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Sanitation Policies and Regulatory Frameworks for Reuse of Nutrients in Wastewater and Human Excreta

National Legislation and National Targets in Relation to Local Implementation

中国生态卫生节点 (CNSS)

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11th *five-year plan* for national economic and social development

Article 6 The compilation of the plan for a city shall be based on the plan for national economic and social development as well as the natural environment, resources, historical conditions and present characteristics of the city. The plan shall be a comprehensive one which gives balanced consideration to all factors.

Furthermore, Outline of the Eleventh Five-year Plan (2006-2010) on National Economic and Social Development of the PRC requires that scientific development shall be fulfilled.

National Targets

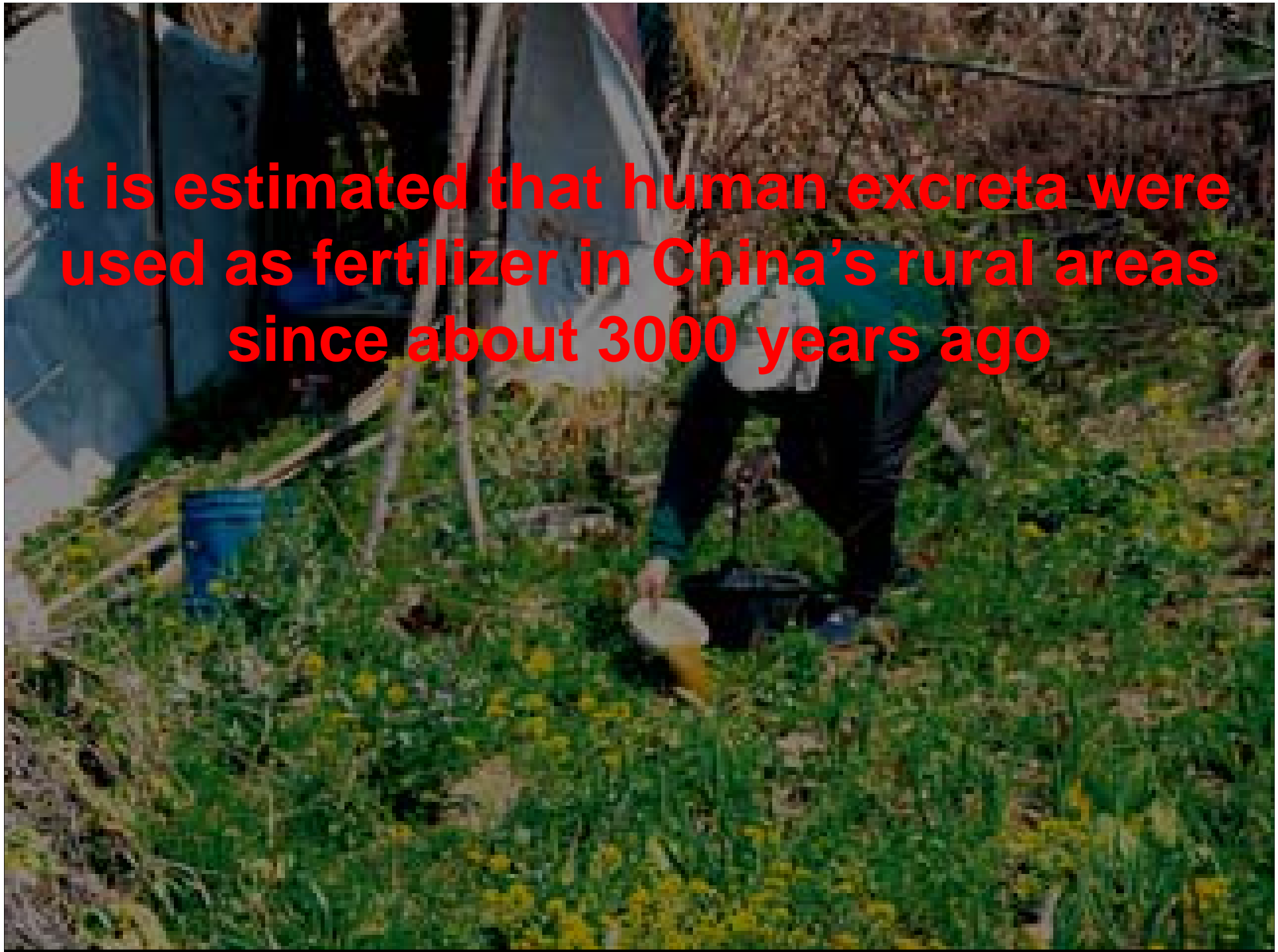
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11th five-year plan of Environmental Protection of China

Scientific outlook on development (circular economy and performance assessment systems for government leaders), building a well-off and harmonious society (people oriented and “five coordination”), advanced environmental awareness and public participation.

“five coordination”: urban and rural development, regional development, economic and social development, **harmony between man and nature**, and domestic development and opening to the outside world (统筹城乡发展、统筹区域发展、统筹经济社会发展、统筹人与自然和谐发展、统筹国内发展与对外开放).

It is estimated that human excreta were used as fertilizer in China's rural areas since about 3000 years ago



Main methods:

- (1) After fermentation for some period in septic tanks, human excreta could be used as base fertilizer or additional fertilizer for crops and fruit trees;
- 2) After fermentation with crop straws, the mixture would be composted, then used as base fertilizer;
- (3) Human excreta could be used for as feed for fish production in ponds.



Transport methods of human and animal excreta as fertilizer

Challenge of Human Excreta Utilization in China

- In the period 1960s to 1970s, human excreta use as fertilizer was very popular. 12 million hectares were fertilized by so-called green fertilizer in the mid of the 1970s;
- With the fast development of industrial fertilizer production in the 1980s, the applied amount of chemical fertilizer already surpassed the amount of green fertilizer;
- At the end of the 1990s, only 35% of fertilizer were green fertilizer, and less than 30% were based on from human excreta.

China is one of the largest producer of phosphate rock and consumes currently more phosphate fertilizer than any other country in the world.

Challenge of Human Excreta Utilization in China

Hygienic problem:

Due to the use of one chamber-septic tanks, fresh and fermented feces could not be separated, thus creating dangerous conditions for health (risk of disease transmission). According to a survey in 1980, incidence of diseases caused by pathogenes like ascaris, hookworm and whipworm were 94%、 65%、 93% respectively in rural areas. This was related to the improper treatment and use of feces, which could not meet the requirement of hygienisation (*Bian YS, 2000*)

Challenge of Human Excreta Utilization in China

Urbanization:

With the fast development of urbanization in China, populations are increasing, urban areas are becoming larger and larger, - and the use of feces and urine is becoming difficult in these urban areas.

Also the process steps between production and utilization are becoming more and more complicated.

Standards of Human Excreta Utilization in China

Application Method of Feces as Fertilizer :

In China feces application is done manually; it is a labor intensive work, and hygienic conditions are not always good.



Standards of Human Excreta Utilization in China --- National Standards

- Sanitary standard for the non- hazardous treatment of night soil (GB7959-87)
- Organic Fertilizer Standards (NY525-2002) 有机肥料标准
- Control standards for urban wastes for agricultural use (GB8172-87) 城镇垃圾农用控制标准

Standards of Human Excreta Utilization in China --- Local Standards

- Quality and safety requirements for organic liquid fertilizer and organic-inorganic compound liquid fertilizer (DB33-Zhejiang Province)

Relevant standards of Human Excreta Utilization in China – Water and Wastewater

- GB6952-2005 - The National Standard for Sanitary Devices defines maximum flush volumes for new toilet facilities: 6 litres per flush for sitting toilets and 8 litres per flush for squatting pans.
- GB 3838-2002 The surface water quality standard classifies surface water into 5 quality categories; e.g. Kjeldahl Nitrogen in mg l⁻¹:

I-II 0.5, III 1.0, IV 1.5, V 2.0.

(Class V is mainly applicable to water bodies for agricultural use and landscape requirements.)

Relevant standards of Human Excreta Utilization in China

GB 18918-2002 - Standard for Pollutant Discharge of Sewage Treatment Plants in Cities and Towns. Grade I Standard A and B limit total nitrogen in effluent from waste water treatment plants to 15 and 20 mg l⁻¹ respectively.

GB/T18920-2002 - Quality Standard of Reused Water as Landscape Water Body: regulates e.g. the total nitrogen level at <15mg l⁻¹ for scenic ponds and lakes.

Relevant standards of Human Excreta Utilization in China

- <Index of Eco-County, Eco-City and Eco-Province Construction> revised in 2007, by State Environmental Protection Agency

Chance of human excreta utilization in China

- In China, there is a great demand for organic fertilizers.
- Especially the producers of fruits for the export are in the need to fulfill ecological-label requirements.
- This demand has led to a recent rapid increase in the number of organic fertilizer companies.
- The government is supporting this trend with start-up subsidies, in an attempt to solve the pollution problem caused by animal wastes.

Statistics of water sources used for crop irrigation in Sichuan Province

Water source	Percentage of use
Tap water	0
Effluent from wastewater treatment plants (mainly DEWATS)	5
Well	5
Lake	9
River	58
Rain	23
Total	100

Current situation in CHINA

2008 joint monitoring report by the United Nations International Children's Fund (UNICEF) and World Health Organization (WHO), "Progress on Drinking Water and Sanitation: Special Focus on Sanitation," estimated that the proportion of the population **obtaining safe drinking water** increased from 67 percent in 1990 to 88 percent in 2006.

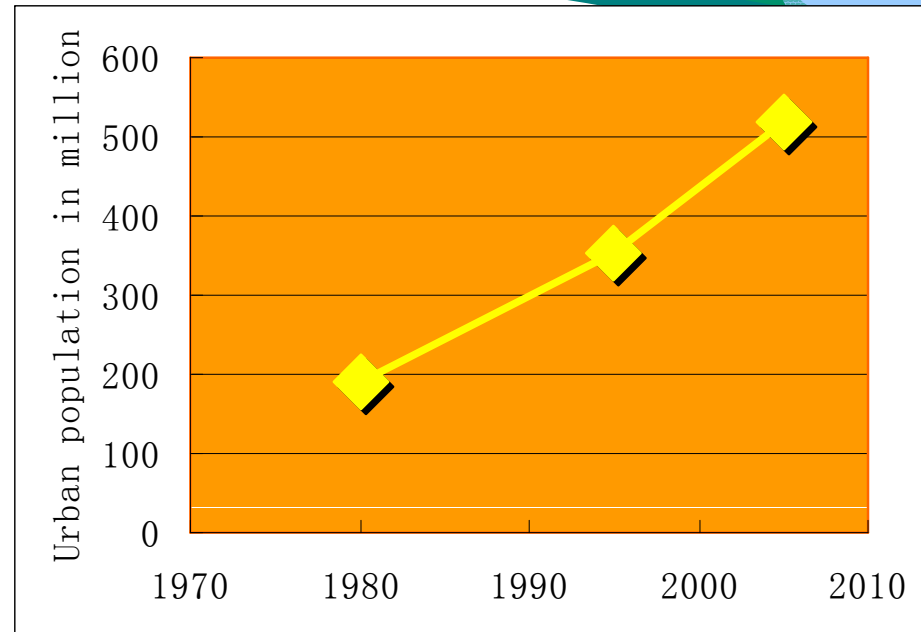
2006 "Harmless" sanitation: 32%

2008 Rural sanitation coverage: 59%;

Urban Sanitation coverage: 74%, but mainly centralized sewer systems, which hinder the nutrient reuse.

Urbanization in China

Annually **17 million** people are urbanized by upgrading their settlement area.



Year	1980	1995	2005
Urbanisation grade	19.39%	28.85%	ca. 40 %
Urbanised population	191 mio.	352 mio.	ca. 520 mio.
Cities	223 cities	640 cities	ca.662

Urbanization in China

With fast urbanization progress, the source-reuse oriented systems are urgently needed in order to reduce the natural source exploitation and realize sustainable development.

Some demonstration projects are being done with or without international technical and financial supports.

SANITATION

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❖ Examples for school toilets in China



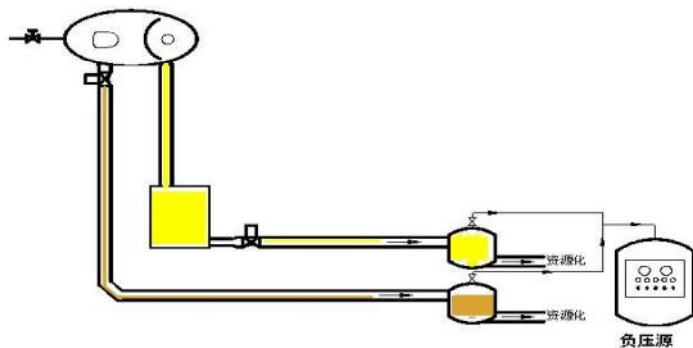
**The world's biggest settlement
(832 apartments, about 1700 people)
with Urine Diversion Dry Toilets installed**



Erdos, Innermongolia

Information: Dongsheng Municipality

Source Separation and Resource Saving systems in densely populated urban areas



Vacuum centre
Environmental Building
Tsinghua University, Beijing

Large scale urine collection and nutrient re-use

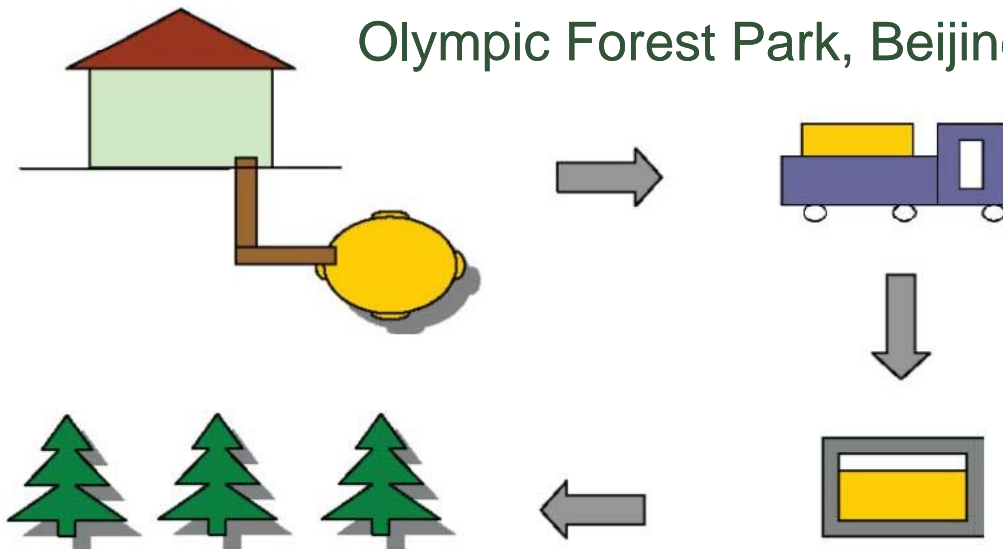
Over 5 million visitors per year

Economic considerations

To guarantee environmentally sound and hygienically safe management of the collected materials



Olympic Forest Park, Beijing - in total 700 ha



20t N, 3t P, 9t K contained in the estimated annual 4.400m³ of yellow-water and 1.400t of compost are to be recycled back into productive ecosystems

Different types of toilets in the OFP



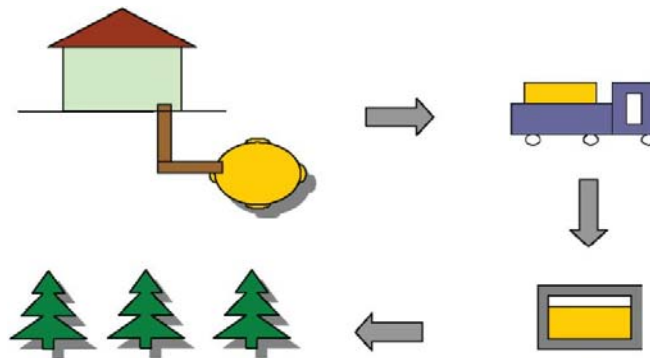
Urine-diverting flush toilets



Waterless urinal



Urine-diverting dry toilets



Conclusions

1. Reuse of Nutrients in Wastewater and Human Excreta is a very important strategy for sustainable development;
2. There are some relevant legislations and regulations in China, but it is not enough, especially in the aspects of promoting source-reuse oriented systems;
3. In order to increase the reuse of nutrients, more efforts need to be done in the aspects of technology research & development, raising public awareness, making decision-makers be involved in the relevant projects;
4. China Node for Sustainable Sanitation works since December 2008 in these topics by networking and knowledge development.

**THANK YOU
VERY MUCH
FOR YOUR
ATTENTION!**

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Environmental Protection Laws in China

Constitution of the People's Republic of China [1982-12-04]

Criminal Law of the People's Republic of China [1979-07-01] [1997-03-14]

Environmental Protection Law of the People's Republic of China [1989-12-26]

Marine Environment Protection Law of the People's Republic of China
[1982-08-23] [1999-12-25]

Law of the People's Republic of China on Prevention and Control of Water Pollution
[1984-05-11] [1996-5-15]

Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution [1995-08-29] [2000-04-29]

Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste [1995-10-30]

Law of the People's Republic of China on Prevention and Control of Pollution From Environmental Noise [1996-10-29]

Forestry Law of the People's Republic of China [1984-09-20] [1998-04-29]

Grassland Law of the People's Republic of China [1985-06-18]

Fisheries Law of the People's Republic of China [1986-01-20]

Environmental Protection Laws in China

Fisheries Law of the People's Republic of China [1986-01-20]

Mineral Resources Law of the People's Republic of China [1986-03-19] [1996-08-29]

The Law of Land Administration of the people's Republic of China [1986-06-25]

[1988-12-29, 1998-08-29]

Water Law of the People's Republic of China [1988-01-21]

Law of the People's Republic of China on Water and Soil Conservation [1991-06-29]

Law of the People's Republic of China on the Protection of Wildlife [1988-11-08]

Law of the People's Republic of China on the Coal Industry [1996-08-29]

Construction Law of the People's Republic of China [1997-11-01]

Law of the People's Republic of China on Conserving Energy [1997-11-01]

Flood Control Law of the People's Republic of China [1997-08-29]

Law on the Exclusive Economic Zone and the Continental Shelf of the People's Republic of China [1998-06-26]

City Planning Law of the People's Republic of China [1989-12-26]

Law of the People's Republic of China on Township Enterprises [1996-10-29]

Foreign Trade Law of the People's Republic of China [1994-05-12]

Environmental Protection Laws in China

Highway law of the People's Republic of China [1997-07-03] [1999-10-31]

Standardization Law of the People's Republic of China [1988-12-29] [1989-04-01]

Law of the People's Republic of China on the Protection of Cultural Relics [1982-11-19]

Law of the People's Republic of China of Industrial Enterprises Owned by the Whole People [1988-04-13]

Agriculture Law of the People's Republic of China [1993-07-02]

Meteorology Law of the People's Republic of China [1999-10-31]

Electric Power Law of the People's Republic of China [1995-12-28]

Law of the People's Republic of China on the Territorial Sea and the Contiguous Zone [1992-02-25]

Law of the People's Republic of China on the Popularization of Agricultural Technology [1993-07-02]

Law of the People's Republic of China on Science and Technology Progress [1993-07-02]

Fire Control Law of the People's Republic of China [1998-04-29]

Environmental Protection Laws in China

Implementing Regulations of the Patent Law of the People's Republic of China

[1992-12-21]

Technology Contract Law of the People's Republic of China [1987-06-23]

Law of the People's Republic of China on Promoting the Transformation of Scientific and Technological Achievement [1999-10-01]

Education Law of the People's Republic of China [1995-03-18]

Vocational Education Law of the People's Republic of China [1995-03-18]

Compulsory Education Law of the People's Republic of China [1986-04-12]

Teachers Law of the People's Republic of China [1993-10-31]

Law of the People's Republic of China on State Compensation [1994-05-12]

Anti Unfair Competition Law of the People's Republic of China [1993-09-02]

Law of people's Republic of China on the Entry and Exit Animal and Plant Quarantine
[1991-10-30]

Land Administration Law of the People's Republic of China [1986-06-25] [1999-01-01]

Railway Law of the People's Republic of China [1990-09-07]

Law of the People's Republic of China on Protecting Against and Mitigating Earthquake Disasters [1997-12-29]

Law of the People's Republic of China on Desert Prevention and Transformation
[2002-01-01]