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Proceedings Pollution Prevention from Ships and Shipyards Symposium – Oceanology International 2001

Potential Economic and Environmental Consequences of the Convention to Ban Harmful Marine Antifouling Systems

Michael A. Champ[1]

The Marine Environmental Protection Committee (MEPC) of the International Maritime Organization (IMO) has proposed a global ban on the use of Tributyltin (TBT) in antifouling paints to "protect the marine environment". The ban on TBT has come about because of TBT has detrimental effects on non-targent marine organisms. In November 1999, IMO agreed that a Treaty be developed by the MEPC to ensure a ban on the application of TBT based antifouling paints by January 1, 2003, and a ban on the use of TBT by January 1, 2008. It was also agreed that a Diplomatic Conference be held in 2001 (Oct. 1-5) to consider the adoption of the international legal instrument[1]. MEPC 46 was held the week of April 23rd at IMO in London to continue drafting the Treaty.

> *Serious concern has been expressed by a wide variety of experts for the need to identify in the Treaty the necessary regulatory language for: the "safe" removal, treatment, and disposal of marine antifoulants deemed "harmful" by the Treaty and (2) who is liable for the future dredging and disposal of TBT-contaminated port and harbor sediments - to <u>also</u> protect the marine environment.*

Current Shipyard Practices – Future Costs

This concern is based on the current shipyard practices of using freshwater and hydro blasting to washdown and to remove salt and paint from vessels. This produces washdown wastewater, which is discharged into waterways, contaminating port and harbor bottom sediments. If TBT is banned by international treaty as proposed, the future cost of removal of dredged material from harbors and waterways will increase significantly (estimates are up to 10 to 15 times). A key question is who is liable for this cost: the public, port and harbor authorities, shipyards and drydocks or ship owners and operators.

In the U.S., only the state of Virginia has discharge regulations (50 part-per-trillion) for TBT in washdown and hydroblast wasters from shipyards and drydocks. When a ship is first placed in a drydock, the vessel is washed down with freshwater to remove salt and prevent corrosion. This washwater is discharged directly to local rivers, estuaries or bays. Over the past few years, hydroblasting has become the preferred method to remove antifouling marine coatings (paints) from a ship's hull because of the human health risks from breathing sand blasted materials. Without national regulations on discharge requirements, this practice will continue and significantly increase between 2003-2008 as a result of the Treaty. Contaminated washdown (salt and slime removal) wastewaters from a large ship can exceed 100,000 gallons. Hydroblasting wastewater from the same ship can exceed 400,000 gallons.

Dealing with TBT Contaminated Shipyard Wastewaters

The Environment Protection Agency (EPA) - funded Center for Applied Ship Repair and Maintenance in Virginia, has found that washdown (salt removal) and hydroblast (paint removal) wastewaters in shipyards can contain up to 6 million parts per trillion TBT. In Virginia, this wastewater is treated to remove TBT from shipyard discharges. Researchers at Old Dominion University have demonstrated that off-the-shelf waste treatment technologies are not satisfactory for the removal and treatment of TBT in these wastewaters. In addition, U.S., UK and Swiss studies to remove TBT and other metals from wastewaters have found that advanced technologies not commonly utilized in normal sanitary treatment plants are required to remove TBT. Studies conducted by EPA, U.S. Navy and the Consortium of Organotin Manufacturers (ORTEPA) have recorded declining levels of TBT worldwide, yet documented 'hot spots' of TBT in bottom sediments in the proximity of shipyards, ports and harbors.

An example of how contamination can increase the costs for disposal of dredged material is seen in the two alternatives available to the Port of NY/NJ. The

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Mud Dumpsite, located 3 miles offshore, has been operational for many decades and has been the traditional disposal area that can accept clean dredged materials. Contaminated "spoils" have to be disposed of at an upland hazardous waste disposal facility. From 1977 to 1991, 90% of all NY/NJ dredge spoils were tested and classified as clean spoils and only 1 to 2 % were contaminated spoils. However, in 1991 the US EPA required bioassay testing. This increased the volume of contaminated spoils.

For contaminated dredged material, the currently available alternative is upland disposal at a hazardous materials storage facility and none are available in the near vicinity. Howland Hook Terminal in Staten Island shipped 150,000 yd^3 of sediment via barge and rail to Utah at a cost of US $17 million or over $110/$yd^3$. Traditional fees for dumping dredge materials at the Mud Dumpsite are in the area of $10/$yd^3$.

Concern has been expressed over the need to identify regulatory language within the Treaty itself for the "safe" removal, treatment and disposal of TBT from ships; and clarification on the issue of liability of future dredging and disposal of TBT-contaminated port and harbor sediments.

Under current regulatory practices for most of the world, TBT in washdown wastewaters can be discharged directly into local waters. The Treaty must address this shortcoming by adding specific language into the Treaty.

It is quite possible that the "regulated" nations can quickly implement new requirements to correct this situation. This implementation will result in the transfer TBT contamination to the "unregulated" countries, which are least able to deal with it. Unregulated countries may unknowingly accept the environmental and human health risks to gain economic benefits from removing TBT from ship's hulls. Market forces are selective for low-cost labor and weak environmental regulation. Unfortunately, most of these developing countries do not have the funding or environmental expertise available for the monitoring, research and technology development essential to treat and dispose TBT washdown wastewaters safely. These activities would defeat the purpose of the Treaty, which is to provide standardized global regulation and ensure that shipowners do not face multiple, fragmented and counter productive national regulations.

It has been estimated that between 70-80 percent of the 28,038 ships in global commerce use TBT. Under current practices, the estimated annual increase in wastes in shipyards and drydocks from the Treaty will be: 2.3 million tons of contaminated grit, 18,000 tons of spent paint, 1.8 million paint cans, and 1.1 billion gallons of contaminated washwater (low pressure for salt removal), and if the trend increases of using high pressure hrdroblasting to remove spent paint, the volume of wastewater could exceed 5 billion gallons of water needing treatment.

Impact on Ports and Harbors

Earlier this year, environmentalists discovered that the proposed international treaty (from IMO) banning Tributyltin-based antifouling paints did not contain any regulatory guidelines for safe removal and disposal of TBT based paints in shipyards in the Treaty. At a meeting of the Marine Environmental Protection Committee (MEPC 46) held in London on April 23 through 27, 2001 to draft the Convention, a group of nations (Cyprus, Brazil, Denmark, Liberia, Marshall Islands and Vanuatu (formerly New Hebrides) stressed the need for language in the treaty requiring safe removal, treatment and disposal of TBT from ships, and the clarification of liability for future dredging and disposal of TBT-contaminated port and harbor sediments. For most of the world, TBT in washdown wastewaters can legally be discharged directly into local waters. In Plenary, the MEPC then instructed the drafting committee to include a new article that regulates the "application or removal of anti-fouling systems" that are banned, requiring that they be "collected, handled, treated and disposed of in a safe and environmentally sound manner to protect the environment and human health."

However, before the language of the treaty is approved in October, more concerns must be considered. Safe methods of removal and treatment of the paint must be defined. Where bottom sediments contain TBT's, either from past activities or from paint removal in compliance with the treaty, port authorities would benefit from defining who is liable for dredging and treating the TBT contaminated dredged material.

A Conference was recently held at the Technical University of Denmark in Lyngby, Denmark to bring together researchers on "Environmental Aspects of Handling Heavy Metal and TBT-Polluted Harbor Sediment." International experts indicated that a cost-effective system for remediation of persistent TBT (mostly paint chips) in contaminated bottom sediments may not be available for several years.

Without incorporation of Article 4 (bis) in the treaty, shipyards complying with national and local discharge regulations could inadvertently release more TBT to ports and harbors in the five-year compliance period than has been released from ships (hulls) in the past 40 years to the same waters. This would be devastating to the marine environment.

The Treaty would be implemented to remove the TBT from ships to protect the marine environment. Consequently, ports and harbors (who had nothing to do with the Treaty) could be at risk for the liability of treatment and disposal of this highly toxic waste in special landfills. The key question then becomes who is liable for the costs of removing and disposing TBT contaminated dredged materials: shipowners, shipyards, or port and harbor authorities?

Michael A. Champ, Ph.D.

Summary Resume

Academic Positions:

- The American University, Washington, D.C., Professor (w/Tenure) and Director of Environmental and Marine Science, 1972-1985; Pollution and Municipal Drinking Water and Wastewater Treatment R&D.
- The University of Hawaii, Hawaii Natural Energy Institute, Consultant Alternative Energy R&D, 1991-1994.
- Texas A&M University, Geochemical and Environmental Research group (GERG), Texas Engineering Experiment Station (TEES), Senior Scientist and Director, Washington, D.C. Office, 1989-1997. The GERG Laboratory is one of the top four analytical laboratories in the world, with expertise in detection of ultra trace levels of contaminants – in particular toxic and hazardous materials at part per trillion (ng/L) concentrations in biota, sediment and water, especially salt water. Oil Spill R&D, Planning, Response, and Training.
- The University of Alaska, Fairbanks, Senior Scientist, 1995-1999. Contaminants in the Arctic, Oil Spill R&D.

Positions in U.S. Government:

- Department of Defense, Army Corps of Engineers, Review Board for the US Congress over the US Army Corps of Engineers for Civil Works Projects in Rivers and Harbors, Resident Scholar, 1975-1976.
- Department of Commerce, National Oceanic and Atmospheric Administration, R&D Office of Marine Pollution Assessment, Ocean Assessments Division, Resident Scholar, 1979-1984.
- Environmental Protection Agency, Office of Policy, Planning & Evaluation, Senior Science Advisor, 1984-1986. Environmental Risk Assessment of Toxics, Biocides, Pesticides, and Hazardous Materials.
- National Science Foundation, Engineering Directorate, Division of Cross-Disciplinary Research, a Program Director, for Industry and Engineering Research Centers Program. 1986-1989. Ocean Space and Resources.

Positions in Industry:

- CASRM (Center for Applied Ship Repair and Maintenance), Consultant Waste Treatment Systems, 1999, 2001.
- Pacific Gas & Electric Co., Consultant Environmental and Alternative Energy Sources R&D, 1989-1993.
- Orange County Sanitation Districts, California, Consultant, Ocean Outfalls and Waste Treatment, 1990-1996.
- Marine Spill Response Corporation, R&D Division, Consultant Oil Spill R&D and Response. 1991-1996.
- Elsevier Science Publishers Ltd., Oxford, UK, Editor and Editor-in-Chief, 1993-present.
- ATRP (Advanced Technology Research Project) Corporation, President 1997-to the present. Texas A&M University and the University of Alaska, Fairbanks incubated ATRP Corporation. ATRP Corp. was endorsed by Senate Resolution sponsored by Senators Stevens, Murkowski, Cochran, Inouye and Chafee and a Joint Declaration between the US House of Representatives (Mr. Weldon) and the Russian DUMA (Mr. Goman) to Expedite the Commercialization of Advanced Environmental and Next Generation Technologies and to Advise Governments and Industry on Human and Environmental Risks.

International Positions:

- UNESCO, U.S. Representative, Man And the Biosphere (MAB) Programme. 1974-1975.
- UN, IMO, U.S. Delegate, (Working Group Member and/or Drafting Group Member), London (Ocean) Dumping Convention & GESAMP Scientific Group of Environmental Marine Pollution Experts, 1980-1983.
- Senior Queens Fellow (QEII), Australia, Sir James Cook University, Townsville and the Great Barrier Reef Park Authority (1983-1984); (for Environmental Contamination and Great Barrier Reef Research).
- Marshall Islands Delegation, Technical Advisor, IMO MEPC 45, 46, for the New IMO Convention to *Control Harmful Antifouling Systems on Ships* (2000- 2001). Treaty Adopted October 5, 2001.

Honors and Awards:

- Appointed a **Queens Fellow in Marine Science** in Australia, 1983 and 1984.
- Singled out by **President Ronald Reagan** in 1984 for leadership and contributions to the U.S. **Exclusive Economic Zone (EEZ) Proclamation**.
- Coordinator and Member of the first U.S. Government Scientific Delegation to visit the Peoples Republic of China, 1984.
- **Fellow of the Marine Technology Society**, Washington, D.C., 1987.
- Among the first U.S. Scientific group to conduct research in Russia after the fall of the Berlin Wall.

- Chaired or Co-chaired 16 national or international conferences or symposia.

Environmental, Aquatic, and Oceanographic Contamination Research:

- NOAA, EPA funded oceanographic cruises (1973-1983) to assess environmental impacts and to support the development of policy and regulatory options for ocean dumping of municipal, industrial wastes, dredged material, and radioactive wastes at nearshore and deep ocean dump sites in the U.S. and Europe.
- Navy (ONR) funded research cruises (1993-1997) from the Barents Sea to the East Siberian Sea, Nuclear Contamination in the Russian Arctic; published > 15 papers and edited 7 special volumes of international peer reviewed journals on "Contamination in the Arctic" (350 scientific papers).
- Navy and EPA (OW) funded projects (1999-2000) for the development of shipyard and drydock waste treatment technologies/System for regulatory and policy formulation relative for the treatment and removal of Tributyltin in washdown of ship hull antifouling coatings and shipyard wastewaters.

Academic Research and Development Centers (Private-Public Partnerships):

- Assisted in the creation of U.S. national R&D centers (currently numbering over 100) created at the major U.S. universities in a wide range of scientific and engineering disciplines, as a major effort by the U.S. to regain international competitiveness in engineering, science and technology.
- Developed and utilized the interactive strategic planning processes to identify critical research agendas to design and direct national research programs.
- Serves annually as a Member of R&D Peer Review Panels for Sciences, Engineering, SBIR, and Technology Development Programs at the National Science Foundation.
- Serves annually as a Panel Member for DOD Peer Review Panels for SBIR and DOD Technology Programs.
- Prepared for the U.S. Navy, a strategy for developing and funding Navy "Mission" Engineering Research Centers for the development of Next Generation Technology (i.e. Internet).

Ocean Resources and Ocean Space – Strategic and Policy:

- Developed in 1986-1988, the Ocean Systems Engineering Program at the National Science Foundation for the protection and utilization and development of ocean space and ocean resources.
- Advanced the Ocean Enterprise Concept and organized in 1989 the NSF funded "Ocean Enterprise Workshop" and several others related to the protection, conservation and development of ocean space and resources.
- Takahashi, Patrick K., John E. Bardach and Michael A. Champ. (Co-Chairmen). 1991. Engineering Research Needs for Offshore Mariculture. Proceedings National Science Foundation Workshop. Published by the University of Hawaii and the East West Center. 540p.
- From 1980-2001 invited to participate in US – Japan (UJNR) Meetings of the Marine Facilities Panel to review marine and technological government sponsored R&D for both countries and presented 4 papers.
- Involved in the engineering, transportation, social, economic and environmental assessment, on the use of Very Large Floating Platforms (VLFS) under consideration by the U.S. Navy Mobile Offshore Bases Program, and for the development of U.S. Regional Offshore Deep Water Container Ports.

Oil Spill R&D and Response:

- From 1990-1996, involved in the design of R&D and interpretation of results and international oil spill contingency planning and response and the review and synthesis of data and information from MSRC funded ($ 55M) R&D projects.
- Collaborated in the development of the "Technology Windows-of-Opportunity" Concept, which provides a common foundation for the implementation of a rapid and cost effective tool for oil spill contingency planning and spill response decision-making.
- Founded and currently the Editor-in-Chief of the international peer review journal: *Spill Science & Technology Bulletin* published by Elsevier Science in Oxford, England, published quarterly.

Other Environmental Legislative, Policy, and Regulatory Experience:

- Extensively involved in the National Environmental Policy Act (NEPA) at CEQ and the national debate and the review of the National Pollution Discharge Elimination System (NPDES) permits.
- Reviewer for Clean Water Act and other related EPA & environmental mandates.
- Assisted Congress in writing 92-500, the Marine Protection, Research and Sanctuaries Act (the Ocean Dumping Act).
- Drafted the U.S. Organotin Antifouling Act, 1988.

- Serves as a member of the Drafting Group for the UN/IMO International Convention to "Control Harmful Antifouling Systems on Ships", MEPC 45 and MEPC 46). Adopted by IMO October 5, 2001.

Publications:

- Published 8 books and Over 350 scientific and technical publications.
- Edited 10 Published Conference Proceedings from National Conferences such as IEEE and Marine Technology Society Conference Special Volumes (1982-2001).
- Edited 9 Published Proceedings from International Conferences and Symposia as special issues of international peer reviewed journals (1984-2001).
- Edited 20 Published issues of *Spill Science & Technology Bulletin (1994-2001)*.

Books and Reference Works:

- Champ and Park. 1982. Global Marine Pollution Bibliography: for Ocean Dumping of Municipal and Industrial Wastes. Plenum Press. New York, 399p.
- Champ and Park, (Editors), 1989. Marine Waste Management: Science and Policy. Volume III. Maine Pollution Processes. Krieger Publishing Company, Inc. Melbourne, FL. 28 Chapters.
- Ardus and Champ. (Editors). 1990. Ocean Resources. Vol. 1. Assessment and Utilization. Kluwer Academic Publishers. London. 330p.
- Champ and Ardus. (Editors). 1990. Ocean Resources. Vol. 2. Subsea Work Systems and Technologies. Kluwer Academic Publishers. London. 240p.
- Champ and Seligman. (Editors). 1997. Organotin: Environmental Fate and Effects. Chapman & Hall Publishers (U.K.). 29 Chapters, 664p.
- Ornitz and Champ. (2002). Oil Spill First Principles: Prevention and Best Response. Elsevier Science Ltd. Oxford. 642p.

Journal Special Issues:

Champ (Guest-Co-Editor). 1984/85. The Exclusive Economic Zone. *Oceanus.* Vol. 27. No. 4. Woods Hole Oceanographic Institution. Woods Hole, Massachusetts. 96p.

Champ (Guest-Co-Editor). 1986. The Great Barrier Reef: Science & Management. *Oceanus.* Vol. 29. No. 2. Woods Hole Oceanographic Institution. 124p.

Champ Wolfe, Flemer, and Mearns. (Guest Editors). 1987. Long-term Biological Records. Special Issue. *Estuaries*. Vol. 10. No. 3. 273p.

Kennicutt II, and Champ (Guest Editors). 1992. Special Issue: Environmental Awareness in Antarctica: History, Problems, and Future Solutions. *Marine Pollution Bulletin.* Vol. 25(9-12):219-336. 21 Papers.

Champ, Makeyev, Brooks and DeLaca (Guest Editors). (1997). Special Issue: Contaminants in the Arctic. (Part I). *Marine Pollution Bulletin*. Vol. 35 (7-12):203-385.

Nicholls and Champ. 1999. (Guest Editors). Physical Properties and Processes that Influence the Clean Up of Oil Spills in the Marine Environment. Special Issue. *Spill Science and Technology Bulletin*. Vol. 5(3/4):177-289.

Champ, Makeyev, Brooks and DeLaca (Guest Editors). 2000. Special Issue: Contaminants in the Arctic. (Part II). *Marine Pollution Bulletin*. Vol.40(10):801-802, 807-853.

Champ, Makeyev, Brooks and DeLaca (Guest Editors). 2001. Special Issue: Contaminants in Terrestrial and Aquatic Watersheds of the Russian Arctic. *CHEMOSPHERE*. Vol. 42(1): 1-102.

Champ, Gomez, Makeyev, Brooks, Palmer, and Betz (Guest Editors). (2001). Special Issue: Contaminants in the Arctic. (Part III). *Marine Pollution Bulletin*. Vol. 43(1-6):1-142.

Education:

- Texas A&M University, BS, Animal Science (Science Option/Biochemistry/Vet. Med.), 1967.
- Texas A&M University, MS, Biology, (Aquatic Ecology, Chemistry & Toxicology), 1969.
- Texas A&M University, PhD, Biology, Chemistry, Engineering (Limnology & Marine Science), 1972.
- Texas A&M University, NSF Post Doctoral in Oceanography, Antarctic Program, 1971.

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