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The need to protect the environment against pollution appears on public agendas with growing frequency and vigour, in the Netherlands as well as elsewhere. The number of activities considered to be threatening or detrimental to the environment has increased since the 1960s and is still increasing. As a consequence, a shift can be observed in the domains, objectives and instruments of environmental policy, and along with that, a shift in success.

Originally, measures were taken especially to reduce industrial emissions in air and water that were considered to be detrimental. Later, the issue was redefined to include obnoxious noise, the poisoning of land and sea, etc. Moreover, attention was drawn to other polluters besides the traditional chemical industries. At present, even private households are included in the environmental legislation. For example, amateur photographers are encouraged to hand in their old batteries separate from the weekly waste bag.

Along with these shifts in domain and scope, the success rate of environmental policies began to fall. The more (potential) polluters were affected, the more they formed a diffuse set of organisations and persons. Big chemical industries are checked relatively easily; individuals demand extensive (and intensive) inspection. That is why the effectiveness and the implementation of the classic instruments of environmental policy came under fire. The question was raised whether a change in instruments would yield better results.

An answer to this question may be found by means of empirical research into the effects of the instruments. This article reports on such a research. It presents a cursory overview of the features of the field in which environmental policy operates and demonstrates the effectiveness of one of the policy instruments, which is often used, the permit. It then investigates whether the permit creates 'incentives' for potential polluters to reduce impermissible radiation. The thus estimated effectiveness of the permits is compared to that of other instruments.

I. Directives and Incentives

Up to now directives dominate the field of environmental policy. Especially by means of permits it has been tried to regulate emissions detrimental to the environment. However, using this type of policy instrument is not without its problems. Permits often do not work due to problems of implementation. E.g. issuing the proper permit often

lacks the necessary information about the specific circumstances of applicants and involves time-consuming procedures. One of the main conclusions proposed by some researchers -simplifying the formal procedures- was implemented in the Netherlands by the Environmental Protection (General Provisions) Act. This did not solve all problems of implementation (see e.g. Ministry of Housing, Physical Planning and Environment, 1985).

Based on empirical research, improvements in the existing set of directive instruments were proposed. Also alternative forms of regulation were considered and introduced. Already in 1974 a white paper was issued by the government at the time, in which they drew attention to the potential impact of incentives as a governmental tool for environmental protection (Nota Instrumenten Milieuhygiënisch Beleid, Tweede Kamer, 1974-1975, 13100). In this white paper the choice of instruments is based on their theoretical potencies as is often stated in the literature (see Bressers, 1985; Clerq, 1983; Mitnick, 1980).

A choice of instruments for regulatory proposals which is only based on theoretical notions can be dangerous. Findings from empirical research point to a form and situation dependency of policy instruments (Bressers, 1986). Ignoring these facts may result in unintended policy effects. The specific features of the policy field concerned should be given due weight in the actual choice of policy instruments. So a rational choice of instruments implies a consideration not only of the theoretically observed properties, but also of the empirical findings.

In this article we want to stress the relation between circumstances, policy instruments and effects by illuminating some research findings in the field of radiation protection policy.¹ In this research project, the often complex relation between circumstances, instruments and effects was studied by means of a theoretical model recently developed by Bressers and Klok (1986, 1987), Twente University of Technology. Based on the contingency approach the model distinguishes central and other circumstances, mediating the relationship between policy instruments and their effects. In section II some aspects of the model will be explained. Section III will deal with some features of the radiation protection policy and the policy field. It will briefly be indicated in what way these features influence the policy outcomes. In section IV research findings will be presented that deal with the effectiveness of the policy instrument considered. Our brief overview ends with some concluding remarks concerning the possibilities for regulation.

II. The Framework of Analysis: a Model

In a theory of policy instruments the different types of policy in-

struments on the one hand, and their effects on the other hand are brought together. Here the implementation and effects are dependent on the circumstances under which the instruments are being used. The subsequent complexity is made manageable by means of a process approach (see also Bressers, 1983). Bressers and Klok distinguish two processes that determine the effects of policy instruments: the implementation process and the field process targeted for regulation. The course and results of these processes are determined by a restricted number of factors called the 'central circumstances'. All other factors, including the instruments, influence these processes only by means of a change in these central circumstances. Regarding the instruments the theory is confined to policy instruments which affect the behaviour of people and organisations outside the government. Within the implementation process two sub-processes are distinguished, the sub-process 'maintenance of form' and the sub-process 'likeness of sanction'. In this article we will only deal with the sub-process 'maintenance of form'. In this sub-process the problem is what remains of the intended form of the instrument, e.g. are firms entitled to a permit and are appropriate stipulations included in this permit? Also important is the impact of the implementations on the legitimacy of the policy. The outcome of the implementation process, the policy achievement, subsequently influences the process to be regulated. In this process the regulated firms take actual decisions about their behaviour. Effectiveness is defined as the extent of behavioural change intended by the policy in question.

For the implementation process 'maintenance of form' the central circumstances are formed by the objectives, information and power of the actors involved: the policy implementers and the regulated (policy objects). Regarding the objectives of the implementers, it is important to know which instrument, as a means of effectuating a change in behaviour, has a high priority with the implementers. Regarding the objectives of the regulated, the degree of resistance against the intended form of the instrument is important. This is determined by the implementation costs for the regulated resulting from the use of the instrument. The information of the implementers is determined by the degree to which they are able to judge what specific form of the instrument has to be used in relation to the specific circumstances of the regulated. This assumes both knowledge of the forms of the instrument and knowledge of the circumstances of the regulated. The information of the regulated consists of knowledge concerning the consequences of the instrument to be used for their behaviour alternatives.

The sources of power of the implementers and the regulated are not defined irrespective of each other. Power is interpreted as a relational notion: the issue at stake is always the balance of power between the policy implementers and the regulated. Bressers and Klok

distinguish the formal balance of power (are the implementers able to apply the intended form of the instrument without the help of others?) and the informal balance of power (mutual dependence of implementers and regulated). These central circumstances determine the maintenance of form of a policy instrument. Subsequently the outcome of the implementation process affects the values of the central circumstances of the field process targeted for regulation.

The framework for analysis of the field process targeted for regulation is the subjectively rational actor model. The decisions of a subjectively rational actor are determined by the following factors (central circumstances):

- 1.a. the available alternatives present;
 - b. the actor's information about the available alternatives present;
 - 2.a. the consequences of these alternatives;
 - b. the actor's information on these consequences;
 3. the importance the decision-maker attaches to these consequences.
- Three types of consequences should be distinguished. First, there are the costs and benefits in terms of the decision-maker's self-interest. Apart from this Bressers and Klok also distinguish between people whose behaviour is deviant from or conforming to the regulations of the government. Finally, also the costs and benefits of the behaviour alternatives for the society as a whole are important.

Practically speaking this means that the central circumstances 'pros and cons of the alternatives' are split up into three central circumstances: the proportion costs/benefits of the alternatives for the decision-maker himself, the normative consequences of the alternatives (deviancy/conformity) and the social consequences of the alternatives. Of course also the central circumstances 'information about pros and cons' (2.b) and 'importance of pros and cons' (3) are being split up into each of the three central circumstances. Finally, together these central circumstances determine the behavioural alternatives of the regulated.

III. Radiation Protection Policy: Specific Features

The radiation protection policy is aimed at protecting man, animal, plants and goods from the detrimental effects of ionising radiation. Ionising radiation can be the product of natural and artificial sources (radioactive materials and X-ray equipment). The protection policy is especially aimed at restricting the detrimental consequences of the artificial sources, e.g. fissionable materials, radioactive materials and X-ray equipment. Leaving the nuclear industry and the nuclear power plants aside, the research project is restricted to the artificial sources of radiation. The radiation dose yearly imposed on the population is shown in Table 1.

Table 1: Yearly average effective dose-equivalent of the Dutch population in milli Sievert

Non-artificial sources of radiation		mSv.
cosmic rays		0.30
primordial nuclides		
external		0.35
internal		0.40
radon		0.93
Artificial sources of radiation		
professional exposure		≤ 0.01
medicine		0.50
science and technology		-
energy		≤ 0.01
consumer goods		-
radioactive waste		-
fall-out		0.01
effected dose-equivalents per year approximately		2.50

Source: Indicatief Meerjaren Programma Straling 1985-1989, Tweede Kamer 1984-1985, 18607 1 and 2.

The table shows a quite restricted exposure to artificial sources of radiation. The materials and equipment are mainly used in medicine, industry and science.

So what are the specific features of radiation use and protection that influence the mode of regulation? A first aspect is the international setting in which the national policy is framed. Important organisations are the European Economic Community (Euratom), the Organisation for Economic Cooperation and Development (OECD) and the United Nations (IAEA). For radiation standards and norms the recommendations of the ICRP are decisive. This group of experts investigates the biological aspects of ionising radiation. The national policies of EEC countries are determined by the Euratom treaty. In 1958 this agreement was ratified. Governments committed themselves to safeguarding the protection of health in the case of using sources of radiation. Chapter three of the convention (articles 30-39) states the basic norms for maximally allowable doses of radiation and contamination. Furthermore, in Euratom countries the use of radioactive materials and X-ray equipment is connected to a system of certificates and/or permits. So national policies are determined by the Euratom convention.

The second aspect consists of three basic principles underlying the radiation protection policy. These are the principle of justification, the ALARA principle and the principle of dose limits. The principle of justification evaluates the necessity of the use of radioactive materials or X-ray equipment. In case there are alternatives, the use of radiation is prohibited. If the use of radiation is allowed, the ALARA principle prescribes radiation emissions as low as reasonably achievable. Firms using radiation are forced to install provisions which lower the radiation emissions to the levels prescribed. Finally, the principle of dose limits prescribes certain upper levels of radiation exposure which may only be exceeded in some medical settings. At the national level every use of radioactive materials and equipment must be judged according to these three principles.

National policies are restricted by the international setting and the basic principles. Norms, standards and modes of regulation are prescribed at the international level. Although national initiatives are possible, national varieties should always fit into the international framework. In the implementation process this framework affects the central circumstance 'information of the implementers'. Bringing up these principles in the negotiations, implementers try to convince the regulated of the necessity of the regulation. More indirectly, the principles also influence the resistance of the regulated. During the negotiations, the three principles are the frame of reference to the implementers. Because of the principle of justification they know the permissibility of the materials used, the equipment and the conditions involved. During the negotiations, the ALARA principle strengthens the position of implementers.

Besides the international circumstances, there are also some national factors which influence policy-making. First we will consider the history of the radiation protection policy. In its present form the radiation protection policy, and especially the permit system, dates back to 1970.² In 1970 the Nuclear Energy Act was introduced and since that time its content has hardly changed. The policy field has changed, however. E.g. the use of radiation has increased both quantitatively and qualitatively, and so has the number of organisations using radiation. Technological developments have made available more materials and equipment, causing an increase in the number of applications. Education has also improved. One may wonder whether the policy is still geared for these changes.

A second feature concerns some changes within government itself. As indicated in its aims, the radiation protection policy is an integral policy. With regard to protection, various aspects can be distinguished which are separately stressed during implementation. Radiation protection concerns aspects of environmental protection, aspects of labour protection and aspects of public health. About 1970 only one minister had the responsibility for these aspects. At present, due to

reorganisations, this responsibility is shared by three ministers. So the implementation process heavily burdens the coordination.

Both factors affect the efficiency of the policy implementation. The reorganisations split up the policy implementation. This demands a high standard of coordination and may cause inter-departmental conflicts. Furthermore, implementation may be delayed, because of time-consuming procedures in the permit authorisation. During the implementation process this will influence the 'priority of the implementers'. Apart from their main goal, maintenance of form, implementers will also pursue secondary objects, such as guarding their territory.

A third feature concerns the social opposition to nuclear energy and nuclear arms (see Midden and Verplanken 1986; Midden, Daamen and Verplanken, 1983). This often causes a mixture of risks in using radioactive materials and X-ray equipment with, e.g., nuclear energy. However, these types of radiation are in no way comparable and especially not regarding their potential risks for man and environment. The social opposition may frustrate the policy implementation considerably, especially when procedures are public (see, e.g., Bröring, 1985). However, public objections are never honoured.

On the other hand, effectiveness is positively influenced by social opposition. Policy implementers, for instance, undoubtedly want to prevent negative publicity as much as possible. This can be done by implementing the policy in its intended forms. This will secure them against unfavourable criticism. No doubt also institutions want to prevent negative publicity by avoiding the association between their activities and radioactivity. Such an association might well frustrate their goals. In order to avoid this kind of criticism organisations will accept and obey the rules. Thus they will be safeguarded by democratic government. So organisations will abandon resistance. Therefore the factor 'social opposition' directly influences the field process targeted for regulation. Furthermore, social opposition will also invigorate the implementer's priority and decrease the resistance of the regulated in the implementation process. By conscientious application of the law, and thus subjecting to it, both parties will be safeguarded by the law.

A fourth feature concerns the absence of external effects in the use of the materials and equipment we are dealing with. In other environment-dependent activities these effects are present. However, in using radiation only the careless person will be affected. Imprudence may affect the physical health of persons and will be an important incentive to prudent behaviour. Of course this presupposes some knowledge of the negative effects of exposure. However, the restricted possibilities of changing behaviour which is detrimental to the environment may influence the effectiveness in a positive way by means of the individual costs and benefits of the regulated.

A last feature concerns the policy itself. The law stipulates the

use of radiation under direct responsibility of a so called radiation protection expert. This expertise relates to the energy and activity of the radioactive material in use. The expert's training increases according to the increase of the energy and the activity of the material. These experts bear statutory responsibility for the radiation protection in an organisation and their interests may coincide with those of the government, viz. in creating the optimum, radiation-protected environment. This may reduce their resistance during the implementation process, because of educational similarities between the expert and the implementers. The expertise may also influence efficiency within organisations. Governmental control and maintenance can be audited because of the full responsibility of the organisation's radiation expert.

So far some features of the radiation protection policy. In the following section we will discuss their impact on the effectiveness of the radiation protection policy, as far as the permit is concerned.

IV. Regulating the Use of Radioactive Materials and X-ray Equipment: the Effectiveness of the Permit

The effectiveness of a policy instrument can be defined as the degree to which the instrument contributes to the objective aimed at (Hoogerwerf, 1985). The objective aimed at has already been described as the protection against the detrimental consequences of ionising radiation. However, the relation between this formal policy objective and the system of permits is a complex one, due to social, biological and chemical factors. Due to these factors, the contribution of the permit to the intended policy objective is difficult to establish. Therefore the relation between the policy instrument and its effects has been formulated more directly. The main objective of the permit can be described as follows: to prevent the use of stated radioactive materials and X-ray equipment in whatever way without permit or in neglect of the rules. So each user should have a permit and should comply with the rules. Based on existing scientific knowledge this objective assumes a relation between influencing the behaviour by means of a permit and the environment objective, the reduction of radiation emissions. In the research project this relation was assumed. Therefore goal attainment was 'measured' by means of the behavioural features of the regulated. The instrument aims at the use of radioactive materials and equipment with a permit and in compliance with the regulations. This dependent variable was arrived at by data from policy implementers. These data concern the yearly number of violated regulations. See Table 2.³ This table shows the violations of various regulations of the Nuclear Energy Act.

Table 2: Violations of the permit regulations of the Nuclear Energy Act (per year)

	Absolute figures	In per cent of total
1. Not possessing the proper permit	174	11.9
2. Not complying with the administrative demands	376	25.7
3. Not or incomplete returning of registration forms	174	11.9
4. Not applying the labelling	174	11.9
5. Not possessing the required permit	78	5.3
6. Not possessing the required expertise	61	4.2
7. Insufficient instruction of radiological employees	79	5.4
8. No having the required situation and construction of the radiological rooms	125	8.5
9. Not complying with the medical demands	121	8.3
10. Exceeding exposure levels of radiological employees	10	0.7
11. Exceeding radiation levels of radiological rooms	6	0.4
12. Incomplete register of fire alarms	55	3.8
13. No proper stocking of the materials	10	0.8
14. No proper controlling of the materials and rooms	7	0.5
15. Other violations	12	0.8
Total	1463	100

These figures should be considered with some care, for the gravity of the violation of various regulations for radiation protection is much too divergent. From Table 2 it appears that all regulations listed are being violated. However, regulations having direct consequences for radiation protection in the case of violation, are well complied with.

See items 10 and 11. These items concern the standards of emission and exposure. These standards are essential for the protection of the radiological workers, and exceeding them may involve unacceptable risks. Administrative regulations are violated most. Compliance with these regulations means a considerable financial burden to permit holders without any related benefits. They mostly concern overhead costs. This may affect the violation of these regulations (items 2-3-4 and 8).

Finally, Table 2 (item 1) shows a 5 per cent violation of the permit requirement. These violations are restricted to consumer goods such as clocks and smoke detectors, in short, articles containing small quantities of ionising material. People often lack knowledge about the ionising effects of these goods and the permit requirement involved, and these goods are often freely obtainable abroad. (See the annual reports of the Food Inspection Department over the years 1980-1984).

Regarding goal attainment, it is concluded that nearly everyone who should have a permit actually possesses one. Only 5 per cent of the violations found in one year concerns the permit requirement. These violations mostly refer to consumer goods, containing only small amounts of ionising material. Higher energy or activity materials are scarcely used without a permit (Arentsen, 1987b). The maintenance of radiation emission and exposure standards is striking. We noticed a reasonable amount of goal attainment; with some exception the permit requirement and regulations are fairly well complied with.

To explain this goal attainment we compared the actual and expected values of the variables of the model (see section II). The model predicts maximum effectiveness in the case of different settings (configurations of variables) in the field process targeted for regulation. In any case alternatives should be present, such as knowledge of these alternatives. Furthermore the actual balance of costs/benefits should be positive or neutral, and the users of radiation should have some information on these costs and benefits. The impact of social consequences may be positive or neutral and that of deviance/conformity positive or irrelevant.

By means of questionnaires data were collected in a random sample of Dutch users of radioactive materials and X-ray equipment, and policy implementers. In the next sections we will discuss some of the results.

V. Research Findings

The variables of the field process targeted for regulation
THE PRESENCE OF ALTERNATIVES. Influencing the choice of a subjectively rational actor is only possible, if he can choose from several alternatives. The alternative for the use of radiation with a permit

is its use without a permit. Table 2 shows a small preference for this alternative. The gravity of this alternative has already been discussed. Ignorance of seller and buyer, and purchasing abroad turned out to be the main reasons for using these articles without the required permit. Is it also possible to obtain more harmful radioactive materials? Although the use of these radioactive materials without permit is restricted, it is hardly possible to obtain them without the required permit. By law it is forbidden to sell radioactive materials and equipment to people not possessing the proper permit. Before selling, suppliers should ascertain the buyers' permits. Because of the limited number of suppliers this could easily be controlled. Although it is extremely difficult to obtain radioactive materials without a permit, one can never fully exclude this alternative. So we conclude that the value of the variable 'presence of alternatives' is positive.

INFORMATION ABOUT ALTERNATIVES. According to the model, the effectiveness of the permit presupposes knowledge of the permit requirement. People who lack this information cannot decide on present alternatives. In this case the model predicts complete ineffectiveness, irrespective of the values of the other variables. In the case of consumer goods, the reports of the Food Inspection Service noted this lack of relevant information.

However, from our survey it appears that most respondents are well informed before they apply for their first permit. About 22 per cent lacked this information, but they became aware while considering the purchase of the materials. This is achieved by means of the prohibition to sell materials and equipment without the required permit. This prohibition can easily be controlled because of the small size and the clear organisation of the supply-side. So fraudulent suppliers can directly be located. As our results indicate, sooner or later everybody who buys radioactive materials will have the necessary information. Therefore we conclude an overall high level of information as far as the alternatives (using radioactive materials with or without the required permit) are concerned.

INFORMATION ON INDIVIDUAL COSTS AND BENEFITS. This variable indicates the user's knowledge of individual costs and benefits of the various alternatives. These costs and benefits are not solely understood in terms of money. Aspects such as respecting or breaking the law, being or not being protected against radiation emission, the costs and avoidance of sanctions are also represented in this variable.

Although the value of this variable was assumed to be 'high' or 'low' in this model, its actual value will be, or will soon become, 'high' for everyone intending to use radioactive materials or equipment. The reason for this is that attaining the organisation's goal, viz. the continuation of its activities, is only possible by means of

applying for the permit. For in case there are alternatives, the intended use of radiation would be prohibited through the principle of justification. So to use radiation without a permit is actually impossible, because in that case the materials are hardly available. So whatever the consequences, intending to continue the organisation's activities implies applying for a permit. Apart from this theoretical statement, our research data indicate that more than half of the permits issued annually concerns organisations which possess one already. So these organisations experience individual costs and benefits. Therefore it can be concluded that the value of this variable is 'high'.

THE ACTUAL COSTS AND BENEFITS. In the model the balance between costs and benefits will be positive if the regulated choose the alternative intended by the government: the use of materials and equipment with a permit. The actual benefits of this alternative for the user concern respecting the law and therefore avoidance of sanctions, being protected against social criticism, being protected against radiation, the continuation of activities and, most of all, the availability of materials. But there are 'some' costs too. First of all, the government charges the piece of paper. However, these costs seem very small when taking into account the technical, educational and organisational provisions attached to the permit. These greatly depends on the materials and equipment to be used and may have gigantic financial consequences.

From the actual number of permit violations, the overall domination of organisation benefits already turned out. Other data confirmed this domination. All respondents endorsed the protection conditions prescribed and therefore did not object to the financial consequences. However, 37 per cent of this group (low-energy users) endorsed protection but at the same time stressed the bureaucratic overkill of the present regulation and its implementation. These organisations may be considered 'neutral' with regard to the value of the variable 'actual balance of costs and benefits'. However, most organisations consider this balance to be positive.

THE IMPACT OF SOCIAL CONSEQUENCES. This factor will only be important if the decisions of the users indeed have social consequences, e.g. a significant increase in radiation exposure of (parts of) the population. However, the materials and equipment our research project is dealing with cannot have that impact, even under the most negative circumstances. Because of their actual absence, social consequences hardly influence decisions. Many organisations stressed this point. E.g. in interviews they pointed to the low energy and activity of the radioactive materials they used and the possible detrimental impact of these materials on the environment. However, organisations do realise the consequences of neglecting the necessary provisions. These consequences cannot be stated in social terms. So the variable 'impact of

social consequences' is labelled 'neutral' because it does not exist in this case.⁴

THE IMPACT OF JUDICIAL CONSEQUENCES. This variable refers to the judicial consequences of the users' decisions. E.g. violating the regulations means breaking the law. The value of this variable could only be measured by means of some secondary indicators. Firstly, conformity of the users may be influenced by social resistance to radioactive materials. In section II we already stressed this point. Although social resistance will affect the costs and benefits of the users (risks of negative publicity, drop of sales), this will affect their compliance with the law: the use of radiation with a required permit. Secondly, in every possible way, and especially by contacting the organisations radiation using, policy implementers continuously stress the importance of respecting the law. Respect for the law is one of the main themes of the educational training of radiation experts. Thirdly, as already stressed, without respect for the law, it is almost impossible to acquire radioactive materials. However, the existing prohibition of selling materials without the required permit never guarantees full compliance with the law. Finally, conformity to the law by means of social education and socialisation cannot be fully excluded. So we conclude that the value of the variable 'judicial consequences' is at least absent or positive, although absence hardly influences the overall effectiveness of the permit.

The variables of the implementation process

In the model, the implementation process is divided into two subprocesses. The subprocess 'maintenance of form' and the subprocess 'likelihood of sanctions'. For our purposes, only the process 'maintenance of form' is important. This process is aimed at maintaining the intended form of the permit. According to the theory, maintenance of form will be maximal if the priority of the implementers is high, the resistance of the regulated low and the information of the implementers sufficient. Under these conditions maintenance of form will be maximal irrespective of the values of the other variables of the model.

PRIORITY OF THE IMPLEMENTERS. Without doubt, the permit and its implementation are the most important aspects of the policy concerning the use of radioactive materials. The Nuclear Energy Act, its directives, implementation and organisation are all grafted onto the permit. Furthermore, implementers owe their jobs, salaries and status to the permit. The relation between the permit and the use of radiation is so evident, that the very discussion of this relation will result in laughter.

The priority of implementers was more directly indicated by measuring the overall necessity of the directives accompanying the permit, especially those protecting against exposure and emissions. Also

the implementation process itself manifests an overall necessity of a permit. All organisations requesting a permit are invariably visited by at least one and at most four officials. They advise about the way provisions should be made and directives should be implemented. The law sets a clear limit to the flexibility of implementers. There is room for discussion, but the necessity of provisions and directives is out of the question. Secondly, in case resistance grows, implementers can cease the issue of the permit by omitting the legal authorisation of the permit. Without such an authorisation, a permit cannot be issued. Finally, a high priority also appears from a subgoal of the implementers: stating their own expertise by means of a clear and strict implementation of the permit. Therefore we can conclude that the priority of implementers is high.

RESISTANCE OF THE REGULATED. On the whole the resistance of the regulated to a permit can be considered low. From our research data it appeared that, firstly, about 80 per cent of the respondents were satisfied with their permits and with the way in which it was implemented. Secondly, no organisation appealed for a permit decree. So we may conclude that resistance is low.

In section II we already pointed to one of the main reasons for this low resistance, i.e. social criticism. This criticism may also be presented within organisations, articulated by employees not directly involved in the radiological activities of the organisation. Especially in industry, employees are not used to radiological activities. Employees' resistance can be avoided by means of an openly authorised permit. So by accepting the permit organisations can avoid negative associations of their activities within and outside their walls.

Finally, the training of the organisations' radiation experts will also decrease resistance. This training is aimed at studying radiation properties and the means to avoid exposure and emissions. Without these technical skills the use of radioactive materials is almost impossible and even useless. Among other things, a permit is nothing but a legal authorisation of these requirements. So resistance to legal authorisation of provisions that may already have been implemented is of some use. So apart from respondents' opinions, there are some indicators that stress the low resistance of users.

THE INFORMATION OF THE IMPLEMENTERS. A final important factor influencing the maintenance of form of an instrument is the implementer's knowledge about the applicant's polluting conditions. This information is necessary in order to issue the proper permit. Contrary to the many types of permits in the field of environmental policy, in the case of a radiation permit it is not the situation that dictates the actual form of the permit, but the other way round, it is the permit that dictates the situation. So acquiring the necessary information is no problem at all. Actually, the implementers already have the information they need from the moment organisations send in their

application form. By means of the principle of justification the permissible use of radiation is well known, and the permits required have been standardised. So before visiting an organisation, implementers already know which permit should be issued. Therefore the information of policy implementers will always be sufficient to issue the right permit.

VI. Some Concluding Remarks concerning the Effectiveness of the Permit

From our provisional analysis it appeared that the actual values of the variables correspond to those predicting an overall maintenance of form and effectiveness in the model. In implementing the intended form of the permit, the information of the implementers seemed to be a crucial factor. In actual implementation, the law prescribes the 'polluting' circumstances of an organisation which are dictated by the permit. And we have shown the actual maintenance of the permit regulations. Also the priority of the implementers is a striking feature. Because of their expertise, skills and information, they can 'dictate' the permit. Organisations will be confronted with devoted and unyielding implementers following the principle 'take it or leave it'. From our analysis it became clear that organisations actually have no choice, if they intend to continue their activities. However, it also became clear that such an implementation is actually out of order. On the whole, organisations submit to the permit less insistently.

Furthermore from our analysis it appeared that the information users have about alternatives is of crucial importance. In case this information is lacking, the ineffectiveness of the permit is striking. This turned out to be one of the main reasons for the use of consumer goods. On the whole users are or will be confronted with the alternatives. So impermissible use of radioactive materials and equipment can be excluded by means of an authority, intensifying control on the supply-side.

VII. Some Concluding Remarks concerning the Potentials of Regulation

In our cursory overview some features of the radiation protection policy have been listed and we have analysed their impact on the effectiveness of the permit. Although the main forms of regulation in this policy field are directives, it became clear that there are some 'incentives' too. Firstly it is almost impossible to obtain radioactive materials (except consumer goods) without a permit. The small size of the supply-side guarantees maintenance of this prohibition. Secondly, the absence of external effects on the use of radiation is

an incentive to comply with the regulations. Thirdly, without special skills and training, the extensive use of radioactive materials is impossible. Fourthly, existing social criticism watches as a 'big brother' the respect for the law.

So regarding these 'incentives' we can ask whether the present system of permits is also an efficient form of regulation? At the moment issuing a single permit involves an elaborate and time-consuming procedure, which usually takes between five and -maximally- seven months. From our research data it appeared that such a period is too long, because of the obstruction of organisations' activities. E.g. the external financing of scientific research projects often implies fast completion. This would be impossible with long procedures. In situations in which such procedures are obstructing, a more autonomous decision-making within institutions could be possible. This may be legitimatised by the presence of skills and expertise. While striking to the legal framework organisations might be granted a kind of basic permit, to be completed by themselves. At the moment for almost every single type of radioactive material a permit is to be issued.

On a limited scale a kind of basic permit has been introduced in the Netherlands. Specialist organisations using great amounts of radioactive material are authorised to organise their radiological activities more autonomously. However, these organisations should be subjected to some restricting conditions. These conditions should concern the presence of an independent, fully autonomously operating, academically qualified radiation protection staff. This staff should be independent of the line structure of an organisation as far as decisions about the use and protection of radiation is concerned. By means of a basic permit an organisation is much more autonomous and flexible in its activities. So time-consuming procedures regarding the issue of a permit would no longer frustrate their activities. For the legal authority a basic permit is also profitable. It needs to be issued only once and the inspection and control of an organisation can be less comprehensive. E.g. implementers can contact the organisation's radiation staff once a year. As a policy instrument this basic permit seems to be promising. It could be an alternative for the existing system of permits. However, an overall replacement of the permit by a basic permit is not suitable because many organisations lack the necessary tools to cope with the conditions prescribed.

Apart from organisations' lack of conditions, an overall introduction of a kind of basic permit does not suit the diversity of the policy field targeted for regulation. The materials and equipment used range from harmless low-activity sources, unreachable because of an impenetrable containment, to high-activity and toxic sources in liquid or gas. So because of the different impacts these materials have on the environment, sources of radiation should be regulated by means of

different instruments. One could classify radiation according to, e.g., their activity or energy, and make and implement the policy on the basis of this classification. This could increase its efficiency. E.g. the use of low-activity sources in a containment could be regulated by means of a restricted regime of product requirements and standard directives in combination with an official announcement. At the moment all sorts of radiation are regulated by means of a permit, individually issued in a time-consuming procedure (about 500 annually). At the moment each permit consists of a set of standard directives. Diversity in the art of regulation could concentrate the authority's attention on more harmful radioactive materials and equipment. However, because of the international setting, these regulatory innovations should always be of the directive type. The Euratom treaty prescribes regulation by means of directives, but only by means of permits in medical and educational settings. So there are possibilities for national variations. Also the international setting prescribes an active involvement of the authorities. But again, nothing is said about the specific form of this involvement. From the beginning, the Netherlands has opted for an integral system of permits and an active and detailed government involvement. However, regulation should be all-embracing and, above all, effective, but at the same time efficient. As we have stated in this article these conditions could be realised if potential self-regulating features are more actively explored and exploited.

Notes

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- 1. This research project was conducted by order of the Ministry of Housing, Physical Planning and Environment at the Centre for Policy Science of Twente University of Technology.
- 2. Already in 1931 it was tried to introduce a similar law, the X-ray law. At the time this attempt was frustrated, a.o. by opposition from the medical world (Cornelis, 1982).
- 3. The reliability of this variable is restricted by various factors. These problems are left out of consideration in this article.
- 4. At the moment, the social impacts of the use of radiation is an issue in the national political debate. Recently, for instance, the Dutch parliament discussed new radiation norms and standards on account of the introduction of the 'Besluit Stralenscherming' (see Tweede Kamer, 1986-1987, no. 19700, nr. 71).

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