4 452:20 504:14 508:19 509:9 526:7,16,18 532:3 539:3 542:14,20 545:9 546:10 548:21 553:3,7,17 553:17 554:3,3,4,7,9,13,16 554:19,22 562:20,22 563:6 563:12 564:1,8 567:7,8 577:6 600:16 solidify 454:9 553:4 solids 454:1 536:7,13,14,14,15,20 536:21 537:1 539:1,4 587:15 601:3 619:4,9 621:21 622:22 630:1 639:4 soluble 418:1 428:7 444:11,22 solution 594:2 solutions 630:2 solve 421:7,12 solvent 444:16 somebody 439:13 470:15 510:10 626:4 637:1 639:12 somewhat 428:11 518:1 537:1 546:22 605:5 612:14 613:22 614:4 618:10 631:3 soon 588:19 643:12 sorry 433:22 448:9 477:8 541:11 574:15 sort 414:5 590:12 601:10 626:10 637:3 sorting 637:17 sound 423:12 sounds 635:6 source 442:20 446:1 526:16 557:10 570:21 571:2,3 sources 448:3,4 475:2 477:5,9,12
side 565:1 signature 621:7 significance 629:20 significant 433:10 480:21 610:2 619:10 significantly 605:22 silica 536:17 similar 411:14 429:20 496:22 572:14 579:22 593:4 642:14 simple 484:9 551:19 564:2 580:8 583:5 628:4 simpler 613:22 simply 410:12 413:15 437:6 438:13 447:16 450:5 458:22 467:7 518:20 528:22 574:9 592:13 599:22 613:7 620:6 629:22 633:5,22 636:20 single 508:8 569:16 570:21 sir 408:10 489:8,22 490:17 491:9,15,19 492:21 494:7,9 494:18 495:13 497:2,11 498:11 499:6,17 500:8 501:11,21 503:9,19 504:2 504:10,20 505:14,19 506:4 506:14 507:5,14,16,20 508:17,22 509:9 510:5,12 511:9,14 512:17,21 513:7 513:13 514:10 515:4,16,20 515:22 516:15,19 518:8 520:17 522:7,12,16 523:7 524:8 525:13 527:7,19 528:8 529:14 531:6,21 532:10 533:10,14 534:17 534:20 535:4,8,10,14 536:6 536:11 537:8,22 539:18 540:9,17 543:13,19,21 544:8,11,17 545:4,8 546:1	site 461:11 495:14 499:1 501:12 549:7 591:18 605:18 situated 495:15 situation 419:14 428:3 429:20,21 469:5 482:4 546:22 616:19 619:12 620:18 639:12 situations 480:22 six 430:4 size 431:4 461:4 495:21 496:6 529:11 sized 411:17 426:5,17 494:21 skeet 500:10 skeptical 477:16 skiffs 531:8 skim 524:22 skimmed 525:4 skip 525:18,20 552:13		

[south - streams]

south 406:18 422:3 451:2 584:16	splitting 555:13	start 408:8 417:14,15,16 424:4,6 426:16 434:4 459:7 473:21 489:13 528:8 588:19	steps (cont.) 455:21 460:17 482:3 509:5 509:6 515:9 641:6
southern 501:5	spoken 409:8	started 493:22 521:17 558:19 569:7 570:8	stewart's 410:11
soviet 572:14	spontaneously 525:6	starting 543:15	sticking 457:7
space 544:20	spot 451:9 557:5 586:17	starts 431:22 632:15	sticks 592:14
spaces 534:1	sprague 474:10,12	state 405:2 406:23,24 498:21	stills 432:10 433:9 437:4 442:7 515:13 531:22 532:1
spare 480:16 608:5	spray 478:22 481:17 482:11	statement 414:20 415:8 416:9 417:18 419:19 424:15 433:17 438:5 443:22 463:12 475:19 476:6 479:16 567:12 577:6 592:6 605:10	stone 480:7 588:5,13
spargers 538:16	sprayed 642:14	statements 477:16	stones 592:14
speaks 594:6	spraying 594:1	states 422:11 438:8,20 470:22 478:1,22 616:13	stoneware 478:2,5,8
spec 533:6,8	square 406:9 454:16	static 441:4	stop 447:16 476:11 588:10
special 432:7 575:6	st 461:17,22 494:12 556:10 596:22 603:3 631:14	stationary 495:11	stopping 489:15
specialist 426:11,13	stack 409:5 425:19 429:22 435:11	stations 623:18 624:5	stops 516:12
specialized 631:22 632:2	staff 497:15	statistical 410:18 443:11,19	storage 432:11 433:5 478:12,13,16 481:17 482:10 513:20 514:2 616:15 617:2 619:6 620:19 622:3,9 623:1,2,16 623:18 624:14,15,20 625:7 626:6,18,20 627:2,5,12,13 628:1,10,14,17,19,20 630:6 631:1,18,22 632:4,21 634:4 635:11 636:20
specialty 443:13 618:7	stage 515:12 517:6 597:16	statistics 443:12	stored 547:22 608:6,7 612:20
specific 411:12 417:9 419:17 425:10 432:7 437:17 450:5 453:6,6 467:12 477:9 506:21 510:16 518:7 531:18 545:3 571:14 595:14 625:8 628:21 633:6	stages 617:8	status 421:15	storm 508:2 565:13
specifically 416:5 423:3 443:16 446:4 474:21 477:2 511:11 537:4 544:14 550:18 557:7 562:14 566:20 604:15 631:19 639:15 644:21	stagnant 441:7	stay 553:18	story 564:21 570:9
specification 519:17 520:16	stale 519:9,11 520:12	steam 477:21,21 574:3,3,4,9,9,11	strange 499:12 572:1
speculating 410:12 418:18	stamp 508:18 511:11 534:19 584:11	steel 531:18 555:1 575:2,10,21 623:7 627:9	stream 413:16 414:15,17 452:8 453:14 458:13 460:5 475:14 483:8,12 495:22 496:3,3 512:4 595:9 604:15 605:1,3 609:14,15 611:13 612:10 613:18 614:22 619:12,13,18 620:1,11 633:14,16,20
speculation 410:11 418:22 566:3	stand 408:4 488:4 626:8	step 413:11 417:21 418:6,7,8,17 419:6,8,9 432:9 434:10 435:5,9 436:18,19,20 444:8 444:12,17,17 459:18,19 460:10 484:14 512:13 532:20 533:18 563:2,11 581:10 620:4,4,6,10 631:15 633:9,10,13,18	streams 442:19 446:16 447:9 453:19 603:21 632:20,22 633:18
speeds 469:19	standard 439:21 506:3 555:18,22 556:6,9 559:2 573:12 592:7 592:10 597:2 612:3 623:17 624:21 625:19	standpoint 493:15 497:17 571:4	
spend 481:7 489:9	standards 624:11 625:5,5,8,12	stands 613:14	
spent 445:1,3 532:7 560:1 633:6 633:11,17,19 634:5,9	standing 569:22	stapled 616:3	
spigot 588:15	standridge 420:19 421:1,10 422:12	steps 419:1,4 431:17 440:8	
split 555:7	splitting 555:13		

[street - taffee]

street 405:19 406:4,11,17 408:12	subject (cont.) 422:21 442:22 470:20	suite 406:18	sure 428:14 447:22 449:14
strengths 519:21	474:7 486:19 505:19	suits 421:17	455:6 467:2 486:14 494:2
strike 446:21 483:14 558:5	507:18 529:4 541:16,21	sulfate 634:12	500:21 504:16 514:5 520:9
593:10	542:5,19 566:7,14,18	sulfide 435:7 475:16	540:12 545:2 546:15
stripper 634:2	576:12 579:2 593:20	sulfur 417:3 435:20,20 436:6,8,10	553:15 560:14 571:19
stripping 619:16,21	603:21 612:22 629:18	526:7,9,11,13,17,18 527:1	585:6 587:18 619:2 633:13
strong 475:16	subjects 413:20 422:19	527:2,4,4,16 594:7	surety 405:9
stronger 520:1,2	submission 449:1	sulfuric 633:3 644:20	surface 460:22 484:10 492:13
strongly 568:2	subparagraph 544:14 551:2 566:20	summary 444:1 506:15 507:8 548:20	505:1 517:20 524:20
structure 416:2 570:13 582:9 583:12	subsequent 412:16 459:18 587:5	summer 432:20	surprised 578:3
583:14 585:9	610:15	sump 515:18 516:2	surprising 611:22
stuck 447:11	subsequently 460:10 472:8	superintendent 474:13 497:16,16,18	surrounded 565:7
studied 441:22 461:12 500:5 524:2	substance 502:4 504:18 528:14,21	604:10,12 606:20	suspect 581:21
529:5 571:20	538:3 574:22	superior 405:1	suspended 527:21,22 528:2
studies 416:9,15 419:20 426:8	substantial 444:10 452:7,10 496:14	supervising 546:22	sustained 644:12
443:17 467:14 486:18	substantially 454:1 455:15 483:8 521:9	supervision 497:10	swan 501:8,10 571:17 572:1
589:2 598:17	539:16	supervisor 443:3 462:22,22 497:21,22	sweet 606:15 609:15
study 410:19 411:1 415:20 416:2	successful 483:7 520:10	498:2 501:16,18 520:2	sweets 606:19,20 607:3,16 608:4,4
416:4 443:10,16 445:21	successfully 447:13	522:14 523:4,8 524:1	609:1,8
446:3 461:13 467:18	suffer 550:20	525:13 526:2 530:20,21	switching 535:11
505:15 529:11 534:22	suffered 637:2	537:16 546:7,9,18 547:5	sworn 408:4 488:4
543:9 558:12 589:12	suffering 640:22 642:2	553:13,14 559:7 560:4	symbol 513:8 551:3,6,12
studying 437:21	sufficient 574:10	568:18 604:11 617:12	synonymous 427:6
studz 471:3	sufficiently 554:7	644:12,22	synthesized 562:6
stuff 527:5 603:17	suffix 503:2	supervisory 591:9	system 426:4 436:5,15,16,16 437:2
stutz 411:21 415:21 479:11	suggest 589:1	supplemental 407:13	437:6 442:2 459:20 490:16
480:11 481:15 493:14	suggesting 480:14 630:2	supplied 453:18	495:2 496:19 508:2,8
494:9,16 496:10,13 578:17	suggestion 481:13 535:10	supply 571:4	526:20 557:20,21 558:1
596:9,16 601:11 603:10	suggests 414:10 546:17	support 598:19 601:6 641:12	561:2 564:5,7 567:22 568:5
stutz's 479:6 481:13	suing 421:17	suppose 467:7 535:18 578:6 623:12	573:21,21 574:6,7 601:16
style 482:2	suitable 478:14	638:13	609:17 619:5,9 637:7,10
subcategories 551:9		supposed 520:5 570:14	systems 437:8 440:11 559:6 637:20
subdivision 497:19		suppress 419:2	t
subject 414:3 416:1,19,21 420:18			table 448:1
			taffee 506:6,7

[tail - time]

tail 424:18	telexing 596:21	testing 413:17 414:5 439:10 517:19 537:4 582:2,4 598:12	think (cont.) 637:13 639:14 641:22 643:1,15 645:5,7,12
taken 414:2 419:4,14 428:10 441:9,22 453:15 454:7 455:21 457:13 460:17 509:6 550:14 555:11 575:7 595:4 606:8 638:11	tell 436:16 448:18 483:5,13 493:20 510:21 532:13 539:13 543:21 550:12 572:11 623:3	tests 439:3,4,7,12 485:7	thio 432:8 435:4 476:6,7 576:8 576:9 595:19 596:2
talk 423:7	telling 499:17	text 534:18 597:5 599:15	third 421:14 427:7 436:19 437:6 543:15
talked 458:4,6 473:1 637:14,14 639:18	temperature 440:13,15 476:16 574:3	thank 417:2 540:15 573:7 609:10	thirty 406:10
talking 417:16 418:10 451:10 454:11 472:13 558:12 566:2 580:4	temperatures 440:11	thereabouts 457:11	thoroughly 579:20
talks 414:15 436:14 477:22	temporary 483:20 485:13,14 588:18	thermally 440:9	thought 409:2 441:12 473:7,9 514:13 606:22 626:5 631:16 633:16 638:6 639:11
tank 434:8 440:21 478:12,16,19 483:17 524:18 597:4,8,10 597:11 624:6 625:7 626:6 626:18 627:9 628:8 632:1,4 634:19 635:4,10,11,16,20	tend 526:18	therminol 558:14,21 559:1,2,8,11,15 560:15,16 567:22 568:4 573:20 574:6	thousand 551:20,21
tanks 475:6,13 479:12 480:1 482:5 491:14,16 513:20 514:2 585:13,16,21,22 586:6,15 587:8 616:14,15 616:20 617:2,4,18 619:6 620:14,19 621:17,22 622:4 622:9,17,19,20 623:1,2,7,9 623:10,11,12,19 624:12,14 624:15,20,22 625:2 626:20 627:2,5,12,14 628:1,10,14 628:17,17,19,20 629:1 630:7 631:2,18 632:21 634:4 636:20 637:2 639:8 639:13	tended 529:2	thickener 586:13	thread 567:20
target 500:12	tends 517:22	thing 417:11 420:6 442:2 452:1 461:3 473:5 482:6 483:21 484:2 488:11 516:4 547:21 585:10,14 610:6	threaded 567:19
task 616:13	tenure 450:17 451:6,15,22 454:4 459:2 488:22 515:22 550:1 552:11 556:17 569:16 592:21 605:3	things 408:9 451:19 470:8 481:1 525:8 528:6,6 536:3 547:2 547:3,4 561:15 562:1,2 567:13 607:6,7 620:8 634:14 643:16	three 411:8 413:9 437:8 521:18 521:22 551:9 564:21 587:9 615:16 629:8
technical 419:16 421:7,10,11 423:1 443:1,2 505:8 529:11 544:2 601:6	term 418:15 427:2,5 465:12 501:14 504:19 509:3 512:11 536:14 538:15 545:10,17 562:5	think 409:7 410:12,18 413:14 415:5 418:17 420:3,6 422:5 425:13 441:17 446:4 451:18 455:12 462:12 480:15 481:1,5,5 483:21 485:4,4,19,22 486:1,3 491:13 496:8,20,21 498:10 500:16 502:11 504:12,16 504:16 506:11,13 509:3,22 511:21 512:20 513:20 514:4 515:8 521:15 522:2 522:22 525:5 527:9 529:18 530:19 531:5,11 534:2 546:10 549:10 550:3 557:1 557:12 559:18 563:16 564:12,22 570:3,11 571:19 573:16,19,22 576:11 579:17 580:3 583:17 585:5 589:8,10 590:19 600:22 603:16 604:11 605:14 606:3 607:4,7 608:12 610:2 613:14 616:22 617:3 622:10 624:1,11,21 626:8 632:14 635:21 636:16	threshold 427:20 428:12
telegram 596:9,16	terms 445:4,5 459:5,5 495:22 549:4 561:22 565:10 615:8 625:6		thrown 543:10 549:1
telephone 420:18	terphenyl 452:10,19 453:4,7,16 553:21		thursday 405:15 543:1
telex 597:1,5,19	test 413:16 583:19 585:12 613:22 614:3 615:9 641:17		time 411:2 412:13 413:6 415:21 416:2,5 417:6,14 419:3,13 419:15 421:2,3 422:15 429:7,13 433:1 434:13 436:4 437:2 438:17 439:2 440:20 442:20,21,22 443:8 445:18,19 447:4 449:12,19 450:20 451:1 452:4,15,16 455:3,4,15 456:16,17 460:5 460:13,15,16 461:12,19 466:1,19,20 467:3 468:7,8 468:16 471:13 472:3,21 474:8 475:5,15 479:17 484:3,16,22 485:2 486:10 486:21 489:10 490:4,8,12 490:16,20 492:3,4,7 493:21 496:16 497:8,11 499:19 500:20 501:1,16,17 504:20 504:20 505:15 506:1,2,9,22 506:22 507:3,3,20 510:2 517:6 521:12 522:16 524:5
telexed 596:18	testified 408:5 488:5 500:9 539:18 549:6 588:3 590:22 604:18		
	testifying 499:1 511:14		
	testimony 464:15 492:11 499:6 516:19 521:16 527:15 540:4 554:10 575:6 583:10 588:21 590:2 592:3 599:18 600:4 601:18 610:11,19 626:14		

[time - understanding]

time (cont.) 525:1,1 526:5 527:10 530:13,13,15,15,20 531:7,7 531:10,10,16 533:2 535:6 535:22 536:3 545:3 546:2,7 546:12 547:13,13 549:19 551:14,15 552:10,13 553:12 555:17 556:7,13,13 558:13,18 559:6,13,19 560:3,6 561:17 567:3 568:8 568:11 569:12,13 570:2 571:17 576:21 578:7,12 579:13,17 580:3 581:1,6,12 582:12 587:2 592:12 597:3 598:12 601:13 603:1 604:2 604:12 606:21 608:15 609:18 610:1,5 611:10,10 616:18,22 617:9,12 618:3,5 618:8 619:15,16 620:2,4,8 622:4 623:17 624:13,16 626:1 627:18,20 628:15 630:10,13,15,20 631:4,13 631:16,18 632:13 635:17 636:17 639:4 640:8 641:9 642:19,21 643:7,13,20,21 644:1	top (cont.) 597:18 621:15 625:15 626:11 638:19 topic 437:18 tops 548:10 torch 573:21 torches 567:9 torn 608:13 tort 567:17 total 438:8 tower 423:18 491:1 568:11 612:4 town 510:10 534:13 toxic 438:7,20 439:11,15,18 538:2 560:22 561:4,5,14 614:8,17 616:14,20 617:17 635:15 636:3,14 641:18 642:3 643:8 644:9 toxicity 437:12,15 438:1,4,19 614:6 614:9 636:13 644:4 toxicology 556:11 traces 515:5 tracing 574:3,9 track 509:17 522:17 533:8 546:19 547:6,8 tracks 608:12 609:5 trade 502:7,13,15 534:16 612:21 transfer 484:10 558:18,20 559:10 559:17 567:7,22 619:1 transferred 544:6 610:5 transporting 587:14 trappings 542:15,20 545:9,15 548:22 565:22 trash 549:21	treat 412:14 484:18 578:1 treating 419:20 583:21 treatment 410:2 412:13,16,16 413:5 420:20 421:2,16 422:3,13 422:15 424:16,20 425:1,2 432:7 444:3 447:7,13,15,16 465:18 471:1,7,10 475:5 479:13 480:1,12 482:21 484:20 485:3 489:3 490:1 490:16 491:4,20 494:3,19 495:4,19 496:1,14,16,22 497:4,7,9 533:18 538:1,4,8 539:5,7,14 578:3 579:7 580:18,22 581:3,3,10,11 582:3,14 583:1,3 584:3 588:8 589:4 597:7,15 598:14 599:11,14 601:7,13 603:11 611:16 612:12 633:22 tree 558:3 trench 441:1,3,5 460:22 564:11,13 565:9 572:18,21 573:5 599:15,17,19,22 600:3,4,10 600:11,12 601:3 trickled 495:12 trickling 494:20 495:1,3,10 598:12 598:18 triggered 474:5 trivial 533:12 trouble 522:11 troublesome 624:10 truck 525:19 547:14 true 498:5,8 518:8,12 521:14 569:12 571:15,16,18 575:9 575:15 591:2 599:22 602:2 604:20 trust 406:3 try 442:2 443:20 525:8 570:21 trying 428:15 574:18 601:9 629:19 639:12	tsd 431:2 442:14 443:7,9 447:19 473:21 479:7 627:20 628:5,7 631:22 636:6 642:22 tubes 556:21 557:1 turn 427:7 431:20 437:10 446:15 448:1 488:8 511:9 550:16 560:2 578:9 621:5 639:17 turned 419:9 426:17 452:3 538:2 555:9 turning 610:9 twentieth 406:17 type 462:7 483:2 488:11,12 500:12 504:3 505:4 528:21 577:12 580:10 625:22 typed 425:10 typical 566:18 typically 514:3
u			
			ullmer 599:2,8,13 unacceptable 429:16 uncommon 624:6 underground 587:17 616:14,20 617:18 621:17,22 622:3 623:9,10 623:11,13,16,18 624:12,15 624:20,22 625:1 627:13 628:1,10,13,17,20 631:18 631:22 632:5 634:19 635:4 635:10 understand 428:14,15 489:16 501:15 521:11 533:10 536:1 549:17 614:11 understanding 410:6 439:1 446:6 455:7 458:11,15 488:6,14,18 495:1 496:15 504:7 521:12 522:19 523:20 570:20 571:5,21 577:20 581:12 601:19 611:22 622:20 623:22 634:22 636:2

[understanding - wastewater]

understanding (cont.) 643:11	urgent 421:8 423:8 588:10	ventilating 552:7	warm 612:16 613:6
understood 439:5 583:1 642:9	usage 522:17	ventilation 543:15 551:2	warmed 613:7
undertake 624:18	use 453:10 456:16,19 465:12	version 465:21 549:5	warned 446:17
undertaken 412:11 415:20 558:21	518:19 551:19 558:9,20	versus 429:12 504:4 554:11 602:8	warnings 447:8
undertaking 412:6,10 421:5 424:22	562:18 571:21 595:16	vessel 419:6	wash 418:1 436:6 445:1,3,13,17
425:20 442:18	601:16 612:9 630:6 636:10	vigorously 538:18	460:4,10,15 611:1 633:9,11
uniformly 529:3 538:15	useful 484:19 553:8 619:18	virginia 494:19	633:17,18,19 634:5,9
union 406:27 572:15	uses 534:15 561:20	visible 415:7 429:22 430:6 456:15	washed 460:10 611:8
unique 518:1	usual 502:22	457:3,6 477:20,21 539:13	washer 459:20
unit 426:2,5,6,9 432:15 437:5	usually 442:1 453:8 498:4 516:22	585:17	washing 444:2,6,13,21 445:7,12
467:22 468:4 479:13 480:2	519:1 613:18	visit 450:3 550:2	632:16 633:9,10
496:11 522:21 530:3	v	visited 424:16 450:4 545:1,2	washington 406:19
583:19	vacuum 444:19 477:20 633:22	visiting 455:4 527:11	waste 410:1 412:14,15,21 413:4,5
units 426:6 432:2,5,13 485:16	vaguely 556:21 593:21 641:3	visits 549:18 550:5	413:11,22 415:22 416:19
643:15	valley 422:4 606:15,19 607:16	visualized 548:7	418:16 423:6,9 442:19
unnecessarily 481:7	608:4,4,10 609:1,8,15	vitrified 423:10,16 478:7 588:4	444:1,14 445:4 446:2,7,16
unreacted 417:22 418:14,16,17	valuable 452:3 453:2	volume 405:13 517:20	446:21 447:7,9,13 448:3,4
445:10 619:17 634:3	value 453:21	w	449:4 452:22 459:9 471:1,7
unsoluble 454:2	valve 552:8	wait 542:11	471:9 475:2,4,7 478:11
unstable 440:9 570:11,12	vapor 427:8,15,16,22 476:17,19	walk 417:12 606:8	479:12 480:1,21 481:4,4,8
unsurmountable 635:3	505:2	walked 449:12	484:20 485:2 489:3,22
unusual 410:14 472:15 632:8	vapors 429:9	walking 450:5 606:7	490:10,15 491:4,20 492:6
upgraded 433:18	variability 447:12	walls 624:12,16	494:3,19 495:11,19 496:14
upgrading 574:9	variable 581:21	want 418:1 481:7 506:14 615:11	496:16,17 497:4,7,8 509:10
uphill 512:20	variety 539:7	wanted 483:11 516:15 527:19	512:10,14 517:20,22 526:7
upper 610:16	various 431:16 439:4 450:6 452:1	534:17,18 540:17 550:16	528:3 530:1,2 538:8,12,15
upsets 480:5	452:22 453:14 507:6,19	552:18 558:5 565:19	539:13 577:6,7,12 578:4
upside 555:9	539:9 543:18 566:1 584:6,9	566:19 582:7 588:21	579:7 580:18,21 581:2,10
upstream 515:9 520:8 538:9 540:7	614:4 620:7 631:4	594:10 601:18	581:14 582:10,14 583:1,3
583:17	velocities 528:5	wanting 520:13	583:19 584:3 587:2,14
urgency 423:7	vendor 601:9	warehouse 563:14,18 611:13 612:19	588:8 589:4 594:1 596:5
	vent 476:14,20,20,20 477:6	613:7	597:7,14 599:11,14 601:7
	564:5		601:13 603:11 604:19
			610:12,16 611:15 613:12
			613:13,21
			wastes 412:19 413:2 415:2 416:10
			419:21 438:9 445:6,18
			457:13,20 458:16 464:7,18
			464:20,21 465:3 482:22
			484:18 491:3 508:19 517:9
			525:15 535:6 578:2 581:15
			614:3
			wastewater 459:3,16,22 460:3,7,13
			464:16

[wastewaters - zero]

wastewaters 460:19	we've 458:4,6 483:17 507:3 586:21 599:16 603:19 619:3 625:1	work (cont.) 443:3 472:2 474:6 510:21 547:1,11 556:11,21 593:8 597:12 625:19,20,22 631:20 638:22 641:8 643:12,17 645:6	years (cont.) 558:13,15 561:6 570:7 582:16 589:8 598:5 608:13 625:2 632:14 644:1
water 415:6,8 418:1 419:7,8 428:7 436:11 441:1,3,5,9 444:11,22 445:1,3,13 454:2 456:1 463:6 465:5 467:4,5 468:15 484:11 496:6 499:13 507:18 512:3 522:9 537:6 557:15 563:4 574:17 574:18 589:14 599:15,19 600:15 609:16 611:1,20,21 612:4,13 632:18 633:9,11 633:17,19 634:1,5,9,10	wgk 615:18 616:7 629:9	worked 408:16 411:14 423:11 427:22 442:15,22 443:17 443:18 447:3 482:7 496:11 496:16 510:20 561:12,17 583:2 610:1,2 618:2,8,8 625:2 628:2 636:10	yellow 539:13,15,15 605:2
waters 495:21	whatsoever 589:19	worker 555:18,22 643:2 644:8	yellowish 604:19
waxy 454:1	wheeler 594:15,16,21	workers 561:10,15 595:15 640:22	yesterday 410:6 418:10 441:18 483:17 595:22
ways 424:18 453:15,20 547:2,4 619:6,18 636:1	whichever 608:21	working 416:1 422:18 424:17 443:5 443:7 447:16 462:5 471:19 472:16 494:11 510:13 539:14 596:19 618:6 631:13 636:17 639:15,18	yield 419:2,4,10
wear 588:6,14	wide 514:8 561:3 586:17 588:15	world 572:8	yields 447:5
weather 540:7 613:1,4	width 498:19	worth 522:10	z zero 615:2
weeks 569:13	wildlife 472:20 473:13	wound 418:16 526:12	
weighed 522:20	william 640:13	write 480:18 481:21 585:22	
weir 414:9,10 475:9,10 479:2 538:21	wilmington 405:14 406:5	writer 473:8	
weirs 538:14	wind 440:22 445:1 533:13	writes 479:11 480:11	
welders 511:3	wish 578:10	writing 479:10 482:1 597:21 609:8 630:1 641:15	
welge 406:8	wished 569:22	written 434:14 481:22 501:3 642:8	
wellwater 612:9	witness 407:2 430:15 462:20 468:20 470:1 482:19 489:18 500:4 505:11,17 529:9 535:2 541:10 543:12 566:9,11,12 576:18 578:16 578:19,20 583:6,8 586:1,7 591:18 593:13,16,17 596:9 596:12,13 599:2,5,6 604:1 604:5,6 605:14 609:9 629:13 640:19	x	
welter 543:9	witnesses 606:22	xylene 613:2,4	
went 444:21 456:10 464:16,19 464:21 465:3,15 500:8,14 503:5 504:8,9 521:18 557:18 565:9 578:4 603:20 610:13,16 613:9 622:9 633:21 634:4 637:2,16 644:12	wondering 489:22 507:20 535:14 544:17 550:22 567:1 573:11 596:15 605:2	y	
west 422:5 450:21 451:17 494:19 512:20 611:13	wood 597:4,8,10,11	yard 464:13 498:14	
wet 428:4 555:9 575:2,3 588:9 633:12	word 598:7 613:15	yards 607:7	
	words 476:13 504:4 641:16,21	year 430:4 529:17 544:6 550:3 551:3,5,12,17 629:18	
	work 408:14 411:13 413:8 419:16 421:7,10,11 423:1,5 423:7,8 424:22 425:20 426:1 431:15 437:15 443:1	years 439:11 489:21 503:13 510:16 512:18 514:14 522:15 549:17 557:6	