UNDP Project Document

Government of the People's Republic of China

United Nations Development Programme

Project Title:

Alternatives to DDT Usage in the Production of Antifouling Paint

Brief description

The project goal is to substitute DDT based antifouling paint by technically feasible, economically viable, and environmentally friendly alternatives. The binding objective of the project is to eliminate the use of 250 MT/year of DDT as additives in the production of antifouling paint by conversion to non-toxic and environmentally friendly alternatives. In addition, the prospective objective of the project is to establish a long-term mechanism to protect marine environment and human health from pollution of harmful antifouling systems based on the technologies, experience and instruments obtained from phase out of DDT based antifouling paint.

To ensure sustainability of the elimination and conversion, related regulations and standards will be established or revised, and supported by capacity building, to create an enabling policy environment for the phase out of DDT based antifouling paint and promote sustainable alternatives. In addition, the successful experience in DDT phase out will contribute to support China to accede to the IMO Convention and elimination of TBT based antifouling paint, in order to establish a long-term mechanism to protect marine environment and human health from pollution of harmful antifouling systems.

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Acronyms

APR	Annual Project Report
AWP	Annual Work Plan
CIO	Convention Implementation Office
CO	Country Office
DDD	***d****ichloro-****d****iphenyl-****d****ichloroethane*
DDE	***d****ichloro-****d****iphenyldichloro-****e****thylene*
DDT	***d****ichloro-****d****iphenyl-****t****richloroethane*
FAO	Food and Agriculture Organization
FECO	Foreign Economic Cooperation Office
GEF	Global Environment Facility
GOC	Government of China
IA	Implementing Agencies
IMO	International Maritime Organization
IR	Inception Report
IW	Inception Workshop
M&E	Monitoring & Evaluation
MIS	Management Information System
MT	Metric ton
NDRC	National Development and Reform Commission
NGO	Non-governmental Organizations
NIP	National Implementation Plan
OP	Operational Program
PIR	Project Implementation Review
PMO	Project Management Office
POP	Persistent Organic Pollutant
RCU	Regional Coordinating Unit
RMB	Renminbi, “People’s currency”
SC	Steering Committee
SDRC	State Development and Reform Commission
SEPA	State Environmental Protection Administrator
TBT	*tributyltin*
TCG	Technical Coordination Group
TPR	Tripartite Review
TTR	Terminal Tripartite Review
UN	United Nations
UNDP	United Nations Development Program
UNDP-GEF	Global Environment Facility, United Nations Development Programme
UNEP	United Nations Environment Program
UNIDO	United Nations Industrial Development Organization
UNOPS	United Nations Office for Project Services
USD	United States dollars
WHO	World Health Organization
WTO	World Trade Organization

SECTION I: ELABORATION OF THE NARRATIVE

PART I: Situation Analysis

Context and global significance

General situation

Fouling of ship hulls is of concern in that it results in increased resistance, fuel consumption, and acceleration of corrosion. Marine antifouling technology is used to prevent organisms from attaching on surfaces of submerged structures. This technology works through controlled or uncontrolled release of toxicant on the surface of hulls. In the early time, lime or bitumen was used for antifouling purpose. Later, As, Hg, Sn compounds or DDT were added to paints as antifoulants to be released to form a toxic layer over the structure (e.g. vessels) which can kill the spores and larva of marine fouling organisms and thus achieve the desired antifouling effect. However, during usage these antifoulants can contaminate marine water, induce biological variation, cause damage to marine food chain, and threaten marine ecological balance and human health.

Annually, China consumes about 65,000 MT of antifouling paint. Surveys conducted during the PDF-B phase shows that China has 300,000 fishing ships widely distributed along its 18,000 km. coastline, which consume 10,000 MT antifouling paint, approximately half, i.e. 5,000 MT is DDT based and the other half, 5,000 MT is organotin based TBT antifouling paint. It is estimated by the China Maritime Bureau that commercial ships navigating in domestic sea territory consume about an additional 20,000 MT TBT based antifouling paint with a working life of 3 years. In addition, another 35,000 MT of TBT-free self polishing antifouling paint was used on ocean-going commercial ships.

DDT based antifouling paint

DDT was first used as booster biocide in antifouling paint in 1950s. From then on, DDT-based antifouling paint was produced and used extensively in all kinds of sea vessels. However, with the rapid development of marine navigation and other operations, the traditional antifouling principle and technology that was used by DDT based antifouling paint has not achieved substantial improvement all through. The product has no DDT biocide release control mechanism and so is only effective at the beginning. The working life of DDT antifouling paint is not more than 1.5 years, and therefore can not meet the longer term antifouling needs of the large sized ocean going ships. But DDT based antifouling has been always used by small and medium sized fishing ships due to their immediate and strong antifouling effects, suitable working life, and low price.

The PDF-B survey shows that China has 300,000 fishing ships widely distributed along its 18,000 km coastline, which consume 10,000 MT antifouling paints annually. Approximately half is DDT based paint and half organotin-based paint. About 250 MT DDT is used for production of DDT based antifouling paint per annum. As of 2002, the accumulative total of DDT used for this purpose since 1950s has reached 10,000 MT. China began to limit DDT usage in all related sectors after China acceded to Stockholm Convention in 2002. From 2002 to 2005, DDT used for antifouling paint production has seen a decrease, but still totaled a cumulative 1,000 MT.

The PDF survey verified 250 MT DDT used for production of 5,000 MT DDT based antifouling paint annually. By searching the database of ship products and reviewing the historical surveys, the project team identified 34 enterprises producing antifouling paints, of which 19 are producing DDT-based

antifouling paints. The paint manufacturers are widely distributed in more than 20 counties/municipalities of the 9 coastal provinces or municipalities. Local product quality supervision and inspection departments were mobilized to visit the enterprises and fill in a questionnaire predefined by the project team. The project team also paid visits to some key manufacturers in order to verify the authenticity of data. Section IV contains additional details on the results of the survey conducted.

Rapid industrial and agricultural development in the coastal areas of China in the recent past has resulted in contaminant discharge into the sea in excess of regulatory limits. This has resulted in significant deterioration in the quality of coastal marine environment as well as reduction in species of economic fish and output and has had adverse affects on income and livelihood of the local fishing community. Results from monitoring study indicates that the quantity of some toxicants found in economic fish, including DDT, in the body of main economic fish species is increasing, even beyond related international regulatory limits. The sources of some of the toxicants have been corroborated to be from their usage in coating of boats and ships. With the entry of China into WTO, her marine product exports have had some constraints in international market because of their failure to meet the relevant Quality Safety Standards.

Coastal environmental quality monitoring from year 2000 to 2005 found residues of DDT and its degradation derivatives DDD and DDE, which are also persistent and toxic, in sea water and sediments. The concentration of DDT in the sediments in some areas exceeded Class I or II of marine environment quality Standards limit. Cu in sediments was also found to exceed Marine Environment Quality Standards. Sediment is habitat to the benthics, e.g. *Meretrix meretrix L*., *Mactra quadrangularis Deshayes, Mytilus edulis*, and Oyster, whose quality will be directly influenced by the sediment quality. For instance, in 2004, monitoring results showed that DDT residue in seashell in coastal waters exceeded standard's limit. DDT and Cu are also detected to exceed standard in bred organisms in the coastal aquatic farms.

The excess DDT and Cu concentrations in sediment is directly related to their extensive usage in DDT and copper based antifouling paint. Use of DDT as a pesticide in agriculture was banned 20 years ago. DDT residues on land, soil, and food have fallen down to trace levels. Therefore, release of DDT from antifouling paint on fishing boats and ships can be considered a new and the main source of DDT found in marine environment.

DDT is listed in Annex B of Stockholm Convention. According to Article 3, Provision 1 of the Convention, the Parties shall limit the production and use of the chemicals listed in Annex B. The Acceptable purpose or specific exemption on production and use of DDT are limited to disease vector control and intermediate for production of Dicofol. DDT as an additive in production of antifouling paint is not considered a permitted use. According to Article 10 and 11 of the Convention, the parties shall encourage and develop activities to research, develop and monitor POPs and their alternatives as well as other potential POPs. As one of the actions in implementation of the Convention, China has listed DDT based antifouling paint into the recently issued list of products to be phased-out, annexed to The Guiding Directory for Industrial Restructure – 2005.

TBT based antifouling paints

In the 1960s, a highly efficient, low price organotin (mainly tributyltin - TBT) gained wide application in antifouling systems on ships. In 1970s, most ocean going ships used TBT based antifouling paint. Like DDT based antifouling paint, early TBT based antifouling paint had an uncontrolled leaching rate. This weakness was overcome by a technological breakthrough – self polishing paint. In such self polishing paint, TBT is chemically combined with polymer such as crylic acid resin to form copolymer. The copolymer has a stable and slow chemical reaction with the NaCl in the sea water to release TBT, CuO2 or other biocides in a controlled rate. New surface of the antifouling paint is exposed and ablated

continuously until all the antifoulants are released. Such TBT based self polishing paints can last a working life of more than 60 months, and have thus been highly welcome by the shipping sector.

TBT is stable in environment and can also be biologically accumulated and enriched. Its harms to environment include acute death, chronic toxication, deformation, and imposex that can cause reproductive problems and population decline or extinction. TBT can also disrupt the endocrine system. It is regarded as one of the most toxic substances that are introduced into the sea, and much research indicates that TBT has caused significant harm to the marine environment and sea organisms.

The "International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001" (the IMO Convention) was adopted at the International Maritime Organization (IMO) diplomatic conference held in October 5, 2001. In accordance with this Convention, 1) all ships shall not apply or re-apply anti-fouling paints containing organotin compounds which act as biocides on and after January 1, 2003, and 2) all ships shall not bear anti-fouling paints containing organotin compounds which act as biocides on their hulls or external parts or surfaces on and after January 1, 2008. It also establishes a mechanism to prevent one harmful antifouling system from being replaced by another harmful antifouling system.

In connection with this, a flag state has become obligated, pursuant to the Article 10 "Survey and Certification", and Annex 4 of the IMO Convention, and Resolution MEP.102 (48) "Guidelines for Survey and Certification of Anti-fouling Systems on Ships", to verify the ship's antifouling systems and to issue an "International Anti-fouling System Certificate".

The IMO Convention has been accepted by 12 countries representing 9% of the total tonnage of the world's commercial ships. The IMO Convention will come into effect after 25 countries accounting for 25% of the total tonnage of the world's commercial ships have signed. Japan is the only country that has acceded to the IMO convention in Asia. China Maritime Bureau has organized related departments to conduct research on whether China should accede the IMO Convention. The impact of TBT on sea organisms, marine resources, and human beings as well as the impacts of China's accession to the shipping sector were analyzed. Most of China's international ocean-going ships do not use TBT based antifouling paint, but it is still widely used by domestic commercial ships and fishing ships. As an active response to the IMO Convention, China Maritime Bureau has issued an announcement banning use of TBT based antifouling paints on ships in order to avoid violation in the future.

The fundamental problem to be solved by this project is to eliminate the use of DDT in production of antifouling paint by adoption of non-toxic and environmentally friendly alternatives. In addition, the project will support China's signing of the IMO Convention in order to establish a long-term mechanism to protect marine environment and human health from pollution of harmful antifouling systems.

Threats, root causes and barriers analysis

DDT based antifouling paint causes pollution to water, sediment and marine organisms in the coastal waters, destroys marine ecological balance, and degrades the quality of sea fish and shells rendering them inedible. (See Section IV for a detailed description of the specific pollution threats in the production of anti-fouling paint.) This bears a direct impact on the economy of local fishermen and human health. DDT is a hazard to human health as well as the environment because it can be transported to other terrestrial and marine ecosystems through atmosphere and ocean current. Socio-economic development and environmental protection at both national and global levels call for urgent ban on DDT use in antifouling paint.

The socio-economic and environmental evaluation recommends that the selected new substitute products should have better or at least the same antifouling effect as DDT-based antifouling paint in addition to

being (i) non-toxic or low toxic, environmentally friendly, and (ii) price should be acceptable to fishermen, no higher than DDT based antifouling paint.

In China, however, complete ban on use of DDT-based antifouling paint and a shift to alternatives that meet the aforementioned requirements still face the following barriers:

- Lack of feasible alternative technologies and products.
- Existing alternatives are too expensive, or their effectiveness is not good enough.
- Lack of joint cooperation mechanism for technical innovation.
- Vast and complex sea territory.
- Disordered production and unregulated market.
- Loose supervision and management on DDT distribution and use.
- Lack of credible and comparable information for user to choose alternatives.
- Limited purchasing power of the user group to afford improved products.
- Inadequate environmental awareness among the users.
- Incomplete legislations and insufficient enforcement.

The price of TBT based antifouling paint is almost as much as that of DDT based antifouling paint. TBT based antifouling paint is also used by another half of fishing ships. Therefore, phase out of TBT will meet more or less the same barriers to phase out of DDT in antifouling paint. Besides fishing ships, TBT based antifouling paint is also used on about 10,000 domestic going commercial ships, but they have better affordability for higher price alternatives.

Institutional, sectoral and policy context

During the project preparation, laws, regulations, standards and rules related with DDT and ship antifouling paint were reviewed. At the same time, relevant governmental agencies and management objects were consulted to identify the structure and status of DDT and ship antifouling paint management systems. Based on these, gaps and issues regarding the existing management policy and the institutional capacity were identified to draw attention of this project.

Overarching laws and regulations

The constitution of People's Republic of China, Article 26, states that the state shall protect and improve living and ecological environment and prevent and treat pollution and other public nuisances. Fisheries Law of the People's Republic of China stipulates that destruction to the ecological environment of fishing water area or fishing pollution accidents shall be investigated against legal reliabilities according to The Marine Environment Protection Law and The Water Pollution Prevention and Treatment Law. But the Water Pollution Prevention and Treatment Law states in Article 2 that prevention and treatment of marine pollution are out of the scope of the law and shall be regulated by other laws. The Marine Environment Protection Law stresses that the discharge of non-degradable organic pollutants into sea should be strictly controlled. Article 13 also states that the state shall strengthen research and development of science and technology to prevent and treat the harms caused by marine environment pollution and phase out outdated production technology and equipment that cause serious marine pollution. Enterprises shall give priority to the clean energy and technologies that uses resources efficiently and generate less pollution.

Table 5 in Section IV, Part V lists the regulations and standards specific to DDT-based antifouling paint.

Legislations related to management of DDT

Comprehensive legislation exists on management of DDT production, storage, transportation, distribution, use, and disposal, but enforcement is insufficient.

Regulations on the safety administration of Hazardous Chemicals (the Regulations) and its detailed implementation guideline clearly make DDT an administrative target. The hazardous chemicals in List of Dangerous Goods (GB12268), issued by means of national standards, are the administrative objects of above regulations, in which DDT is also listed.

The Regulations clearly indicate responsibilities of parties which produce, store, transport, distribute, use, and dispose DDT. According to requirements of the Regulation, the life cycle of DDT from production, storage, transportation, distribution, use and disposal is to be well managed. However, the management responsibilities are allocated to departments of safety, transportation, quality inspection, environmental protection, and health. A lack of united coordination mechanism results in inconsistency of planning and implementation of the Regulations, and greatly limits their intended functions.

Currently there is no specific regulation on restriction of DDT usage in production of antifouling paint and application of DDT based antifouling paint usage on ships. The legal basis for the relevant administrative agencies to limit such usage is not sufficient. The Guiding Catalogue for the Adjustment of Industrial Structure (2005 version) issued by NDRC, lists DDT based antifouling paint into the Class of outdated technologies for phase out, but the Catalogue only provides guideline to relevant departments on industrial structural adjustment, moreover it is not legally binding.

The national standard General Specification for Antifouling Paint on Ship Bottom is the only standard for testing the quality and technical performance of antifouling paints. A series of complementary measures of detection and test are also developed to support the implementation of the standard. The standard is adopted by Fishing Boat Inspection Bureau and China Classification Society for certification of antifouling paints used on ships. Manufacturers also follow the standard. However, this standard was prepared 20 years ago to deal with technical performance indicators such as antifouling effect, fineness, viscosity, drying time, and etc, without taking into account environmental indicators. From 2002, National Technical Committee for Coating and Pigment Standardization (TC5), which is responsible for the establishment and revision of national and industrial standards of coatings, has started to revise General Specification for Antifouling Paint on Ship Bottom by adding organotin indicators into it, but DDT is not addressed.

Agencies that have direct responsibility for antifouling paint include General Administration of Quality Supervision Inspection and Quarantine, China Maritime Bureau under Ministry of Communications, and Fishing Boat Inspection Bureau under Ministry of Agriculture. General Administration of Quality Supervision Inspection and Quarantine surveys and inspects the quality of all the products sold in the market. China Maritime Bureau under Ministry of Communications surveys and inspects the quality of civil ships for transportation and the quality of products used on these ships. Fishing Boat Inspection Bureau under Ministry of Agriculture surveys and inspects the quality of fishing boats and products used on them. The PDF-B survey found that DDT based antifouling paint is mainly used on fishing boats. Therefore, the administrative target and scope of Fishing Boat Inspection Bureau of Ministry of Agriculture is quite consistent with that of the project.

In April 2003, China Maritime Bureau entrusted China Classification Society to promulgate Regulation on Survey and Certification of Antifouling Systems on Ships that requires TBT ingredient should be surveyed in the antifouling systems on international going ships above 400 tonnages. Regulation on Prevention of Marine Pollution by Ships is being revised to incorporate punishment provisions for pollution from harmful antifouling systems on ships.

National Bureau of Fishery Management and Fishing Port Superintendence established 3 Sub-Bureaus of Fishery Management and Fishing Port Superintendence in North Sea, East Sea, and South Sea. The responsibilities of the sub-bureaus include inspection of the implementation of fishery laws and regulation in their jurisdictions, auditing, issuing and annulment of fishing permits, as well as organize monitoring of fish resources and aquatic ecology. The project can be greatly supported by strengthening the capacity and legislation enforcement of the 3 bureaus.

China Bureau of Fisheries under Ministry of Agriculture has the administration rights over the fishing ships. It provides administrative guidance to the local administrative department in three areas: fishing resources administration, fishing port management, and fishing boat inspection. At the national level, the fishing boat inspection is separated from China Bureau of Fisheries and is the responsibility of China Fishing Boat Inspection Bureau under Ministry of Agriculture. At local levels, the three areas of fishery administration may be designated to different departments under agricultural department. Administration of the commercial ships is the responsibility of China Maritime Bureau under Ministry of Communications, but certification and accreditation of ships and ship products are designated to China Classification Society. Antifouling paint is a product used on ships, and is thus subject to survey and certification by Fishing Boat Inspection Bureau and China Classification Society.

Regulations of the People's Republic of China on Fishing Vessel Inspection and Rules on Fishing Boat Product Inspection issued and implemented by Fishing Boat Inspection Bureau state requirements on fishing ships registered or to be registered and on the products used on fishing ships. Manufacturers of antifouling paints to be used on fishing boats should be accredited in production conditions, product standards, and quality assurance system. The product standards should adopt General Specification for Antifouling Paint on Ship Bottom (GB/T 6822-1986). Accredited manufacturers will be granted with a certificate of fishing ship product, a certificate of accreditation, and a label of accreditation. Products without being accredited by Fishing Boat Inspection Bureau are not allowed to be used on fishing ships.

China Classification Society requires all the ships classified by the Society to use ship products that are surveyed and accredited in accordance with Regulation on Certificate Holding and Verification of Ship Products and Rules on Ship Product Inspection that were promulgated and implemented by China Classification Society. Antifouling paint is listed as one of the ship products. The product standards also adopt General Specification for Antifouling Paint on Ship Bottom (GB/T 6822-1986), taking into account only the technical performance. With the IMO Convention adopted, China Classification Society issued Regulations of Inspection and Certification of Antifouling System that requires antifouling systems should be applied in accordance with the IMO Convention on international going ships above 400 tonnages.

The accreditations implemented by the above two agencies are compulsory according to related laws, regulations, and standards of China. Antifouling paint products and manufacturers that meet the related standards will be assigned a unified accreditation certificate and label. Besides this, there is a voluntary certification and labeling program applied by manufacturers. The manufacturers of the certified and labeled products will advertise their products in the market to differentiate from other uncertified products and reflect the special quality of their products, and the sense of environmental protection and social responsibility. There are many types of antifouling paint products in China’s large sized market that may have striking differences in technical and environmental performances even they are accredited by compulsory certification and accreditation procedures. Implementation of an innovative voluntary certification and labeling program will encourage manufacturers to further improve their product quality and environmental soundness so that their products can continue to take or even expand shares in market place.

Stakeholder analysis

The project will involve a wide range of stakeholders that will play various complementary roles in the project. Stakeholders to be included in the project implementation are listed below. Refer to the Stakeholder Involvement Plan in Section IV, Part IV for details.

The lead national agency responsible for project implementation is **State Environmental Protection Administrator (SEPA).**

The **National Technical Coordination Group** (TCG) consists of the following 11 agencies:

State Environmental Protection Administration
National Development and Reform Commission,
Ministry of Foreign Affairs,
Ministry of Finance,
Ministry of Commerce
Ministry of Science and Technology
Ministry of Agriculture
Ministry of Public Health
Ministry of Construction
General Administration of Customs
State Electricity Regulatory Commission

Three **Local Project Management Offices** (PMOs) will interface with fishermen and ship enterprises along the coastline.

Other stakeholders will be involved as members of the Steering Committee, Project Team and National Expert Team as appropriate. Some of these additional stakeholders include General Administration of Quality Supervision, Inspection and Quarantine, National Certification and Accreditation Administration, State Administration of Work Safety, Fishery Management Bureau of Ministry of Agriculture, National Fishing Boat Inspection Bureau, Maritime Safety Administration of Ministry of Communication, National Standardization Technical Committee State Oceanic Administration, and the local governmental agencies.

Baseline analysis

DDT based antifouling paint has been in use for more than 30 years in China. Though it is presently used to a much lesser extent than in the past, its consumption remains relatively stable among the target group – owners of fishing ships of medium to small sizes. This group is characterized by a relatively low level of education, environmental awareness and income. The fishermen tend to be resistant to change, especially where higher cost is involved. Under the prevailing situation, it is not foreseeable that their income will grow in the near future. All alternatives available in market, mostly copper based, are of higher price and their prices will keep rising with the market prices of copper in the near future. There is also debate on the environmental performance of these alternatives, and many scholars call for a cautious approach in selection of alternatives.

Without the support of GEF project, the fishermen will continue using DDT based antifouling paint, unless alternatives having better antifouling effects, sound environmental performance, and lower cost are made available in the marketplace. Due to lack of specific legal prohibition on use of DDT for production of antifouling paint, manufacturers will continue exploit the market as long as demand exist. Even if such laws and regulations were formulated and promulgated, its implementation would face challenges or even be impeded by the very broad and sparse market against under staffed enforcement forces. As a result,

DDT will continue being released into marine environment, accumulated, transported and transformed in various environmental media, and will continue to cause damage to global environment and human health.

PART II: Strategy

Project Rationale and Policy Conformity

The baseline analysis identified the current situation with respect to use of DDT-based anti-fouling paints for the fishing industry, and correctly predicts that without assistance, the industry will continue to use the DDT-based product as it is relatively inexpensive as well as effective. As a developing country, China is faced with a series of huddles in its attempt to phase out and substitute DDT in production of antifouling paint. China therefore, needs assistance from GEF to overcome these.

The project design is fully consistent with GEF policy, programs and guidelines. Strong partnerships among the international implementing agency, Chinese government, private sector, and non-governmental organizations (NGOs) were established during the project preparation. All GEF projects stress the need for wide involvement of the public, including the affected communities, NGO, community based organization, academia, and other affected stakeholders. The design of this project gives priority to and creates favorable conditions for full public involvement.

The project is put forward based on GEF's Operational Program on Persistent Organic Pollutants (OP#14) which is aimed at reducing or eliminating release of POPs into environment by providing developing countries and countries with economies in transition, with assistance on incremental basis. This is consistent with the goal of Stockholm Convention which aims to protect human health and environment from POPs. GEF will provide funding, on the agreed incremental costs basis, for three types of activities to address the issue of POPs: capacity building, on-the-ground interventions, and targeted research.

Capacity building activities are aimed at strengthening the capacity of developing countries and countries with economies in transition to address the threats posed by POPs, based on priorities identified in their NIPs. DDT as an additive in production of antifouling paint is listed as a priority for phase out in China's NIP. According to paragraph 13 of OP#14, activities of this project eligible for GEF funding for capacity building include: strengthening of human and institutional capacity, strengthening and harmonization of the policy and regulatory framework, strengthening of monitoring and enforcement capacity, development of technological assess capacity and management practices, developing and implementation of public awareness /information / environmental education programs, and facilitation of dissemination of experiences and lessons learned.

On-the-ground interventions are to assist eligible countries to reduce and eliminate POPs emissions into the environment. According to paragraph 15 of OP#14, the activities of this project eligible for GEF funding for conducting on-the-ground interventions include: promotion and demonstration of environmentally friendly technologies / products / practices and development and implementation of programs that eliminate POPs.

GEF's targeted research is aimed at providing information and tools to improve the quality and effectiveness of GEF projects and programs. The targeted research will help close the information gaps and provide technical support for making decisions on POPs related issues. According to paragraph 15 of OP#14, the activities of this project that are eligible targeted research include:

- The development/promotion of cost-effective rapid assessment methodologies, including biomarkers markers for environmental and human monitoring, in order to address data gaps in GEF-eligible countries that currently lack sound management decisions, as well as awareness promotion;
- Development of methodologies for exposure assessment in susceptible populations, as well as identification of exposure pathways in particular scenarios, in order to better target POPs reduction efforts;
- Characterization of the behavior, fate, and impact of POPs under conditions prevalent in developing countries, including the potential for their remobilization through dredging of harbors or channels, to better understand the sources and sinks of POPs in these areas and their contribution to global contamination; and
- Methods to estimate releases in order to increase the knowledge base for planning and investments in POPs reduction measures.

The project design is also consistent with GEF's Contaminant Based Operational Program (OP#10) in the focal area of International Waters. This OP focuses on adoption of methods, techniques, pilot projects, innovative technologies, institutional arrangement, and economic instruments to demonstrate the removal of barriers by adopting Best Practices to prevent discharge of key contaminants, including global contaminants and ship contaminants. DDT in antifouling paint has both the properties of global and ship contaminant. In paragraph 10.18 (f), it is clearly stated that interim best practices for minimizing risk, phase out of the use of a particular contaminant or a process that generates pollution prevention strategies for problematic contaminant, substitution of chemicals in feedstock, and other possible interim measures should be developed.

Project Goal, Objective, Outcomes and Outputs/activities

The project goal is to substitute DDT based antifouling paint by technically feasible, economically viable, and environmentally friendly alternatives. The binding objective of this project is to eliminate 250 MT DDT per year used for production of DDT based antifouling paints by converting to technically feasible, economically viable, and environmentally friendly alternatives. The prospective objective of this project is to establish a long-term mechanism to protect the marine environment from pollution of harmful antifouling systems by supporting China to sign International Convention on the Control of Harmful Anti-fouling Systems on Ships (the IMO Convention) based on the technologies, experience and instruments obtained from phase out of DDT antifouling paint.

The project aims to realize its objectives on both national and global level. On the national level, it will support the implementation of "Strategy for Phase out of POPs Pesticides in China[1]"in order to reduce their environmental risk in China, and protect marine environment and human health from DDT hazard. On the global level, reduction of total DDT emission into the global environment will reduce the probability of the long-distance transportation of DDT to other countries.

[1] "Strategy for Phase out of POPs Pesticides in China" for implementation of the Stockholm Convention on Persistent Organic Pollutants has been prepared under UNDP Project CPR/01/R51 with funding supported by the Government of Italy, as a critical part to be incorporated in the National Implementation Plan (NIP). The preparation of the NIP was supported by the National Development and Reform Commission, Ministry of Finance, Ministry of Agriculture, Ministry of Health, Ministry of Construction and other involved departments. To insure the Strategy reflects the actual situation of POPs pesticides in China and represents the benefit of the stakeholders, two workshops were hold in November 2003 and June 2004 with the aim that the stakeholders were fully consulted. The participants of the workshops include: different level governmental officials, all enterprises who were producing technical grade POPs, some of enterprises who were using POPs pesticides to produce products, domestic and international experts, representatives from UNDP, UNIDO, UNEP, FAO and the World Bank. Most participants of the workshops gave comments on the draft strategy orally or in writing.

The implementation timeframe is 4 years. In the first year, technically and economically feasible technologies/alternatives will be selected through open bidding and ranking process for on-ship coating experiment as well as for selection of manufacturing enterprises that possess strong technical capacity, competent management experience, and sound business development plans. Manufacturing sites will be prepared and equipment installed. Capacity will be built and policies providing enabling environment will be established. In the second and third years, production and promotion of the substitutes/alternatives in the market will be initiated and upscaled. In the fourth year, results and experience will be summarized and compiled into reports, while at the same time the production and sales of the alternatives will be further consolidated.

Specifically, the project activities and outcomes are described below. The Incremental Cost Analysis and the Project Logical Framework are elaborated in Section II.

Outcome 1 Institutions and mechanism for project management and coordination
Activity 1 Establish project management institutions and build their operational capacity.

Activity 1.1 Establish project management institutions and coordination mechanisms based on the existing institutional settings, including:

- Establish a cross-sectoral steering committee drawing upon resources at national and local levels. (i) Invite key officials from administrative departments of economy and trade, finance, product quality supervision, fishing boat inspection, maritime affairs, petrochemistry, oceanography, and environmental protection at national and local levels to establish the cross-sectoral steering committee; (ii) Provide the project team with political guidance and coordination; (iii) At least hold once a year steering committee meeting, with the first meeting held within 12 months after the kick-off of the project; (iv) Attend annual project review workshop (tripartite review workshop).
- Establish the national DDT based antifouling paint alternative project team. (i) Draw upon resources from State Environmental Protection Administration, Ministry of Agriculture, State Oceanic Administration, Maritime Bureau of Ministry of Communications, and General Administration of Quality Supervision Inspection and Quarantine to establish the national project team; (ii) A coordinator designated by SEPA to be responsible for daily implementation supervision, progress reporting, management and liaison; (iii) Equip the project team with necessary office furniture and other equipment; (iv)The national project team will be in charge of the management and implementation of the project under the guidance of the CIO, including arrangement and coordination the M & E activities; (v) Prepare TORs for tasks; (vi) Review and evaluate the progress reports submitted by contractors; (vii) Manage the project finance according to UNDP's procurement procedures and financial rules and regulations; (viii) Organize stakeholders to have project coordination meetings; (xi) Review and evaluate project results.
- Establish local project management offices. (i) Establish 3 local project management offices in North Sea (Huanghai Sea and Bohai Sea), East Sea, and South Sea resided in Fishery Management and Fishing Port Superintendence Bureaus. The local project management offices will be led by Fishery Management and Fishing Port Superintendence Bureaus and composed of staff from the provincial departments of economy and trade, product quality supervision, maritime affairs, oceanography, and environmental protection; (ii) Coordinate and organize seminars and workshops at the local level; (iii) Supervise project implementation at local level, including production and use of alternatives and environmental sound management of DDT or DDT based antifouling paint contaminated sites and equipment; (iv) Participate in awareness training activities; (v) Incorporate DDT based antifouling paint phase out into the

routine schedule of environmental inspection and establish joint responsibility system to strengthen the supervision and crack down of illegal production. (vi) Coordinate the various provincial departments to have policy dialogue under the guidance of the national project team; (vii) Collect information and compile progress reports.

Activity 1.2 Establish a national expert team to provide technical and consulting supports to the project implementation.(i) Recruit a CTA (Chief Technical Advisor), NAT (National Technical Advisor), policy experts, antifouling paint experts, and evaluation and program experts; (ii) Provide the project team with support in technical management and overall coordination; (iii) Provide support in institutional strengthening, policy framework, antifouling paint technology development and application, project monitoring and evaluation, and action plan development; (iv) Provide technical support in environmental sound management of contaminated sites and equipment; (v) Prepare project progress and status reports and other requested reports for monitoring and evaluation in the event of annual project reviews, tripartite project reviews or other field inspections and investigations; (vi) engage Governmental research agencies or private consulting firms through bidding process to provide technical consulting services.

Activity 1.3 Conduct trainings to improve managerial and technical capabilities for project management. (i) Compile training materials; (ii) Train managerial staff at national and local levels on antifouling paints, Convention requirements, project goal and objectives, methodological approaches, project procurement and management, and information management. One-week training workshop will be held for about 40 people from the national and local project management offices; (iii) Train related technical staff in status and trend of antifouling paint development, production management, marketing, and after-sale services.

Activity 1.4 Conduct study tour abroad to learn advanced experience and technologies. (i) Select key staff at national and local levels for a 2-week study tour abroad; (ii) Arrange the study tour schedule and decide on itinerary; (iii) Communicate with related host countries to arrange visit reception; (iv) Summarize and digest experience and lessons learnt from the study tour and incorporate the experience and lessons into the implementation of the project.

Outcome 2 **Management information system (MIS) and information management**

Activity 2 ***Establish an MIS and website for the project***

Activity 2.1 Establish an MIS for the project. (i) Overall evaluate the data availability and MISs of related department such as fishing boat inspection, maritime affairs, hazardous chemicals, and oceanography; (ii) Identify needs of information and data by this project; (iii) Identify needs of hardware and software for the project MIS; (iv) Deploy the needed software, hardware and information to establish the project MIS; (v) Develop database of technical, socio-economic and environmental indicators and model base under the project MIS; (vi) Develop or deploy data transmission protocols and processing tools; (vii) Develop decision support tools to provide information support to the project implementation, monitoring and evaluation.

Activity 2.2 Establish a mechanism for data collection, processing and analysis of data, transmission and information sharing. (i) Obtain data through socio-economic and environmental surveys, investigations and monitoring; (ii) Monitor DDT/TBT level in various environmental media, (iii) Conduct socio-economic impact surveys, (iv) Establish sound information transmission and exchange mechanisms among different departments at the central level; (v) Establish sound mechanism for information collection, analysis, transmission, and processing between the central project team and local project management offices; (vi) Train information management staff together with Activity 1.3; (vii) Process and analyze data collected using the developed tools; (viii) Establish a

mechanism to ensure long-term information flow to facilitate reporting requirement, after completion of the project.

Activity 2.3 Establish a website to disseminate project information to the public.(i) Apply for a domain name; (ii) Evaluate and deploy software and hardware for the website; (iii) Design the website structure and the web pages; (iv) Design interactive functions of the website; (v) Test and run the website; (vi) Update and promote the website.

Outcome 3 Enabling policy environment

Activity 3 ***Establish or revise regulations, standards, and action plan supported by capacity building to create an enabling policy environment for phase out of DDT based antifouling paint and promotion of sustainable alternatives.***

Activity 3.1 Establish or revise related regulations, standards, and rules. (i) Make application to TC5 for revision of General Specification for Antifouling Paint on Ship Bottom by taking into account the DDT indicator; (ii) Develop complementary methods to carry out the revised General Specification for Antifouling Paint on Ship Bottom, such as detection of DDT contents in antifouling paint and paint film; (iii) Approve and issue the revised standards and methods; (iv) Draft and issue Restriction of DDT Usage in Production of Antifouling Paint and Restriction of Application of DDT Based Antifouling Paint on Ships.

Activity 3.2 Revise compulsory rules of inspection of ship products. (i) Revise Rules of Inspection of Ship Products by China Classification Society according to the revised General Specification for Antifouling Paint on Ship Bottom; (ii) Revise Rules of Inspection of Fishing Ship Products by Fishing Boat Inspection Bureau according to the revised General Specification.

Activity 3.3 Establish and promote a voluntary certification and labeling program in the antifouling paint sector. (i) Prepare tender documentations to select a consulting firm in certification and accreditation; (ii) Hold a workshop for development of Implementation Rules of Voluntary Certification of Antifouling Paint Products; (iii) Develop Implementation Rules of Voluntary Certification of Antifouling Paint Products; (iv) Establish a technical committee for voluntary certification of antifouling paint products; (v) Conduct factory accreditation, including survey and accreditation of the production conditions, product consistency, and quality assurance system; (vi) Issue certificate and label; (vii) Advertise the certificate and label in the market by enterprises; (viii) Encourage manufacturers to have other independent certifications to ensure compliance with quality and environmental standards.

Activity 3.4 Sustain DDT phase out by reducing the potential risk of TBT use in antifouling paint. (i) Monitor contents of TBT in ports, shipyards, typical sea areas, sediments, and sea organisms to determine the degree of pollution caused by TBT based antifouling paint; (ii) Put forward policy recommendations for China to address issues of TBT based antifouling paints; (iii) Disseminate the successful experience achieved from phase out of DDT based antifouling paint to accelerate the phase out of TBT.

Activity 3.5 Strengthen the capacity of related departments to effectively enforce the regulations, standards and action plan. (i) Improve the monitoring capacity of the monitoring agencies of the standards; (ii) Inspect and crack down illegal production of DDT based antifouling paint against promulgated regulations; (iii) Improve the capacity of the industrial society to carry out standards; (iv) Build the capacity of China Maritime Bureau to implement the IMO Convention.

Outcome 4 **Conversion from DDT based antifouling paints to alternatives.**

Activity 4 ***Adopt multiple means of technological support, policy induction, market regulation, and awareness raising and education to promote the conversion from DDT based antifouling paints to alternatives.***

Activity 4.1 Test, select and acquire alternative technologies. (i) Establish an expert panel to adopt specific rules and methodologies for testing and evaluation of feasible alternative technologies; (ii) Prepare tender documents; (iii) Call for maximum submission of technical data sheets (TDS) and material safety data sheets (MSDS) of antifouling paints for review by the expert panel; (iv) Select a number of qualified formulations of antifouling paints based on TDSs and MSDSs submitted for participation in unified on-ship patch test; (v) Deploy ships to coat antifouling paint samples according to the specified rules; (vi) Monitor the activities of the test ships and record the process according to the specified rules; (vii) Evaluate and determine reliable alternative technologies for scale production and commercial promotion starting the second year of the project implementation; (v) Sign technology transfer and cooperation agreements with technology vendors to acquire technology transfer.

Activity 4.2 Select demonstration enterprises and business plan improvement. (i) Prepare tender documents; (ii) Invite antifouling paint manufacturers to bid; (iii) Select those having strong technical competence, management experience, and business plan; (iv) Improve their business plans; (v) Sign cooperation agreements and other legal documents with enterprises.

Activity 4.3 Produce, distribute and promote alternatives. (i) Conduct feasibility study according to China's regulations and procedures for project construction or expansion; (ii) Conduct environmental impact assessment; (iii) Submit to related administrative agencies for approval; (iv) Prepare the production site and equipment at approximately 5 plants; (v) Purchase, installation, operation and maintenance of capital equipment; (vi) Technical training and technology transfer; (vii) Provide incentives to manufacturers to push the supply and promote the scale production of alternatives; (viii) Provide incentives to dealers and users for mass purchase in order to promote the distribution and use of alternatives; (ix) Compile and distribute handbook for application of alternatives, (x) Demonstrate and promote to fishermen the benefits of using alternatives; including through community based activities and dealers, (xi) Employ incentive scheme to promote the use of alternatives among fishermen, e.g. award for first time use or successive use.

Activity 4.4 Conduct environmental sound management of DDT at contaminated sites and equipment. (i) Identification of levels of contamination in Tianjin Chemical Plant and all 19 DDT based antifouling manufacturing sites to prepare concrete activities for cleaning of contaminated sites and equipment; (ii) Incorporate concrete cleaning activities into the framework of NIP for collective cleaning of sites and equipment contaminated by POPs.

Outcome 5 **Environmental education and awareness raising**

Activity 5 ***Conduct environmental education to promote environmental awareness of key stakeholders and the public, improve their understanding of harm of DDT/TBT based antifouling paints and the benefits of alternatives.***

Activity 5.1 Prepare publicity materials to conduct environmental education and awareness raising purpose targeting government officials, personnel in the industrial field and the public through multiple media of TV, radio, newspaper, magazine, journal, Internet, CD-ROM, and printing materials. (i) Hold press conference for formal initiation of the project; (ii) Hold seminars and workshops to train officials from the local governmental departments of economy and trade, finance, product quality supervision, fishing boat inspection,

maritime affairs, petrochemistry, oceanography, and environmental protection. (iii) Invite a famous director to direct a short thematic film; (iv) Make a special program with TV stations; (v) Make a special program with radio stations; (vi) Set up a special column with professional journal and other publications; (vii) Add contents in the environmental educational textbooks introducing antifouling systems; (viii) Conduct national exhibition of the results of the project; (ix) Update website contents.

Activity 5.2 Mobilize NGOs to conduct community based environmental education and awareness raising. (i) Conduct "train the trainers" workshops by convening volunteers from NGOs in civil society and universities; (ii) Mobilize the trained volunteers to conduct community and fishing culture based education and awareness raising targeting end users to realize the harms of DDT based antifouling paint and benefits of alternatives to achieve changes in consumption behaviour; (iii) Set up focal points in communities and fishermen organizations for long-term promotion of alternatives and awareness raising; (iv) Conduct environmental education activities in local middle and primary schools, (v) Establish partnership among governmental agencies, enterprises, NGOs, general public and end-users to strengthen interactions.

Outcome 6 Monitoring and evaluation

Activity 6 Effective monitoring and evaluation on project implementation and achieved results

Activity 6.1 Conduct meetings for project inception, review progress and project results. (i) Hold inception meeting by organizing key stakeholders from the central and local project units; (ii) Hold annual steering committee meeting; (iii) Hold annual project review; (iv) Hold tripartite project review annually.

Activity 6.2 Launch field investigations and inspections to monitor and evaluate progress of project implementation. (i) Launch special inspections on enforcement of regulations, rules, and standards regarding antifouling paint production, distribution and use at least twice during project implementation; (ii) Conduct investigations and inspections for the independent mid-term project evaluation; (iii) Conduct investigations and inspections for the independent final project evaluation.

Activity 6.3 Prepare progress reports to monitor project progress and performance. (i) Prepare memorandum or minutes of meeting for each field mission; (ii) Prepare and submit annual progress and experience review; (iii) Prepare the final project result and experience review.

Activity 6.4 Conduct annual project audit.

Project Indicators, Risks and Assumptions

Two types of indictors are set for this project: *binding indicators* and *prospective indicators*. The binding indicators are those legally binding that will be realized by multiple means including policy, technological and market instruments, with the market instruments to play the decisive role in the latter stage. The prospective indicators are to be realized based on the realization of the binding indicators. The binding indicators are for DDT based antifouling phase out and substitution, while the prospective indicators are for organotin phase out and substitution. DDT based antifouling paint should be completely phased out, while organotin based antifouling paints will be reduced to the maximum extent to create favorable conditions for China to accede to the IMO Convention so that synergies can be achieved in protection of international waters.

The key indicators of the project are binding, which will be the reduction of DDT used as additives in production of antifouling paint from 250 MT to zero. DDT releases into the sea through application of antifouling paint on ships will be eliminated. Other important indicators include the reduction of DDT accumulation in total volume and rate in sediment and in sea organism body and reduction of loss caused

by POPs pollution. Prospective indicators will include reduced amount of TBT used in antifouling paint, reduction of TBT contents in marine environmental media and the harms. The Monitoring and Evaluation Program has developed a series of such indicators.

In order to realize the project objectives, risks in the following aspects must be taken into account:

i. alternative technology
ii. small and medium sized enterprises
iii. legislations and enforcement
iv. market change
v. stakeholder participation
vi. TBT based antifouling paint or other cheap and harmful antifouling system
vii. Hard to change consumption behaviour

The Project Logical Framework in Section II, Part II provides a detailed analysis of the risks and assumptions.

Alternative technology

A workshop on selection of alternative antifouling paints was held on 15 – 16 February 2006 which reviewed the history, status and future of antifouling technologies. Criteria for selection of alternatives were also defined in the areas of technical, environmental, economic and intellectual property aspects. Section IV includes a detailed listing of the selection criteria identified.

Table 6 in Section IV shows overall comparative assessment and the key characteristics of candidate technologies and possible improvements. It is anticipated that during project implementation, some other alternative technologies that can better match the selection criteria will also be considered and promoted to ensure that the best suitable and sustainable technologies will be adopted. It can be seen from the analysis in Section IV under f) Candidate Alternative Technologies that with the support of this project the remaining disadvantages of these antifouling paint technologies can be adequately addressed within the first year of project implementation and be promoted and accepted by the end users for sustainable use in the remaining years of implementation. Therefore, the technological risk is low in adopting these alternative technologies.

Small and medium sized enterprises

Antifouling paints are mainly produced by a few large scale paint manufacturers in addition to numerous medium and small scale plants. This project will select, through open bidding process those manufacturers that are technically and economically competitive and with sound business plans to produce and promote alternatives in the target market. The selected enterprises will be provided with necessary technical and financial support to produce and promote alternatives. These supported enterprises will be obliged to realize the binding indicator.

Risks of unemployment and economic losses may arise when DDT based antifouling paint production is eventually closed down, especially in medium and small scale plants. However, such risk is minimal given that such plants do produce other types of paints beside DDT based antifouling paint. As the project will create a bigger market for the alternatives by phasing out DDT based antifouling paint and subsequent actions by China to control/eliminate the use of TBT based antifouling system, the small and medium sized enterprises can grasp this opportunity based on their local advantages on direct distribution to and interactions with the end-users. They will be supported by this project to convert to production and distribution of alternatives through technical trainings. They will also be encouraged to form consortium

to bid for participation and financial support to produce alternatives. Therefore, there is minimal social risk of unemployment in medium and small sized enterprises.

Legislations and enforcement

Presently, there is lack of effective control on DDT production, distribution and use. Though DDT is listed as a hazardous chemical to be managed according to relevant regulatory measures, its actual production, distribution and use is literally unregulated. It is paramount to legislatively cut off supply of DDT as additive in production of antifouling paint

No regulations exist for management of DDT based antifouling paint, so there is probable risk of insufficient legal foundation to phase out DDT-based antifouling paint. State Administration of Work Safety should promulgate regulations to prohibit DDT usage in production of antifouling paint and its subsequent use on ships in order to facilitate phase out DDT based antifouling paint. These regulations should be implemented in conjunction with the implementation of Regulations on the Safety Administration of Hazardous Chemicals. Guiding Catalogue for the Adjustment of Industrial Structure (2005 version), recently issued by NDRC to provide related sectoral department with guidance on industrial adjustment has listed DDT-based antifouling paint as outdated technology earmarked phase out. This has laid legislative basis for formulation and promulgation of legally binding regulations on the phase out of DDT-based antifouling paint

The implementation of regulations on prohibition of DDT usage in production of antifouling paint and subsequent application of DDT-based antifouling paints on ships, once promulgated, will involve multiple implementing agencies, creating loopholes for possible under implementation or non-implementation by some agencies. In order to minimize the risk of inadequate implementation of the Regulations and associated measures, the project should support State Administration of Work Safety and its subordinate agencies at various levels to conduct special supervision and inspections on production, distribution and use of DDT.

China has not yet acceded to the IMO Convention. Production and use of high efficiency and low price organotin based antifouling paints are not legally banned in China. After legislations are made to prohibit production and use of DDT based antifouling paint, it is very possible that DDT based antifouling paint will be replaced by organotin based antifouling paint. Clearly the implementation of one convention should not be achieved by violation of another convention. Therefore, this project will support China to accede to the IMO Convention so that synergies can be realized in phasing out DDT and organotin based antifouling paints, and a long-term mechanism to ensure that antifouling paints will develop toward an environmentally friendly direction can be established. Communications with China Maritime Bureau during the PDF-B found that there are still some difficulties for China to sign and implement the IMO Convention, but in general these difficulties can be effectively overcome by referring to the experience and lesson from the phase out of DDT based antifouling paint. Therefore, it is feasible for China to accede to the IMO Convention after the completion of this project.

Market risk

The price of the raw materials may remain high during and after the project implementation. During the PDF-B survey, antifouling paint manufacturers reflected that it was getting harder to buy DDT, and had begun exploring substitutes. The higher cost of production has driven the enterprises back to look for channels to buy DDT. Therefore, the existence of raw materials of high quality-cost ratio is a preconditional incentive for enterprises to quit use of DDT spontaneously. During the analysis of the substitution technologies, it was concluded that the cost of the raw materials for alternatives can be

greatly reduced with the assistance of this project. Thus, the risk associated with the price of the raw materials is low.

The market for antifouling paint used on fishing ships is predicted to remain stable in the foreseeable future. It can be predicted that the types and number of fishing ships will not change significantly in the near future and hence a stable market for antifouling paint shall be maintained. However in the long term there may be some changes in the market. Since 2002 after China's accession into WTO, aquatic product market has become more active and international trade on aquatic products has witnessed a steady growth. Favorable policies have been implemented by the state to encourage the development of ocean-going fishing and fishing in open seas, and reduce the number of small-sized fishing ships in coastal waters by encouraging fishermen adopt alternative sources of livelihood. As a result, it can be predicted that the number of small-sized fishing ships will decrease while large and middle sized fishing ships will increase.

It is estimated by China Maritime Bureau that the commercial ships navigating in domestic sea territory will annually consume about 20,000 MT TBT based antifouling paints with a working life of 3 years, this is in addition to the 5,000 MT of TBT based antifouling paint used by fishing ships. Once China accedes to the IMO Convention, a large market share previously dominated by the TBT based antifouling paint will be taken over by sustainable, competitive alternatives.

Stakeholder involvement

As mentioned earlier, this project will involve a number of governmental agencies at central and local levels. Some of these agencies are the members of the National Technical Coordination Group (TCG) for implementation of Stockholm Convention. During the project implementation, these agencies can be well coordinated and mobilized by the TCG mechanism.

DDT based antifouling paint manufacturers generally control the local market share by virtue of home ground advantage. Their production and sales remains relatively stable from year to year. DDT based antifouling paint is sold to local paint stores, ship maintenance plants or individual fishermen and thus it would be risky if these key stakeholders are not fully involved in phasing out the DDT based antifouling paint. The risk is worsened by the 12 million stakeholder fishermen sparsely distributed along the coastal provinces. It would therefore be hard to realize the project's objective without improving the awareness and promoting consumption choice of this group towards more environmentally friendly products.

TBT based antifouling paint or other harmful and cheap antifouling systems

As China has not yet acceded to the IMO Convention, production and use of high efficiency, low price organotin based antifouling paints are not legally banned. After legislations are promulgated to prohibit production and use of DDT based antifouling, it is highly possible that DDT based antifouling paint users will turn to organotin based antifouling paint when DDT-based formulations are under strict control or are eliminated. In this situation, TBT based antifouling paint will constitute a significant risk to undermine the success of phase out of DDT based antifouling paint.

Therefore, the results achieved and experience gained by this project will contribute to support China to accede to the IMO Convention so that synergies can be realized in phasing out DDT and organotin based antifouling paints, thus establishing a long-term mechanism to ensure environmentally sustainability. Furthermore, the experience will also help China to overcome some difficulties it currently faces to sign and implement the IMO Convention to eliminate TBT based antifouling system, minimize the risk of DDT antifouling paint user switching to TBT when the former is no longer available.

Hard-to-change consumption behaviors

Given that most of the end users of DDT based antifouling paint belong to a group which is characterized by a relatively lower level of income, education and environmental awareness, it is anticipated that their consumption behaviors will be hard to be changed.

- First of all, they are very price sensitive due to limited income that may even decline due to degraded coastal environment and thus will resist paying a higher price for alternative antifouling paint.
- Second, they are conservative to accept new ideas and hard to accept new products unless the better benefits can be demonstrated. This situation is compounded by limited access to comparative information on alternatives, creating a challenging barrier to switch to alternative products to phase out DDT based antifouling paint.

To address the characteristics of this end users group, the support will have to ensure that price of the alternatives is established at a level that can be accepted by the end users, with the support of the project, to decrease the price through technological improvements and other means (refer to Candidate Alternative Technologies in f), PART V, Section II for more details). Furthermore, innovative culture and community based programs / strategy of demonstration, incentives and education will be developed to convince the end users to accept the alternatives (refer to PART II for more details about the Strategy).

Expected Global, National and Local Benefits

As a typical persistent organic pollutant, DDT as well as its metabolites, is highly toxic, hard to degrade, persistent and can spread through atmosphere, biosphere and ocean current, and thus have a direct or potential harm to the global ecosystem and human health. In recent years, the concentration of DDT in China's coastal waters has been on the increase. It has exceeded Class IV of Sea Water Quality Standard. DDT released into Yellow Sea, East Sea and South Sea will be dispersed into the Pacific by Kuroshio and North Equatorial Current.

The implementation of this project will eliminate the release of DDT into environment through production, distribution, use, and disposal of DDT based antifouling paint, particularly the release of DDT into sea through leaching of antifouling agents coated on the bilge. The benefits from the elimination will include:

- Reduction of the total volume of DDT to spread to each corner of the global environment and cause damage to the health of the whole human beings and the biosphere;
- Improvement of the marine environmental quality and the health of the marine ecosystem and the people involved in production, distribution, use and disposal of DDT and DDT based antifouling paint;
- Reduction of the economic loss from excessive DDT contents in aquatic products and the medical care cost from the exposure under DDT; and
- Improvement of the economic benefits of the antifouling paint industry by exporting environmentally friendly and functionally feasible products to the neighboring countries in Southeast Asia.

It is worthy of notice that no systematic evaluation has ever been done regarding the socio-economic and environmental impacts of DDT uses since 1950s. Marine environmental quality degradation, aquatic product quality degradation and yield decrease, and human health damage are caused by interactive factors including marine eutrophication, over harvest, and many other complicated factors, of which DDT use in antifouling paint is only one of the most important factors. There is a lack of thematic data and research to this use. Therefore, it is not possible to precisely evaluate the cost of environmental quality

degradation and human health damage by using such methods as shadow price, opportunity cost, preventive payment, or medical care cost. In addition, the benefits from using alternatives will also be difficult to evaluate. However, some practical estimations are made based on the data gathered during the PDF-B phase and literature review, and the results show the implementation of this project will achieve a significant cost-effectiveness. Part V provides more details on cost-effectiveness analysis.

Country Ownership: Country Eligibility and Country Drivenness

China signed the Stockholm Convention on Persistent Organic Pollutants in May 2001, and the congress ratified the Convention in June 2004. The Convention entered into effect on November 11, 2004. China is eligible for GEF funding under paragraph 9(b) of the GEF Instrument.

Implementation of the Stockholm Convention is in conformity with China State Policy on Environmental Protection. Recommendations on the development of the 11th Five-Year Plan of National Economic and Social Development by the Central Government of the Communist Party of China emphasized the concept of scientific innovation-oriented development, resource-efficient, environmentally friendly in building a harmonious society. Substantial measures shall be taken to resolve significant issues that affect economic development and particularly those that threaten human health. In December, 2005, the State Council issued *The State Council's Decision to Realize Scientific Development and Strengthen Environmental Protection.* It also indicates that hazards due to POPs has gained attention in China, and that the State will establish and implement long-term environmental protection mechanism to control POPs through international cooperation and communication.

Early in September 1999, China had already established an interdepartmental task force for POPs. These institutions were tasked to participate in technical coordination, negotiation and joint deliberation on the phase out of POPs in accordance to Stockholm Convention. They participated in all the 7 intergovernmental negotiation committee meetings. In December 2000, State Environmental Protection Administration established the POPs Convention Working Team to organize and make preparation for strengthening capacity of POPs Convention related projects. With China's approval of POPs Convention and progress in implementation, the status of the working group has been officially recognized and renamed China Office for the Implementation of Stockholm Convention. Its functions have been transformed from the Convention fulfillment preparation to comprehensive implementation of the Convention.

The PDF-B grant phase of the development of the National Implementation Plan (NIP) in China as a first step to comply with the Convention was implemented by the Foreign Economic Cooperation Office (FECO) of the State Environmental Protection Administration (SEPA) under a letter of agreement with UNIDO. The GEF Council Meeting approved the full size project in May 2003 and endorsed the project document in September 2004. The full NIP project was initiated on September 21, 2004. The NIP development work should be completed in June 2006. The NIP will be submitted to GEF and will serve as the overall guidance to implement the Convention in China in the future.

As part of process for the preparation of the NIP, with the support of the Government of Italy and implemented by UNDP/UNOPS, investigation of the production, distribution, use, import/export and obsolete/stockpile situation of 9 kinds of POPs pesticides was conducted. Based on the investigation and assessment, a Strategy for Phase out of POPs Pesticides in China was drafted in June 2004. The Strategy was reviewed and revised several times by related ministries involved in the implementation of the Stockholm Convention, after receiving valuable comments and inputs from international and national stakeholders at a June 2004 workshop. Based on the Strategy and its annex documents, key information was used to develop this follow-up project proposal. The Strategy will become a part of NIP for China to implement Stockholm Convention on Persistent Organic Pollutants. The Strategy includes an overall

deployment on DDT elimination and substitution, in which the application of DDT as biocide additive in antifouling paint is required to be completely eliminated within 2 - 4 years from 2006.

The State Council approved the establishment a working coordination group in April, 2005 based on the NIP's Coordinating Group. This Coordination Group is responsible for deliberations on the State's guiding principle, policy, regulation, standards and guidance on management and control of POPs, in line with national management and implementation of the Stockholm Convention on POPs. In order to better implement the responsibilities of the working coordination group, the Convention Implementation Office was designated to be in charge of day-to day liaisons and communication.

Additionally, China has set up a Technical Coordination Group meeting mechanism. At least two meetings will be held annually to exchange and share information, deliberate project output and report on projects' achievement. This technical coordination group meeting mechanism plays a significant role in support of reduction and phase out of POPs.

Sustainability and Replicability

According to the Strategy for Phase out of POPs Pesticides in China, it will take ten years (before 2014), to realize its target of complete phase out of DDT. The regulatory mechanism established and the technical and managerial capacity strengthened by this project will lay a foundation and provide experience and lessons for eliminating other applications of DDT. The sustainability of this project will be guaranteed from the following aspects: (i) intensive mobilization of all related stakeholders throughout the process; (ii) demonstration of the effectiveness of environment-friendly alternative technologies / products; (iii) support capacity building at both national and local levels; (iv) formulate laws, regulations and rules to control and manage DDT anti-fouling paint and promote alternatives, and multiple means to be adopted for actual enforcement of them.

According to the Strategy, all DDT applications will gradually be banned. One feature of this project is that it will comprehensively consider links to other similar projects, especially those on DDT elimination related projects. At present, GEF has approved PDF-B project on "Improvement of Production Technology of Dicofol from DDT and Introduction of Alternative Technology including IPM Practice for Leaf Mites Control", which awaits initiation. The experience obtained in the design and implementation of this project would directly help to jumpstart the Dicofol project which when implemented, will phase out 85% of DDT produced by the Tianjin Chemical Plant. Considering that the Strategy still needs further improvement, concrete design and implementation of this project could also provide support and reference basis

The existence and effective operations of the National Leading Group and the Convention Implementation Office (CIO) are critical in guaranteeing sustainability and replication of this project. Another fundamental condition to guarantee the sustainability and replicability of this project is the good coordination and cooperation among central and local government and related parties. The institutional arrangement is described in details in Part III below.

GEF, according to its instrument, can also provide support to other environmental treaties. TBT, as a toxic organic pollutant, also meets the funding requirement under Operational Program OP#10 of GEF. This project will conduct strategic study at the latter stage of implementation to replicate the experience and lessons learned from this project to phase out TBT.

In order to ensure the replicability of this project, several activities are designed to disseminate the outcomes and experience (Outcome 5). As mentioned earlier, the activities for Outcome 5 include public participation, participation of stakeholders, professional training, community awareness training, etc. The

participating parties in this project, including central and local government agencies, companies and non-government organization, would all take part in information dissemination. The project website is also regarded as an effective information platform to provide information to the public and research institutions.

PART III : Management Arrangements

Partnership arrangements

Financial partnerships:

GEF, as the interim financial mechanism for the Stockholm Convention, will provide most of the funding for the project. In addition, the Government of China and domestic enterprises will provide co-finance for the implementation of the project.

The Government of China has already committed to provide the necessary co-financing under this project. The central government has committed to provide 30 million RMB, or equivalent of 3.75 million USD as co-financing to be used mainly for legal and institutional strengthening and capacity building.

During the PDF-B, the CIO has had extensive communication with antifouling paint manufacturers and achieved positive response from them in providing co-financing to the project. The CIO published a call for expression of interest in its official website (www.chinapops.org), and notified all the antifouling paint manufacturers in China by email, telephone and meeting. So far, 7 enterprises have submitted their commitment to providing co-financing. Their in-kind contributions in fixed assets have also been verified by independent asset evaluation entities. During project implementation, 3 to 5 enterprises will be selected to provide a total co-financing of 68 million RMB, or equivalent of 8.5 million USD for production and promotion of alternatives in this project.

In-kind co-finance from enterprises will cover required site preparation, production equipment, analytical instruments, raw materials, employee salary, enterprise R & D and training, and advertisement expenses. Letters of commitment to providing co-finance are annexed to Annex E of the Executive Summary.

Additionally, some bilateral governments (such as Japan, Norway and Italy) have expressed strong desire to provide co-financing, but because of the complicated and time-consuming procedures involved to leverage bilateral co-financing, related procedures are still progressing at the time of submission of this full size project.

Institutional and implementation arrangements

The implementation organization for this project is outlined in Section IV, Part II, Organigram of the Project. Key teams and committees are also elaborated, including corresponding authority, membership and responsibilities. The stakeholders and their roles are described in detail in Section IV, Part IV, Stakeholder Involvement Plan.

SEPA is the core coordinating agency for all POPs activities in China. All major national and local government, scientific institutions and enterprises will be involved in project implementation. International Implementing Agencies, potential bilateral partners, and enterprises from private sectors will be invited to review and advise on the progress and impacts of project implementation through the Technical Coordination Group (TCG) meeting mechanism which will be held at least twice a year.

PART I V: Monitoring and Evaluation Plan and Budget

Project monitoring and evaluation will be conducted in accordance with established GEF and UNDP procedures and will be provided by the project team and the UNDP Country Office (UNDP-CO) with support from UNDP-GEF. The Logical Framework Matrix in Section II, Part II provides *performance and impact* indicators for project implementation along with their corresponding *means of verification*. These form the basis on which the project's Monitoring and Evaluation system will be built.

The following outlines the principle components of the Monitoring and Evaluation Plan and indicative cost estimates related to M&E activities. The project's Monitoring and Evaluation Plan will be presented and finalized at the Project's Inception Report following a collective fine-tuning of indicators, means of verification, and the full definition of project staff's M&E responsibilities.

Monitoring and Reporting

Project Inception Phase

A Project Inception Workshop will be conducted with the full project team, relevant government counterparts, co-financing partners, the UNDP-CO and representation from the Regional Coordination Unit (RCU) and UNDP-GEF headquarters, as appropriate.

The fundamental objective of this Inception Workshop is to assist the project team to understand and assimilate the goals and objectives of the project, as well as to finalize preparation of the project's first annual work plan on the basis of the project's logframe matrix. This includes reviewing the logframe (indicators, means of verification, assumptions), imparting additional details as needed, and on the basis of this exercise finalize the Annual Work Plan (AWP) with concise and measurable performance indicators, and in a manner consistent with the expected outcomes for the project.

Additionally, the purpose and objective of the Inception Workshop (IW) will be to: (i) introduce project staff to the UNDP-GEF expanded team which will support the project during its implementation, namely the CO and responsible RCU staff; (ii) detail the roles, support services and complementary responsibilities of UNDP-CO and RCU staff vis-à-vis the project team; (iii) provide a detailed overview of UNDP-GEF reporting and monitoring and evaluation (M&E) requirements, with particular emphasis on the Annual Project Implementation Reviews (PIRs) and related documentation, the Annual Project Report (APR), Tripartite Review Meetings, as well as mid-term and final evaluations. Equally, the Inception Workshop will provide an opportunity to inform the project team on UNDP project related budgetary planning, budget reviews, and mandatory budget rephasings.

The Inception Workshop will also provide an opportunity for all parties to understand their roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff and decision-making structures will be discussed again, as needed, in order to clarify for all, each party's responsibilities during the project's implementation phase.

Monitoring responsibilities and events

A detailed schedule of project reviews meetings will be developed by the project management, in consultation with project implementation partners and stakeholder representatives and incorporated in the Project Inception Report. Such a schedule will include: (i) tentative time frames for Tripartite Reviews,

Steering Committee Meetings, (or relevant advisory and/or coordination mechanisms) and (ii) project related Monitoring and Evaluation activities.

Day-to-day monitoring of implementation progress will be the responsibility of the Project Coordinator based on the project's Annual Work Plan and its indicators. The Project Team will inform the UNDP-CO of any delays or difficulties faced during implementation so that the appropriate support or corrective measures can be adopted in a timely and remedial fashion.

The Project Coordinator, the National Technical Advisor, and the Chief Technical Advisor will fine-tune the progress and performance/impact indicators of the project in consultation with the full project team at the Inception Workshop with support from UNDP-CO and assisted by the UNDP-GEF Regional Coordinating Unit. Specific targets for the first year implementation progress indicators together with their means of verification will be developed at this Workshop. These will be used to assess whether implementation is proceeding at the intended pace and in the right direction and will form part of the Annual Work Plan. The 3 local/regional project management offices will also take part in the Inception Workshop in which a common vision of overall project goals will be established. Targets and indicators for subsequent years would be defined annually as part of the internal evaluation and planning processes undertaken by the project team.

Measurement of impact indicators related to global benefits will be done according to the schedules defined in the Inception Workshop. The measurement of these will be undertaken through subcontracts or retainers with relevant institutions, or through specific studies that are to form part of the projects activities. Indicators of project goal, progress and performance will be continuously monitored and evaluated throughout the whole project life. Impact indicators to be measured include contents of DDT and its degradation products in antifouling paint, ambient air of manufacturing factories, coastal waters, sediments, benthics, marine microorganism, and representative fishes.

At least two special inspections will be conducted during the project implementation to report the production, distribution and use of antifouling paints and supervise the enforcement of related regulations, rules and standards.

Periodic monitoring of implementation progress will be undertaken by the UNDP-CO through quarterly meetings with the project proponent, or more frequently as deemed necessary. This will allow parties to take stock and to troubleshoot any problems pertaining to the project in a timely fashion to ensure smooth implementation of project activities.

UNDP-CO and UNDP-GEF RCU as appropriate, will conduct yearly visits or more often based on an agreed upon schedule to be detailed in the project's Inception Report / Annual Work Plan to assess first hand project progress. Any other member of the Steering Committee can also accompany, as decided by the Steering Committee (SC). A Field Visit Report will be prepared by the UNDP-CO and circulated no less than one month after the visit to the project team, all SC members, and UNDP-GEF.

Annual Monitoring will occur through the Tripartite Review (TPR). This is the highest policy-level meeting of the parties directly involved in the implementation of a project. The project will be subject to Tripartite Review (TPR) at least once every year. The first such meeting will be held within the first twelve months of the start of full implementation. The project proponent will prepare an Annual Project Report (APR) and submit it to UNDP-CO and the UNDP-GEF RCU at least two weeks prior to the TPR for review and comments.

The APR will be used as one of the basic documents for discussions in the TPR meeting. The project proponent will present the APR to the TPR, highlighting policy issues and recommendations for the

decision of the TPR participants. The project proponent also informs the participants of any agreement reached by stakeholders during the APR preparation on how to resolve operational issues. Separate reviews of each project component may also be conducted if necessary.

Terminal Tripartite Review (TTR)

The Terminal Tripartite Review will be held in the last month of project operations. The project proponent is responsible for preparing the Terminal Report and submitting it to UNDP-CO and UNDP-GEF's Regional Coordinating Unit. It shall be prepared in draft at least two months in advance of the TTR in order to allow review, and will serve as the basis for discussions in the TTR. The Terminal Tripartite Review considers the implementation of the project as a whole, paying particular attention to whether the project has achieved its stated objectives and contributed to the broader environmental objective. It decides whether any actions are still necessary, particularly in relation to sustainability of project results, and acts as a vehicle through which lessons learnt can be captured to feed into other projects under implementation of formulation.

The TPR has the authority to suspend disbursement if project performance benchmarks are not met. Benchmarks will be developed at the Inception Workshop, based on delivery rates, and qualitative assessments of achievements of outputs.

Project Monitoring Reporting

The Project Coordinator in conjunction with the UNDP-GEF extended team will be responsible for the preparation and submission of the following reports that form part of the monitoring process. Items (a) through (f) are mandatory and strictly related to monitoring, while (g) through (h) have a broader function and the frequency and nature is to be defined throughout implementation.

(a) Inception Report (IR)

A Project Inception Report will be prepared immediately following the Inception Workshop. It will include a detailed First Year/ Annual Work Plan divided in quarterly time-frames detailing the activities and progress indicators that will guide implementation during the first year of the project. This Work Plan would include the dates of specific field visits, support missions from the UNDP-CO or the Regional Coordinating Unit or consultants, as well as time-frames for meetings of the project's decision making structures. The Report will also include the detailed project budget for the first full year of implementation, prepared on the basis of the Annual Work Plan, and including any monitoring and evaluation requirements to effectively measure project performance during the targeted 12 months time-frame.

The Inception Report will include a more detailed narrative on the institutional roles, responsibilities, coordinating actions and feedback mechanisms of project related partners. In addition, a section will be included on progress to date on project establishment and start-up activities and an update of any changed external conditions that may effect project implementation.

When finalized the report will be circulated to project counterparts who will be given a period of one calendar month in which to respond with comments or queries. Prior to this circulation of the IR, the UNDP Country Office and UNDP-GEF's Regional Coordinating Unit will review the document.

(b) Annual Project Report (APR)

The APR is a UNDP requirement and part of UNDP's Country Office central oversight, monitoring and project management. It is a self -assessment report by project management to the UNDP-CO and provides input to the country office reporting process and the ROAR, as well as forming a key input to the Tripartite Project Review. An APR will be prepared on an annual basis prior to the Tripartite Project Review, to reflect progress achieved in meeting the project's Annual Work Plan and assess performance of the project in contributing to intended outcomes through outputs and partnership work.

The format of the APR is flexible but should include the following:

- An analysis of project performance over the reporting period, including outputs produced and, where possible, information on the status of the outcome
- The constraints experienced in the progress towards results and the reasons for these
- The three (at most) major constraints to achievement of results
- AWP, CAE and other expenditure reports (ERP generated)
- Lessons learned
- Clear recommendations for future orientation in addressing key problems in lack of progress

(c) Project Implementation Review (PIR)

The PIR is an annual monitoring process mandated by the GEF. It has become an essential management and monitoring tool for project managers and offers the main vehicle for extracting lessons from ongoing projects. Once the project has been under implementation for a year, a Project Implementation Report must be completed by the UNDP-CO together with the project. The PIR can be prepared any time during the year (July-June) and ideally prior to the TPR. The PIR should then be discussed in the TPR so that the result would be a PIR that has been agreed upon by the project, the executing agency, UNDP CO and the concerned RC.

The individual PIRs are collected, reviewed and analyzed by the RCs prior to sending them to the focal area clusters at the UNDP-GEF headquarters. The focal area clusters supported by the UNDP-GEF M&E Unit analyze the PIRs by focal area, theme and region for common issues/results and lessons. The TAs and PTAs play a key role in this consolidating analysis.

The focal area PIRs are then discussed in the GEF Interagency Focal Area Task Forces in or around November each year and consolidated reports by focal area are collated by the GEF Independent M&E Unit based on the Task Force findings.

The GEF M&E Unit provides the scope and content of the PIR. In light of the similarities of both APR and PIR, UNDP-GEF has prepared a harmonized format for reference.

(d) Quarterly Progress Reports

Short reports outlining main updates in project progress will be provided quarterly to the local UNDP Country Office and the UNDP-GEF regional office by the project team.

(e) Periodic Thematic Reports

As and when called for by UNDP, UNDP-GEF or the Implementing Partner, the project team will prepare Specific Thematic Reports, focusing on specific issues or areas of activity. The request for a Thematic Report will be provided to the project team in written form by UNDP and will clearly state the issue or activities that need to be reported on. These reports can be used as a form of lessons learnt exercise, specific oversight in key areas, or as troubleshooting exercises to evaluate and overcome obstacles and

difficulties encountered. UNDP is requested to minimize its requests for Thematic Reports, and when such are necessary will allow reasonable timeframes for their preparation by the project team.

(f) Project Terminal Report

During the last three months of the project the project team will prepare the Project Terminal Report. This comprehensive report will summarize all activities, achievements and outputs of the Project, lessons learnt, objectives met, or not achieved structures and systems implemented, etc. and will be the definitive statement of the Project's activities during its lifetime. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the Project's activities.

(g) Technical Reports

Technical Reports are detailed documents covering specific areas of analysis or scientific specializations within the overall project. As part of the Inception Report, the project team will prepare a draft Reports List, detailing the technical reports that are expected to be prepared on key areas of activity during the course of the Project, and tentative due dates. Where necessary this Reports List will be revised and updated, and included in subsequent APRs. Technical Reports may also be prepared by external consultants and should be comprehensive, specialized analyses of clearly defined areas of research within the framework of the project and its sites. These technical reports will represent, as appropriate, the project's substantive contribution to specific areas, and will be used in efforts to disseminate relevant information and best practices at local, national and international levels.

(h) Project Publications

Project Publications will form a key method of crystallizing and disseminating the results and achievements of the Project. These publications may be scientific or informational texts on the activities and achievements of the Project, in the form of journal articles, multimedia publications, etc. These publications can be based on Technical Reports, depending on the relevance, scientific worth, etc. of these Reports, or may be summaries or compilations of a series of Technical Reports and other research. The project team will determine if any of the Technical Reports merit formal publication, and will also (in consultation with UNDP, the government and other relevant stakeholder groups) plan and produce these Publications in a consistent and recognizable format. Project resources will need to be defined and allocated for these activities as appropriate and in a manner commensurate with the project's budget.

Independent Evaluation

The project will be subjected to at least two independent external evaluations as follows:

(a) Mid-term Evaluation

An independent Mid-Term Evaluation will be undertaken at the end of the second year of implementation. The Mid-Term Evaluation will determine progress being made towards the achievement of outcomes and will identify correction course if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned on project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-Term evaluation will be prepared by the UNDP-CO based on guidance from the Regional Coordinating Uı and UNDP-GEF.

(b) Final Evaluation

An independent Final Evaluation will take place three months prior to the Terminal Tripartite Review meeting, and will focus on the same issues as the mid-term evaluation. The final evaluation will also look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental goals. The Final Evaluation should also provide recommendations for follow-up activities. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF.

Audit Clause

The Government will provide the Resident Representative with certified periodic financial statements, and with an annual audit of the financial statements relating to the status of UNDP (including GEF) funds according to the established procedures set out in the Programming and Finance manuals. The Audit will be conducted by the legally recognized Government auditor, or by a commercial auditor engaged by the Government.

Learning and Knowledge Sharing

Results from the project will be disseminated within and beyond the project intervention zone through a number of existing information dissemination networks and forums. New channels will be created to strengthen the knowledge sharing among the public in Public Awareness and Education Component. In addition:

- The project will participate, as relevant and appropriate, in UNDP-GEF sponsored networks, organized for Senior Personnel working on projects that share common characteristics.
- The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons learned.

The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects. Identification and analysis of lessons learned is an on- going process, and the need to communicate such lessons as one of the project's central contributions is a requirement to be delivered at least once in every 12 months. UNDP-GEF shall provide a format and assist the project team in categorizing, documenting and reporting on lessons learned. To this end a percentage of project resources will need to be allocated for these activities.

Table 1: Indicative Monitoring and Evaluation Work plan and Corresponding Budget

Type of M&E activity	**Responsible Parties**	**Budget US$** *Excluding project team staff time*	**Time frame**
Inception Workshop	▪ Project Coordinator	50,000	Within first six months of project start up
Inception Report	▪ Project Team	Included in IW	Immediately following IW
Measurement of *Means of Verification* for Project Purpose Indicators	▪ Project Team	100,000	Start, mid and end of project

Measurement of *Means of Verification* for Project Progress and Performance	▪ Regional field officers and local IAs	100,000	Annually prior to APR/PIR and as defined in Annual Work Plans
APR and PIR	▪ Project Team	None	Annually
TPR and TPR report	▪ Project team ▪ UNDP-GEF	None	Every year, upon receipt of APR
Steering Committee Meetings	▪ Project Coordinator ▪ UNDP CO ▪ UNDP-GEF	80,000	Following IW and subsequently at least once a year
Quarterly Progress Report	▪ Project team	None	Each quarter
Technical reports	▪ National consultants	30,000	To be determined by Project Team and UNDP-CO
Mid-term External Evaluation	▪ External Consultants	40,000	At the mid-point of project implementation.
Final External Evaluation	▪ External Consultants	60,000	At the end of project implementation
Terminal Report	▪ Project team	20,000	At least one month before the end of the project
Lessons learned	▪ Project team	None	Annually
Audit	▪ Independent Audit Entity	20,000	Annually
Visits to field sites (UNDP staff travel costs to be charged to IA fees)	▪ UNDP Country Office ▪ UNDP-GEF (as appropriate) ▪ Government representatives	20,000	Annually, as required
TOTAL indicative COST *Excluding project team staff time and UNDP staff and travel expenses*		**520,000**	

Table 2: Impact Measurement Template

Key Impact Indicator	Baseline	Target (at Year 4)	Means of Verification	Sampling frequency	Location
Amount of DDT produced by Tianjin Chemical Plant	1,600 MT	Reduced at least 250 MT per year	Site visit and investigation	Annually	Tianjin Chemical Plant
Amount of alternatives produced	0	At least 5,000 MT	Thematic investigation	Every two years	Enterprises and end users

Key Impact Indicator		Baseline	Target (at Year 4)	Means of Verification	Sampling frequency	Location
Price of alternatives	Other biocide based	45-60 RMB/kg	25-35 RMB/kg	Market survey	Every two years	Market and end users
	Capsaicine based	87-140 RMB/kg	25-35 RMB/kg	Market survey	Every two years	Market and end users
Content of DDT in antifouling paint		5% in DDT based antifouling paint by weight	0	Laboratory analysis	Annually	Manufac-tures and market
Number of ships using alternatives		0	At least 150,000 start using DDT based antifouling paint	Sampling investigation	Every two years	All 9 coastal provinces

Among the key impact indicators, DDT/TBT contents in ambient air and sea water can have a significant decrease with the reduced use of DDT and TBT based antifouling paints during project implementation. As regard other indicators like DDT/TBT levels in organisms, it is unlikely to decrease over the life of the project in a significant way. In this case, this project will establish a baseline against which longer term progress can be gauged.

PART V: Legal Context

This Project Document shall be the instrument referred to as such in Article I of the Standard Basic Assistance Agreement (SBAA) between the Government of the People's Republic of China and the United Nations Development Programme, signed by the parties on 29 June 1979. The host country implementing agency shall, for the purpose of the Standard Basic Assistance Agreement, refer to the government co-operating agency described in that Agreement.

The UNDP Resident Representative in China is authorized to effect in writing the following types of revision to this Project Document, provided that he/she has verified the agreement thereto by the UNDP-GEF and is assured that the other signatories to the Project Document have no objection to the proposed changes:

a) Revision of, or addition to, any of the annexes to the Project Document;

b) Revisions which do not involve significant changes in the immediate objectives, outputs or activities of the project, but are caused by the rearrangement of the inputs already agreed to or by cost increases due to inflation;

c) Mandatory annual revisions which re-phase the delivery of agreed project inputs or increased expert or other costs due to inflation or take into account agency expenditure flexibility; and

d) Inclusion of additional annexes and attachments only as set out here in this Project Document

SECTION II : STRATEGIC RESULTS FRAMEWORK AND GEF INCREMENT

PART I : Incremental Cost Analysis

Refer to Annex A of the GEF Project Executive Summary

PART II : Logical Framework Analysis

Refer to Annex B of the GEF Project Executive Summary

SECTION III : TOTAL BUDGET AND WORKPLAN

(to be read in conjunction with the Advisory Note on Atlas and Total Workplan Terminology)

Award ID: 00043092							
Project Title: Alternatives to DDT Usage in the Production of Antifouling Paint							
GEF Outcome / Atlas Activity*	**Activities**	**Source of Funds**	**Amount (USD) 2006**	**Amount (USD) 2008**	**Amount (USD) 2008**	**Amount (USD) 2009**	**Total (USD) All Years**
Outcome 1: Establish Project Management Institutions and Build Operational Capacity	Activity 1.1 Establish project management institutions and coordination mechanisms	GOC	150,000	150,000	100,000	50,000	450,000
		GEF	250,000	200,000	150,000	150,000	750,000
		Private Industry					
	Activity 1.2 Establish a national expert team	GOC	20,000	20,000	20,000	20,000	80,000
		GEF	80,000	60,000	40,000	40,000	220,000
		Private Industry					
	Activity 1.3 Conduct trainings	GOC	10,000	20,000			30,000
		GEF	20,000	20,000			40,000
		Private Industry					
	Activity 1.4 Conduct study tour abroad	GOC					
		GEF		80,000			80,000
		Private Industry					
	Sub-total		530,000	550,000	310,000	260,000	1,650,000
Outcome 2: Establish MIS and Website	Activity 2.1 Establish MIS and strengthen information support	GOC					
		GEF	10,000	30,000	20,000	10,000	70,000
		Private Industry					
	Activity 2.2 Data collection, analysis, transmission and sharing.	GOC	50,000	50,000	50,000	50,000	200,000
		GEF	100,000	200,000	200,000	100,000	600,000
		Private Industry					
	Activity 2.3 Establish a website	GOC					
		GEF	10,000	10,000	5,000	5,000	30,000
		Private Industry					
	Sub-total		170,000	290,000	275,000	165,000	900,000

Outcome 3: Establish or Revise Regulations, Standards, and Action Plan	Activity 3.1 Establish or revise related regulations, standards, and rules.	GOC	100,000	100,000			200,000
		GEF	100,000	100,000			200,000
		Private Industry					
	Activity 3.2 Revise compulsory rules of inspection of ship products.	GOC		20,000			20,000
		GEF		30,000			30,000
		Private Industry					
	Activity 3.3 Establish and promote a voluntary certification and labeling program	GOC		20,000			20,000
		GEF		20,000			20,000
		Private Industry					
	Activity 3.4 Sustain the results of DDT phase out	GOC	75,000	100,000	75,000	50,000	300,000
		GEF					
		Private Industry					
	Activity 3.5 Strengthen capacity and enforcement	GOC	50,000	75,000	75,000	50,000	250,000
		GEF	75,00	150,000	150,000	75,00	450,000
		Private Industry					
	Sub-total		400,000	615,000	300,000	175,000	1,490,000
Outcome 4; Adopt Multiple means of Technological Support, Policy Induction, Market Regulation, and Awareness Raising and Education to Promote Conversion	Activity 4.1 Test, select and acquire alternative technologies.	GOC	750,000	750,000			1,500,000
		GEF	1,750,000	1,250,000			3,000,000
		Private Industry					
	Activity 4.2 Select demonstration enterprises and business plan improvement	GOC					
		GEF	50,000	50,000			100,000
		Private Industry					
	Activity 4.3 Production and distribution of alternatives.	GOC					
		GEF		1,500,000	1,000,000	500,000	3,000,000
		Private Industry		3,200,000	3,200,000	2,100,000	8,500,000
	Activity 4.4 Conduct environmental sound management of DDT contaminated sites and equipment.	GOC		200,000	200,000	100,000	500,000
		GEF		400,000	200,000	100,000	700,000
		Private Industry					
	Sub-total		2,550,000	7,3550,000	4,600,000	2,800,000	17,300,000

Outcome 5: Conduct Environmental Education to Promote Awareness	Activity 5.1 Prepare publicity materials to promote environmental education and awareness raising	GOC	50,000	50,000	50,000	50,000	200,000
		GEF	300,000	300,000	200,000	200,000	1,000,000
		Private Industry					
	Activity 5.2 Mobilize NGOs to promote environmental education and awareness	GOC					
		GEF	200,000	200,000	200,000	200,000	800,000
		Private Industry					
	Sub-total		550,000	550,000	450,000	450,000	2,000,000
Outcome 6: Monitoring and Evaluation	Activity 6.1 Conduct meetings to review and monitor progress of project activities	GOC					
		GEF	50,000	80,000	60,000	50,000	240,000
		Private Industry					
	Activity 6.2 Launch field investigations and inspections to facilitate M&E	GOC					
		GEF	50,000	50,000	40,000	40,000	180,000
		Private Industry					
	Activity 6.3 Prepare progress and monitoring reports	GOC					
		GEF	20,000	20,000	20,000	20,000	80,000
		Private Industry					
	Activity 6.4 Conduct annual project audit	GOC					
		GEF		10,000		10,000	20,000
		Private Industry					
	Sub-total		120,000	160,000	120,000	120,000	520,000
Total Budget excluding PDF-B			**4,320,000**	**9,515,000**	**6,055,000**	**3,970,000**	**23,860,000**
PDF-B GEF Resources							**295,000**
PDF-B Co-financing							**70,000**
Total Project budget including PDF-B							**24,225,000**

SECTION IV : ADDITIONAL INFORMATION

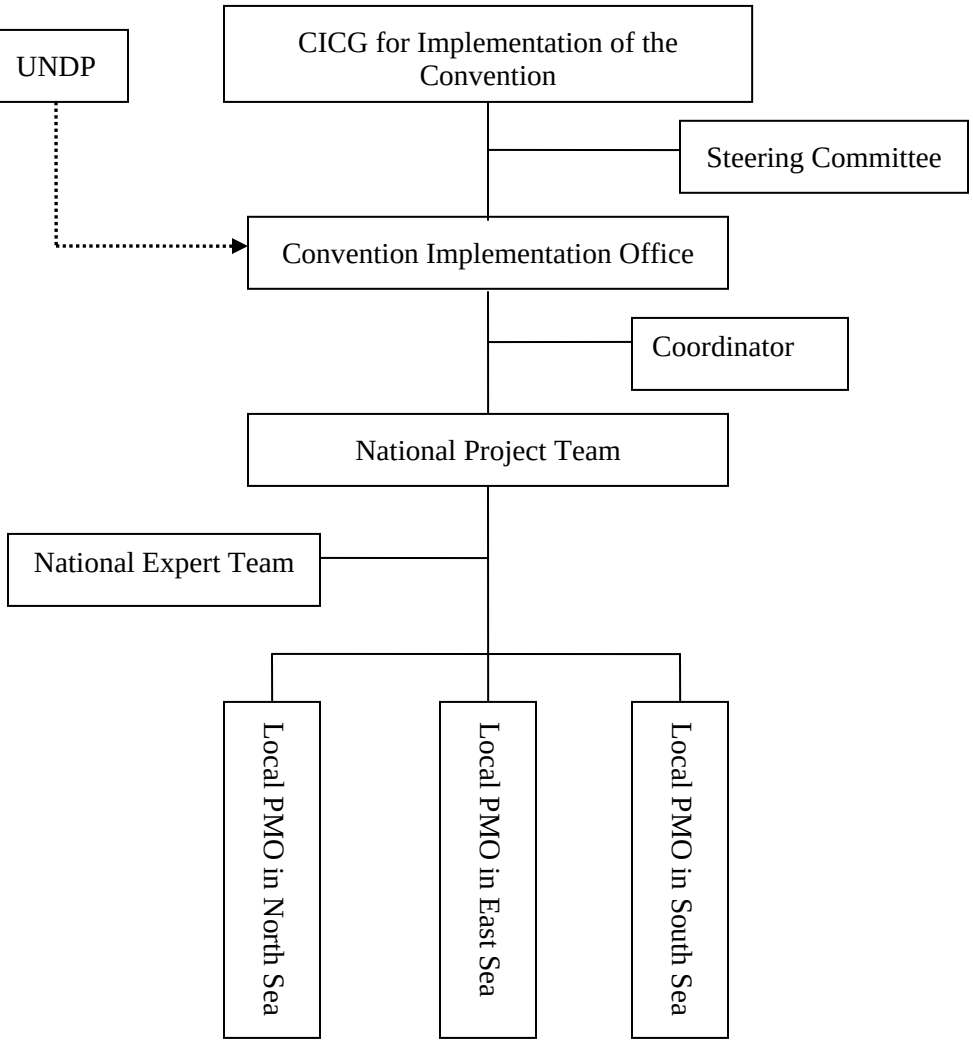
PART I : Other agreements

Note: attach endorsement letter(s) .

[Once the GEF Council has approved the project, add letter(s) of financial commitment, MOUs with executing agency if relevant, and other official agreements.]

PART II : Organigram of the Project

The project will be implemented under National Execution (NEX) modality, and will involve a wide range of stakeholders.



a. **Convention Implementation Coordination Group (CICG)**. China established the National NIP Development Leading Group in September 2003. The National Leading Group provides overall guidance and coordination for the NIP development process at its Project Concept and Project Brief stages. This Group became the National Leading Group for Implementation of the POP Convention when China ratified the Convention on August 13, 2004. The National Leading Group was formally approved by State Council in April 2005, and renamed as National Technical Coordination Group (TCG) for Implementation of the Stockholm Convention. It will provide (i) review of significant policies related to POPs management and control, (ii) guidance and coordination to significant activities for national POPs management and implementation of the Convention. It consists of the following 11 agencies:

   i. State Environmental Protection Administration (SEPA)
   ii. National Development and Reform Commission (NDRC)
   iii. Ministry of Foreign Affairs (MOFA)
   iv. Ministry of Finance (MOF). MOF is the GEF Focal Point in China.
   v. Ministry of Commerce (MOCom)
   vi. Ministry of Science and Technology (MOST)
   vii. Ministry of Agriculture (MOA)
   viii. Ministry of Public Health (MOH)
   ix. Ministry of Construction (MOC)
   x. General Administration of Customs (GAC)
   xi. State Electricity Regulatory Commission (SERC)

b. **Steering Committee (SC).** The project will establish a steering committee by drawing upon resources from related ministries or commissions at the national level, and from local governmental agencies to provide the project team with political guidance and inter-ministerial coordination support.

c. **Convention Implementation Office (CIO).** The CIO is part of SEPA and is responsible coordinating the day-to-day implementation of the Stockholm Convention in China. CIO's responsibilities include: (i) provision of technical support for international negotiations and policy studies on the Stockholm Convention, (ii) provision of support to the development and implementation of corresponding policy and regulations, as well as coordination of key governmental stakeholders, (iii) mobilize co-financing for the project from bilateral and domestic governmental and private sources, (iv) collecting data and information, compiling reports, organizing trainings, and publishing information. In this project, the CIO will provide guidance to ensure the successful implementation. Regular monitoring and enforcement inspections will be conducted by the CIO. As CIO is not an independent entity, FECO will represent SEPA to sign and manage contracts with stakeholders in this project.

d. **National Team of DDT Based Antifouling Paint Substitution Project (Project Team) in CIO.** The project team is composed of staff from SEPA, Ministry of Agriculture, Ministry of Communications, State Oceanic Administration, and General Administration of Quality Supervision, Inspection and Quarantine, and SEPA will designate a coordinator who also acts as the team leader. The Project Team will be in charge of the day-to-day management and implementation of the proposed project under the guidance of the CIO, and oversee the local project management offices. Its responsibilities include (i) assignment and supervision of project activities; (ii) recruitment of international and national consultants; (iii) provision of guidance to the local PMOs; (iv) coordination with stakeholders, including GEF, donors, IA, relevant domestic ministries and agencies, and private sector; (v) preparation of terms of references (TORs) for activities under the project, (vi) review of project progress reports submitted by the local PMOs, (vii) supervising project procurement and financial resources in accordance with UNDPs procedures, (viii) organizing and convening project

coordination stakeholder meetings, and (ix) review of project outputs. The project team will be provided with technical support by the National Expert Team.

e. **National Expert Team.** The project will recruit a Chief Technical Advisor (CTA, an international consultant), a National Technical Advisor (NTA), policy experts, technical experts in antifouling paint, and evaluation and programming experts to form a national expert team to assist CIO in the following activities:

i) Introduction of successful experiences gained from foreign countries;
ii) Assisting the project team in overall technical management and coordination of all project activities;
iii) Provision of technical support for institutional strengthening, policy framework, antifouling paint management, environmental sound management of DDT contaminated sites and equipment, project monitoring and evaluation, and replication program development;
iv) Provision of project implementation progress appraisal at different stages;
v) Revision and improvement of the training material developed during the implementation of the project; and
vi) Provision of advice on alternative antifouling technologies selected by the project.

f. **Three Local Project Management Offices (PMOs).** The project will involve a large number of fishermen and fishing ships that are widely distributed along the coastal line. Extensive awareness promotion and trainings will be conducted at community and local governmental levels. Inspection of the implementation of relevant regulations will rely on local administrative agencies. Such scenario poses great management and coordination challenges to the national project team. In order to effectively implement the project and involve the local stakeholders, 3 local project management offices will be established. The local PMOs will be composed of staff from relevant provincial governmental agencies in respective provinces of the 3 sea areas. Their responsibilities will include (i) coordination/organization of local training and seminars; (ii) overseeing operations of enterprises; (iii) carrying out joint inspections of implementation of related regulations; (iv) promoting policy and dialogue; and (v) collecting information and preparing progress reports.

PART III : Terms of References for key project staff and main sub-contracts

[NOTE:. This Part should be added only after the GEF has approved the project, and before requesting CEO endorsement. Include TORs for Project Manager, and CTA. TORs for other key staff or sub-contracts can be developed during the project's inception workshop].

PART IV : Stakeholder Involvement Plan

During project preparation, a wide range of stakeholders have been consulted and will continue to be involved in the implementation of the project.

- **State Environmental Protection Administrator** is an organization directly under the State Council and is responsible for the supervision and examination of the implementation of the Convention, NIP and the POPs Strategy. SEPA has the responsibilities to prepare detailed

work plan for international cooperation and to develop and implement relevant policies and regulations. It is tasked to: investigate, summarize and supervise data on the production, import, export, consumption, circulation, stockpiling, disposal, and impacts reported by all enterprises, sectors, and customs. It is also responsible for scrutiny and data verification; declaration of POPs projects, implementation organization, monitoring the declaration and implementation of the projects, assessment and acceptance of the projects, and to supervise and monitor the implementation of relevant policies and regulations. SEPA, as Executing Agency of the project, will implement this project in coordination with International Implementing Agency, UNDP.

- **State Development and Reform Commission** is a member to the department of State Council. It is the macro regulation and control department in charge of comprehensive research and formulation of policy for economic and social development, control of total volume balance, and provides guidance on the overall economic and institutional reforms. It puts forward objectives and policy for national economic and social development and optimization of major economic structure. It maps out and organizes the implementation of industrial and pricing policy; promotes strategic adjustment and upgrade of industrial structure; planning of industrial sectors; and guides development of industrial technical regulations and standards. It has recently issued Guiding Catalogue for the Adjustment of Industrial Structure (2005 version) that incorporates DDT based antifouling paint into the list of outdated technologies for phase out, and will urge relevant departments to carry out the implementation.
- **General Administration of Quality Supervision, Inspection and Quarantine** is an administrative and executive agency directly under State Council in charge of quality inspection, econometrics, import and export commodity inspection, and hygiene quarantine and promotion of quarantine of import and export and standardization. It will supervise and inspect the quality of antifouling paint in accordance with the General Specification for Antifouling Paint on Ship Bottom (GB/T 6822-1986) which is to be revised during the implementation of this project.
- **National Certification and Accreditation Administration** is the administrative agency entrusted by State Council to comprehensively manage, supervise and coordinate the certification and accreditation at national level. It is responsible for establishing the catalogue of products for national compulsory certification and safety and quality permitting, designing and issuing certification labels, and assessment of the certification procedures and technical rules. It also organizes and implements compulsory certification, safety and quality permission. It will be requested by this project to provide supervision and guidance on the establishment and implementation of a voluntary certification and labeling program for antifouling paint products.
- **National Standardization Technical Committee** is an operational unit under General Administration of Quality Supervision, Inspection and Quarantine, and is authorized by State Council to comprehensively manage the standardization at the national level. It is responsible for organizing the establishment and revision of national standards, coordinating and administering the operations of all the technical committees for national standardization, and publicizing, implementing and promoting national standards. General Specification for Antifouling Paint on Ship Bottom (GB/T 6822-1986) is part of Chinese Technical Committees of Standardization of Paint and Pigments (SAC/TC5). It will incorporate environmental indicators into the Specification.
- **State Administration of Work Safety** is directly under State Council and is in charge of overall supervision and management of work safety. It is responsible for the supervision and management of safe production of hazardous chemicals, organization and coordination of investigation and treatment of major accidents, and organization of supervision and inspection of national work safety, occupational sanitation of work places. All the entities producing,

distributing and using DDT as a hazardous chemical will be supervised and administered by State Administration of Work Safety.

- **Fishery Management Bureau of Ministry of Agriculture** is responsible for protection and prudent exploitation of fish resources, organization of ocean going fishing development, fishing telecommunication development, protection of aquatic fishing ecology and wildlife, formulation of codes and technical standards for construction of fishing boats, machines and mesh nets. It is also responsible for fishing boat inspection, fishery management, and fishing port superintendence. The National Bureau of Fishery Management and Fishing Port Superintendence and Fishery Management Bureau of Ministry of Agriculture, are two agencies pooling one group of staff. The former is in charge of administrative affairs and the latter is in charge of technical operations. National Bureau of Fishery Management and Fishing Port Superintendence established 3 Sub-Bureaus in North Sea, East Sea and South Sea, which are directly under the administration of the National Bureau and are responsible for provision of technical guidance to the local bureaus of fishery management and fishing port superintendence. In coordination with the National Bureau of Fishery Management and Fishing Port Superintendence, this project will establish 3 project management offices resident in the 3 sub-bureaus.
- **National Fishing Boat Inspection Bureau** is directly under Ministry of Agriculture and is in charge of inspection, survey, supervision and administration of fishing boats. It implements the laws, regulations and international treaties related to fishing boat inspection. It is entrusted by the Ministry of Agriculture to; drafts laws and regulations for fishing boat inspection and fee standards for inspection of fishing boats and products used on fishing boats, draft laws, formulate technical codes, procedures, certificate formats, and guidelines for fishing boat inspection and survey, and supervise their implementation. In this project, it will be involved in revising or establishing regulations for management of antifouling paints used on fishing boats, and organize the relevant agencies to supervise the implementation of the regulations.
- **China Maritime Bureau of Ministry of Communication** is responsible for maritime safety supervision, prevention of ship pollution, inspection of ships and marine structures, safeguarding of navigation, and implementation of regulations, technical codes and standards for work safety in maritime communication and transportation. In this project, it will be involved to conduct research on the impacts to shipping sector for China to accede to the IMO Convention and finish related procedures for China to accede to the IMO Convention. It will also strengthen its legislation enforcement capacity for improved supervision and administration of antifouling systems on ships in shipping sector.
- **State Oceanic Administration** is the administrative agency in charge of protection, investigation, survey, monitoring, evaluation and scientific research of marine environment. It will be involved in this project to conduct monitoring of DDT in marine environmental media to provide data for project monitoring and evaluation.
- **China Classification Society** is an operational unit directly under the Ministry of Communication in charge of survey and inspection of ship technologies. It operates under the law of enterprise. It is the only professional agency in China to undertake survey and inspection of ship class entry. It will formulate Rules for Inspection of Antifouling Paint Products in accordance with the regulations issued by the Maritime Safety Administration of the Ministry of Communication on antifouling paint products used by ships in transportation sector, and test, certify and accredit antifouling paints that can be used on its governed ships.
- **Consulting service providers and Government Research institutes** from the fields of biocide and antifouling paints will be involved through an open bidding process, to conduct joint applied research based on the technical results achieved. Existing substitute technologies will be assessed in terms of their technical feasibility, social acceptability, economic viability, and environmental soundness. Those meeting these criteria will be selected for commercialization to be supported by this project.

- **Manufacturers** of raw materials and antifouling paints will be involved through an open bidding process to present their technical competence, managerial experience, production and product promotion plans. Five manufacturers will be selected and provided with the substitute technologies to produce and promote the alternative antifouling paints. It is important to note that manufacturers including those for raw materials and antifouling paints should be treated separately.
- **Dealers** will be provided with incentives for mass sales.
- **Non-governmental organizations (NGOs)** in higher institutions and the civil society will be mobilized to launch awareness promotion campaigns and deliver training to the communities.
- **Media** including TV, radio, Internet, journal, newspaper, magazine, CD-ROM and other publications to publicize antifouling paint and marine environment protection will be used.
- **End users/fishermen** will be offered the awareness promotion training so that they can realize the hazards of DDT based antifouling paint and the benefits of the alternatives. Subsidy/incentive will be provided to them at the beginning the use of the alternatives to promote and cultivate culture of adoption of alternatives.
- **The public**. A striking feature of this project is the most extensive involvement of the public. Various approaches of education will be adopted to raise their awareness on marine environmental protection and protection of their own human health. The harms of DDT or other toxic, persistent biocides based antifouling paint are not yet sufficiently realized by the public. It is necessary to launch education activities to alarm the whole society and attract concern about the harms of DDT or other toxic, persistent biocides based antifouling paint.

PART V : Results of PDF B Activities

a) Identification of fouling organisms in the coastal waters of China

There are more than 2,000 species of marine fouling organisms, most of which are found in seas, coastal waters, and bays. 614 species have been reported in Chinas' coastal waters. The most dominant species found are: algae, polypus, Ectoprocta, serpulidae bivalve, barnacle and crustacea etc. The dominant species tend to vary from coast to coast (Table 3).

Table 3: Predominant Fouling Organism of 4 Coastal Waters in China

Sea	Predominance fouling organism	Familiar fouling organism
Bohai Sea	Tricellaria occidentalis, Schizoporella unicornis, Oyster, Ostrea echinata, Chthamalinlae, Molgulidae, Hydrozoa	Filellum serratum, Acan-thodesia serrata, Gammaridae, Enteromorpha lingulata, Balanus uliginosus Utinomi, Acan-thodesia serrata
Huanghai Sea	Phormidium thermophilum Sjuja, Ulotrlchales, Balanus Amphitrite, Bugula californica Robertson, Mytilus edulis, Styela clava, Hydroides fusca Imajima, Chthamalinlae	Tubularia marina Torrey, Obelia, Enteromorpha lingulata, Gammaridae, serpulidae, Molgulidae, B.schlosseri, Cryptosulapalla siana, Spirorbidae
East sea	Megabalanus Hoek, Balanus uliginosus Utinomi, Enteromorpha lingulata, Bacillariophyta, A.pacifica Uchida, Balanus uliginosus Utinomi, Tubularia mesembryanthemum, Cordylophora lacustris, Limnoperna fortunei	Phialidium, Tricellaria, Hydroides fusca Imajima, Membraniporidae, Ulva linza, Enteromorpha coziana P.Dange, Gammaridae

South sea	Balanus uliginosus Utinomi, Balanus reticulatus Utinomi, Hydroides prisca Pillai, Hydroides longispinosa Imajima, Bugula neritina, Enteromorpha lingulata, Eudendrium rameum, Electridae	A.pacifica Uchida, Membraniporidae, Styela clava, Perna uiridis, Oyster, Obelia, Saxicava

b) PDF B Survey

Survey was conducted during PDF-B stage. Of the 34 questionnaires distributed, 24 were returned with a return ratio of 70.6%. 15 enterprises of the 24 are DDT based antifouling paint manufacturers. There were still 4 DDT based antifouling paint manufacturers that have not returned their data due to their misunderstanding of the survey purpose. Table 4 provides the DDT based antifouling paint production information of the 15 enterprises in year 2005. The information of other years is not well recorded at the surveyed enterprises, but is supposed to be very close to that of year 2005 as antifouling coating on fishing ships is quite a routine practice from year to year.

Table 4: Production of DDT based antifouling paint in China in 2005

No.	Enterprise	DDT based antifouling paint produced (MT)	DDT used (MT)
1	Guangzhou Tianlang Coating Co. Ltd	220	11
2	Guangzhou Zhujiang Chemical Industry Group Co. Ltd	120	4.45
3	Haifeng Guanghua Coating Manufacturing Corporation	240	3.6
4	Guangxi Wuzhou Longyu Coating Manufacturing Company	160	2.4
5	Guangxi Beihai Coating Manufacturing Company	180	9
6	Fuzhou Liheng Chemical Industry Co. Ltd	119	4.92
7	Fuan Hongsheng Coating Industry Co. Ltd.	100	0.1
8	Fujian Longhai Ship Coating Corporation	100	5.1
9	Zhangzhou Ruilong Chemical Industry Co. Ltd.	80	4
10	Wenling Aoerba Coating Industry Company	42	1.2
11	Wenlingfa Coating Manufacturing Company	700	35
12	Ningbo Feilun Coating Manufacturing Company	168	1.2
13	Shanghai Kailin Coating Manufacturing Company	1,800	100
14	Qingdai Institute of Marine Chemical Industry	800	30
15	Tianjin Dengta Coating Co. Ltd	Not available (NA)	NA
16	Foshan sanshuihuaying Coating Co. Ltd	NA	NA
17	Changzhou Fengjin Coating Co. Ltd	NA	NA
18	Jinzhou Haize Coating Co. Ltd.	NA	NA
19	Ningbo Haiwei Coating Co. Ltd.	NA	NA
Total		**4,830**	**212.02**

It can be seen that the 15 manufacturers produce 4,830 MT DDT based antifouling paints using 212.02 MT DDT per year. It can be extrapolated that the total amount of DDT based antifouling paint in China is around 5,000 MT consuming 250 MT DDT per year in its production.

c) Analysis of DDT threat areas

DDT based antifouling paint will cause environmental impacts in different stages of its life cycle:

- Production and storage of DDT. DDT is a hazardous chemical that has been produced for more than 60 years. DDT is produced by using the raw materials chlorobenzene, chloral and oil of vitriol through synthesization, distillation and crystallization, and is then packed, stored, and distributed to dealers or users. The waste acid containing DDT and other reactive compounds will be counteracted by high temperature and then supplied to phosphate fertilizer plant for further processing. Chlorbenzene and chloral are also environmental chemical toxicants. DDT production will cause serious pollution to the adjacent environment. For instance, DDT in soil of 4 km^2 around Tianjin Chemical Plant which produces bulk DDT in China is detected to exceed Class III of environmental soil standards 1mg/kg, which is not suitable for normal agricultural or forest plantation and growth. China has another chemical plant in production of DDT.
- Production of DDT based antifouling paint. DDT based antifouling paint is produced by mixing and grinding matrix material, pigment, solvent, Cu_2O powder and DDT in high temperature in muller, and then sealed into bucket. During the normal production process, trace organic solvent and DDT will be emitted into the air but can be filtered by active carbon to prevent environmental pollution. There are 19 small and medium sized enterprises along the coastal provinces producing DDT based antifouling paint with only simple and crude equipment. Leakage of DDT from loose production and distribution in these enterprises can cause considerable environmental impacts.
- Coating of DDT based antifouling paint. During the coating in shipyards by professional staff or by fishermen themselves, DDT antifouling paint will be spilled into water and soil. Trace DDT will also be evaporated into air with organic solvent during the preparation, coating, and drying of the paint.
- In-sea navigation. Biocides are released into sea water slowly during the navigation of ships, and deposited into sediments, sea microorganisms and other animals and plants. The paint layer may be flaked off into the sea in case of mechanical collision or poor coating quality.
- Dockyard anchor and maintenance. After the end of the fishing season or due to the damage of the ships, DDT will continue to leach out into sea during the dockyard maintenance. The removed old paint waste containing DDT will be mixed with domestic or industrial wastes without special separation treatment, and transported for collected landfilling treatment, which will cause risks of contamination of the local soil, underground water and surface water.

d) Regulations and standards

Table 5 below lists the regulations and standards related to DDT based antifouling paint. The gaps of the existing legal system towards sound management of DDT based antifouling paint are identified and analyzed:

Table 5: Regulations and standards related to production, distribution and use of DDT-based antifouling paint

No.	Regulations and standards	Promulgating agency	Implementing agency	Time into effect	Jurisdiction
1	Regulations on the Safety Administration of Hazardous Chemicals	State Council	State Administration of Work Safety	March, 2002	Entities producing, operating, using, importing, and exporting hazardous chemicals

2	Measures for the Administration of Operating Licenses for Hazardous Chemicals	Former State Economic & Trade Commission	State Administration of Work Safety	November 2002	Entities distributing hazardous chemicals
3	Measures for the Administration of Registration of Hazardous Chemicals	Former State Economic & Trade Commission	State Administration of Work Safety	November 2002	Entities producing, storing, and using hazardous chemicals
4	Guiding Catalogue for the Adjustment of Industrial Structure (2005 version)	National Development and Reform Commission	National departments related	December 2005	DDT based antifouling paint manufacturers
5	Labor protection rule at Work Place Using Hazardous	State Council	Ministry of Healthy	December 1996	Work place where use of toxic substances may cause occupational poison
6	Measure on the Administration of Manufacturing Licenses of Industrial Products	General Administration of Quality Supervision, Inspection and Quarantine	General Administration of Quality Supervision Inspection and Quarantine	Sep 1st , 2005	Manufacturers of industrial products
7	General Specification for Antifouling Paint on Ship Bottom (GB/T 6822-1986)	National Standardization Technical Committee	General Administration of Quality Supervision Inspection and Quarantine	August 1st, 1987	Ship antifouling paint manufacturers
8	Regulation on Survey & Inspection of Ships and Marine Structures	State Council	China Maritime Bureau	February 4, 1993	All the ships registered in China
9	Regulation on Certificate Holding and Verification of Ship Products	China Classification Society	China Classification Society		Ship products used in fishing vessels certified by China Classification Society
10	Rules of Marine Products Inspection	China Classification Society	China Classification Society		Ship products used in fishing vessels certified by China Classification Society
11	Regulations of Inspection and Certification of antifouling system	China Classification Society	China Classification Society	April 3rd, 2003	International navigating ships with volume of 400 tonnages and above
12	Regulations of the People's Republic of China on Fishing Vessel Inspection	State Council	Fishing Boat Inspection Bureau	August 1st, 2003	Fishing ships registered in China
13	Rules of Marine Products Inspection	Fishing Boat Inspection Bureau	Fishing Boat Inspection Bureau		Products used in fishing ships registered in China

e) Selection Criteria for Alternative Technologies

A workshop on selection of alternative antifouling paints was held on 15-16 February 2006, attended by more than 30 representatives from the central government, China Coating Association, research institutes, manufacturers and UNDP. The workshop reviewed the history, status and discussed the future of antifouling technologies. Criteria for selection of alternatives were also defined as follows:

a) Technical aspect

- Can meet the requirements of the existing technical standards;
- Have a service life of 1 year for wooden ships and 1 or 3 years for steel ships;
- Can meet the different antifouling requirements in different sea areas (North Sea, East Sea, and South Sea);
- Satisfactory results have ever been achieved from previous on-ship experiment.
- Alternatives with service life of 1 year and 3 years should have a fouling rate <10% after on-ship experiment for half a year and 2 years respectively; and
- The alternatives should achieve a customers' satisfaction degree of at least 70%.

b) Environmental aspect

- DDT and TBT free;
- Organic biocides contained should be assessed and certified to be environmentally friendly by international organizations such as IMO;
- Content of copper should be reduced to a minimum; and
- Content of other heavy metals should not exceed the levels of relevant international, national standards.

c) Economic aspect

- A reasonably higher cost compared with DDT based antifouling paint, will be allowed if its acceptance in the market by users can be successfully achieved through advertising the new features of the alternatives,; and
- Degree of commercialization: large scale production can be realized within 1 year and financial sustainability can be achieved within 3 years under the support of the project.

d) Intellectual property right

- No violation of intellectual property right or patent right will be involved in introducing and transferring alternatives from outside.

f) Candidate Alternative Technologies

Antifouling technologies can be categorized into three classes by their degree of technical maturity: mature technologies, less mature technologies, and prospective technologies. In the early stage, lime or bitumen was used for antifouling purpose. Later, As, Hg compounds or DDT were added into antifouling paints as antifoulants to be released to form a toxic layer over the structure. In 1960s with the development of chemical industry, a type of high efficiency and low price metal compound organotin (mainly TBT) appeared and gained wide application in antifouling systems on ships. In 1970s, most of the ocean going ships used TBT based antifouling paint.

Copper compounds and organic booster biocides blended in self-polishing copolymers have been used as tin-free antifouling paints since regulation prohibiting the use of organotin antifouling paints was enforced at the end of 1980s by some countries. Usually, Irgarol 1501 and Diuron have been the most commonly used as an organic booster biocide because they are the most cost-effective. However, these

antifoulants and their degradation products are more stable than the other biocides; therefore, such antifoulants have the potential to cause environmental problems due to increasing concentrations. High concentrations have been found in many marinas. Therefore, safer and better organic booster biocides should be selected as soon as possible before new serious environmental problems are found. The better organic booster biocides are required to have higher biocidal activities, shorter half-life in seawater, and higher cost-effective than those of Irgarol 1051 and Diuron, and above all, their degradation products should be environmentally safe.

Sea Nine 211 developed by Rohm & Haas Inc. is such a safer and better organic booster biocide that can be incorporated into the antifouling paint. Sea Nine 211 contains isothiazolinone as the biocide which can break the albuminoid bonds of bacteria and algae and rapidly restrain the growth of microorganisms after it has contact with microorganisms. It can also penetrate the biological film of the fouling organisms adhered to ship hull and peel off the fouling organisms. It has high antifouling efficiency even with a very low content. Experiments show that only an isothiazolinone concentration of 60ppm can restrain bacteria from growing. It has a good solubility compatible with paint and resin latex. It can be easily degraded into non-toxic acetic acid after it comes into the environment. It is expected that more biocide with similar features like Sea Nine 211 will be identified.

Antifouling paints are developing towards non-toxic and environmental friendly direction. Biocide free antifouling technologies such as electrical macromolecule film, fluorine carbon resin coating, organic silicon resin, and bionic antifouling paint are being actively developed and tested. There is a good prospect on the application of these technologies, but they will need a long time to be commercialized in the marketplace.

Based on extensive literature review and field surveys during the PDF-B phase, Table 6 lists most of the existing technologies and their key characteristics. By applying the defined selection criteria, substitution technologies to be adopted in this project will in principle be those alternatives whose environmental performance is acceptable, and technological maturity can be well promoted in the first year of implementation, to reach the requirement of scale production. Price will also be reduced through technological improvements to a level that will induce to full commercialization during the remaining 3 years of the project..

Table 6: Overview of antifouling technologies and their key characteristics

Antifouling technologies	Technological Maturity	Demonstrated Effectiveness	Service Life	Environmental Performance	Price
Metals and their compounds (Cu, As, or Hg, TBT), DDT, rosin, or bitumen	Mature	Effective	1 year	Toxic	Low
TBT-free, Cu, Cu alloy or compounds, booster organic biocide, and rosin mixed antifouling paint	Mature	Effective	1 year	From low toxicity to toxic dependant on the booster biocide selected	High
TBT based crylic acid ester or copolymer self-polishing antifouling paint	Mature	Effective	3-5 years	Toxic	Medium to high

TBT-free, Cu, Cu alloy or compounds, booster organic biocide crylic acid ester or copolymer self-polishing antifouling paint	Mature	Effective	3-5 years	From low toxicity to toxic dependant on the booster biocide selected	High
Alkali silicate antifouling paint	Less mature	Effective only in North and East Seas	1 year	Non-toxic or low toxicity	Low
Natural repellant based antifouling paint	Less mature	Effective	1-3 years	Non-toxic or low toxicity	High
Electric macromolecular film antifouling	Prospective	Effective		Non-toxic	High
Fluorine carbon rosin coating	Prospective	Effective		Non-toxic	High
Non-sticky organic silicone resin	Prospective	Effective with artificial cleaning		Non-toxic	High
Bionic coating	Prospective	Ineffective		Non-toxic	High

As a result, 3 alternative technologies have so far been preliminarily selected for consideration during the project implementation. It is anticipated that during project implementation, some other alternative technologies that can better match the selection criteria will also be considered and promoted to ensure that the best suitable and sustainable technologies will be adopted.

a) Use other organic booster biocides that are accredited by international authorities to replace DDT/TBT based antifouling paint. The technology is mature while the environmental performance is largely dependant on the organic booster biocides selected. Environmental authorities of some developed countries have approved a list of organic booster biocides for use in production of antifouling paints. However, environmental performance and antifouling performance of these biocides also vary from one to another. The price of these biocides is higher than that of DDT based antifouling paint from 4 to 29 times, rendering the price of these biocides based antifouling paints 2-4 times higher than that of DDT based antifouling paint. The key to apply this antifouling system is to select those biocides similar to Sea Nine 211 that is environmentally friendly and can have high efficiency with even a low content. The high price of the products in using this technology is the required import of the biocides. Domestic production of these biocides by introducing the foreign technologies can greatly reduce the cost and price. During the first year of the project implementation, antifouling paint manufacturers using these biocides will participate in the unified on-ship patch test so that the desired biocides based antifouling paint products will be identified for adoption in this project.

b) Capsaicine or capsainoids is used as repellant to replace DDT. This technology has been sufficiently demonstrated as effective in laboratory and on ships. Capsaicine or capsainoids has strong repelling effect, but it does not kill sea organisms. Thus, it has sound ecological benefits. Capsaicine or capsainoids based antifouling paint has been tested on ships in many cases, and the effect has been proven to be acceptable. The key problem with this less mature technology is the prohibitively high cost associated with the extraction of capsaicine or capsainoids from natural crop that prevents its commercialization. The current price of naturally extracted capsaicine or capsainoids is 30,000 to 40,000 RMB per kg. The key to apply this antifouling system is to chemically synthesize the Capsaicine or capsainoids by artificial means and reduce the raw material cost. PDF-B phase survey has found that quite a few research institutes, both in China and abroad, have successfully developed

the chemical synthesis of capsaicine of high purity in laboratory. The price can be reduced to only 500 RMB per kg. in scale production. Shanghai Kailin Coating Manufacturing Company incorporated the synthesized capsaicine into antifouling paint as the antifouling agent, and the test effects from board experiments show an even better efficiency than antifouling paint based on capsaicine extracted from natural hot red pepper. It can be safely foreseen that chemically synthesized capsaicine based antifouling paint will also have a better efficiency than the natural product based antifouling paint. During the first year of project implementation, necessary technical and financial support will be provided to producers to apply this technology from laboratory experiment to scale production in the factory.

c) Alkali silicate antifouling paint. Fouling sea organisms generally grow best in slightly alkali environment with pH between 7.5 and 8.0. Neither a too alkali nor acidic environment can be fit for their growth. Alkali silicate is used as film formulation substance in antifouling paint, which can be cheap and non-toxic. The on-ship experiment showed that the effect is acceptable in other sea areas except in South Sea. But this antifouling system has poor physiochemical property and has only a short working life of not more than one and a half year. The key to apply this antifouling system is to improve the physiochemical property by adding proper amounts of regulator agent, booster agent, and hydrolysable crylic acid rosin into the matrix. It was found during the PDF-B phase that a number of research institutes in China have successfully overcome these weaknesses, but the improved product has not been produced in a meaningful scale to replace the lower end antifouling paint products due to the barriers of conventional choice and use of DDT or TBT based antifouling paints among the fishermen. During the first year of project implementation, this technology will be supported to reach scale production. This technology does not foresee a significant economic barrier to commercialization. It is particularly suitable for use by fishing boats with only one year interval of activity in North Sea and East Sea.

Table 7 provides the price comparison for the three antifouling paints in this project

Table 7: Prices Comparison of the three types of antifouling paints

Type of antifouling paint		Working life (month)	Price (RMB/kg)
DDT based		<=12	15-18
		<=36	22-32
DDT replaced by other biocides	Sea Nine 212	<=36	45-55
	Irgarol 1052	<=36	50-60
	TCPM	<=12	40-48
		<=36	44-52
	Zineb	<=36	35-40
	Zinc Omadine	<=36	35-40
	TBT	<=36	30-35
	CS	<=12	18-22
		<=36	35-40
DDT replaced by pepper repellant	Capsaicine or capsainoids extracted from natural product	<=12	87-93
		<=36	122-140
	Capsaicine or capsainoids chemically synthesized	<=12	20-25
		<=36	35-40
DDT replaced by silicate		<=12	15-20

Note: UN exchange rate as of April 20006: RMB 8.01 = US$1

g) Cost-effectiveness

The use of DDT based antifouling paint will render costs in the following aspects:

- The fishermen will pay 75 million RMB for 5,000 MT DDT based antifouling paint per annum by assuming a conservative unit price of 15 RMB per kg.
- Economic loss of aquatic product export will be incurred by the excessive DDT contents. The increase rate of aquatic product export in 2005 was reduced by 14% as compared with that in 2004, mainly due to the over residual of pesticides. While it is hard to quantitatively determine the impacts of DDT usage in antifouling paint to the aquatic product quality, it should be a significant factor due to direct release of DDT into coastal waters and accumulation in aquatic products.
- The long-term exposed groups under DDT will pay for health treatment. For instance, Tianjin Chemical Plant will provide the DDT production staff with 1 month health leave with pay. Due to the special damages such as disruption of reproductive, neural and endocrine systems DDT can cause to people under long-term and accumulative exposure, in no way the cost of medical care can be over estimated.
- Long-term accumulative contamination of soil and water during production and use of DDT and DDT based antifouling paint will also cause damages to the sensitive species, and even trigger species extinction. The cost of species extinction and rehabilitation of damaged ecosystem will be too huge to calculate.

The implementation of this project will of course continue to make the fishermen ever using DDT based antifouling paint pay 75 million RMB or even slightly higher amount for alternatives, but will also generate the benefits in the following aspects:

- Reduce the economic loss of aquatic product export related with DDT usage in antifouling paint,
- Reduce or eliminate the cost for health treatment of DDT exposed groups, and
- Reduce the cost for cleaning of contaminated environment and rehabilitation of damaged ecosystems,

In addition, considerable economic and social benefits can be generated from the promotion of technically feasible, economically acceptable, and environmentally friendly alternatives. As the prospective objective will address TBT based antifouling paint through establishment of a long-term mechanism, the financial sustainability of the alternatives industry will be further guaranteed by the expanded market. The market can be further expanded by exporting competitive alternatives to the neighboring coastal countries.

Based on the local benefits, the phase out of DDT based antifouling paint will reduce the total volume of DDT that will spread to each corner of the global environment and cause damage to the health human beings in other regions and the biosphere.

It is clear that the cost-effectiveness of this project should not be simply calculated by the unit phase out cost of DDT per kg due to the nature of the domestic and global benefits intrinsically not easy to calculate. In summary, the project implementation will achieve a high cost-effectiveness even though it is not easily quantified.

SIGNATURE PAGE

[Note : leave blank until preparing for submission for CEO endorsement]

Country: _____

UNDAF Outcome(s)/Indicator(s):

_____

(Link to UNDAF outcome., If no UNDAF, leave blank)

Expected Outcome(s)/Indicator (s):

_____

(CP outcomes linked t the SRF/MYFF goal and service line)

_____

Expected Output(s)/Indicator(s):

_____

(CP outcomes linked t the SRF/MYFF goal and service line)

_____

Implementing partner: _____
(designated institution/Executing agency)

Other Partners: _____

_____

Programme Period:	2006-2009
Programme Component:	Energy and Environment for Sustainable Development
Project Title:	Alternatives to DDT Usage in the Production of Antifouling Paint
Project ID: _____	
PIMS Number:	3664
Project Duration:	48 months
Management Arrangement:	National Execution

Total budget:
Allocated resources: _____

- Government
- Regular _____
- Other:
  - Donor _____
  - Donor _____
  - Donor _____
- In kind contributions _____

Agreed by (Government): _____
Agreed by (Implementing partner/Executing agency):_____
Agreed by (UNDP):_____